SUSITNA HYDROELECTRIC PROJECT FINAL REPORT

BIG GAME STUDIES

VOL. VI BLACK BEAR AND BROWN BEAR

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1. SUMMARY OF RESULTS

This study describes the brown bear (Ursus arctos) and black bear (Ursus americanus) populations in the area that would be influenced by a large 2-dam hydroelectric project on the Susitna River in southcentral Alaska. These dams would inundate an area of 185 km² along an approximately 120-km-long stretch of river. Estimates of levels of impact are offered where data are adequate to make such estimates. Primary emphasis in this study was to provide baseline data on bear populations prior to project construction. This data could be compared with post-project populations to provide definitive answers on levels of impacts. Most data were based on periodic relocations of radio-marked bears.

This study was conducted in 2 phases. During the first phase it was learned that the Watana Impoundment would likely have a much greater impact on populations of bears than would the Devils Canyon Impoundment. Correspondingly, subsequent efforts emphasized the Watana project area and relatively few data were obtained on the Devils Canyon Impoundment impact area in the second phase of studies.

1.A. Brown Bear Results

The area of the proposed project is inhabited by a large population of brown bears. A population density of 2.79 bears/100 km² was estimated based on capture-recapture techniques developed during the course of this study. For brown bears, the size of the impoundment-impact area was estimated to be 12,127 km². This area included the area within 1 mean brown bear home range diameter from the Susitna River. Extrapolation of the density estimate to this area provided an estimate of the number of brown bears that would be affected by the proposed project. This estimate was 327 bears (95% CI = 295-386).

Bear use of the impoundment area was analyzed using 3 impoundment proximity zones: 1) within the area that would be flooded; 2) from the shoreline of the proposed impoundment to a distance of 1 mile; and 3) from 1-5 miles from the impoundment shoreline. Brown bears used the area that would be inundated by the proposed Watana Impoundment over twice as frequently as expected under the null hypothesis that use occurred in proportion to the area of this zone. This selection was evident for males and for females not accompanied by cubs of the year. Females accompanied by newborn cubs showed selection against the area that would be inundated by the Watana Impoundment. Use of the impoundment zone was most pronounced during June. Selection was also shown for the area that would be inundated by the Devils Canyon Impoundment. However, compared with the Watana Impoundment, the area that would be inundated by the Devils Canyon Impoundment is small and overall influence would be less.

Data on use of impoundment proximity zones formed the basis for my estimate that annual carrying capacity for 43 brown bears would be eliminated due to inundation of habitat by impoundments.

Brown bears, at least in populations that are subject to hunting, tend to develop avoidance reactions to human presence. This avoidance reaction and barriers to movements associated with the impoundments and access roads are expected to result in additional losses of habitat availability for brown bears in the study area. No estimates of the level of such losses are made here. However, the data on pre-project brown bear movements collected in this study provide the basis for making such estimates following completion of post-project studies.

The only anadromous fish stream in the study area was clearly identified as a seasonally critical habitat area for brown bears. Prairie Creek, a small tributary of the Talkeetna River, contains the highest concentration of spawning king salmon (Onchorhynchus tshawytscha) in the upper Cook Inlet area. Salmon are easily caught by bears in this shallow creek and brown bear movements to this stream were documented from an area of more than 15,000 km^2. Most bear use of Prairie Creek occurred in July and early August. The proportion of marked Su-Hydro bears fishing for salmon in Prairie Creek varied from 13% to 38% in different years. In 1984 and 1985 50-60 bears were estimated to be using the creek at 1 time. The total number of different bears using Prairie Creek at some time during the salmon run was larger than this by some unknown amount. It is anticipated that disturbance displacement of brown bears from Prairie Creek will result from increased human access to the stream from access roads to and across the impoundments. The level of this disturbance-displacement can range from slight to complete, depending on the limitations that are placed on human uses of the Prairie Creek area. Some of the limitations needed to assure continued brown bear use of Prairie Creek are under the control of the hydro-project developers. The most effective of these limitations would be to prevent access to the south side of the Susitna River in the vicinity of the Watana dam site. If Prairie Creek salmon resources were to become unavailable to project-area bears, a loss of annual carrying capacity for about 41 bears might result.

Reductions in annual carrying capacity for bears would likely be expressed through reductions in bear densities and reductions in reproductive rates. For this reason baseline data on pre-project reproductive rates were described. Separation of mother and offspring occurred when offspring were in their 3rd year of life (2.0+ years old). Mean reproductive interval was at least 3.8 years. Mean age of first litter production for females was 5.5 years (4-8). More bears (44%) produced first litters at age 6 than at any other age. Litter size averaged 2.1 cubs (1-4), 1.7 yearlings (1-3), and 1.7 2-year-olds(1-3). Cub mortality was 37.7% and yearling mortality was 21.6%.

Mean home range size was 1022 km^2: 1941 km^2 for males and 501 km^2 for females. A few bears made identifiable movements to caribou calving areas. Subadult males typically disperse from maternal home ranges at age 2 or 3, while subadult females typically do not disperse.

Annual brown bear harvests by hunters in the project area averaged 32 bears/year during 1983-1985. Hunter harvests are increasing in this area, a probable consequence of increased hunter effort resulting from liberalized seasons and bag limits.

Brown bears are effective predators on moose calves in the study area. No differences in predation rates between different sex and age groups were detected except that females accompanied by newborn calves had lower predation rates ($P < 0.05$). During intensive monitoring we saw radio-marked bears on calf moose kills every 11.8 consecutive observation days. This figure led to an estimate of 3.6 moose calves killed by an average adult brown bear during the spring.

Brown bears typically denned at high elevations away from the impoundment zone. Availability of physically acceptable denning sites was not thought to be a limiting factor in this area. However, there was a tendency for individual bears to den in the same general area in successive years. Displacement of these individuals to denning areas of uncertain acceptability could result in additional mortalities or stress. Such displacement is most likely to result from disturbance occurring on the access road between the Denali Highway and the Watana Dam site. This portion of the access road runs through good brown bear denning habitat. Further displacement could result from equipment working in winter in those borrow areas that are located away from the river near good denning habitat.

1.B. Black Bear Results

Black bears were known to occur in the project area when this project started but the population turned out to be larger than anticipated. Correspondingly, study plans were modified to incorporate black bears. The black bear population in the vicinity of the proposed project can be characterized as typical of a population occurring in marginal habitat: unstable in numbers from year to year with probable periodic declines due to failure of key food crops (notably berries in this area), and low productivity. Black bear habitat is better and bears are more abundant downstream from the proposed impoundments. The population in the area of the impoundments is an upstream extension of the downstream population. This population lives in an increasingly narrow finger of acceptable black bear habitat which follows the course of the Susitna River from Devils Canyon to near the upper limits of the upper impoundment. Studies downstream from the proposed impoundments were also conducted to evaluate the hypothesis that anticipated reductions in salmon-spawning habitat resulting from dam-induced changes in water flow regimes would impact downstream bears.

In the vicinity of the proposed impoundments black bear habitat is largely confined to spruce-forest areas along the river, and to adjacent shrub-lands. The size of this area, determined from movements of radio-marked bears, is 1191 km^2. A black bear density estimate of 8.97 bears/100 km^2 was obtained in a portion of this area, and extrapolated to the whole area to obtain a population estimate of 107 black bears (95% CI = 93-122) in the project area during spring 1985. The population at the time this estimate was made (spring 1985) was thought to be below maximum carrying capacity. At this time the population may have been recovering from a decline caused by an apparent berry-crop failure in summer 1981.

Black bears living in the vicinity of the Watana Impoundment selected for the area that would be inundated by this impoundment. This preference was particularly evident in May and June when 52% and 46%, respectively, of all locations of radio-marked bears were within the area that would be flooded by the impoundment. The population of bears in the vicinity of the Watana Impoundment was estimated to be 59 bears. In the vicinity of the Watana Impoundment, loss of annual carrying capacity for 26 bears was estimated. This loss would result from inundation. Other factors, when combined with this loss of habitat though inundation, led me to conclude that that a resident black bear population could probably not survive in the vicinity of the proposed Watana Impoundment. Transient black bears from downstream areas would probably continue to use the area seasonally.

Selectivity for the lower (Devils Canyon) impoundment was much less pronounced. This was because the lower impoundment would have more black bear habitat remaining above the proposed impoundment shoreline. Only 3% of point locations of radio-marked black bears were within the area that would be flooded by the Devils Canyon Impoundment; an additional 43% were within 1 mile of the impoundment shoreline. Under the assumptions used in this analysis, the Devils Canyon Impoundment would result in loss of annual carrying capacity, through inundation, for only 2 black bears.

Downstream from the impoundment area, black bears were found to frequent the vicinity of sloughs used by spawning salmon. Analysis of bear scats collected along these sloughs during late summer revealed that salmon remains were infrequent and that devil's club (Oplopanax horridus) berries were prevalent. Based on these results, impacts on black bear populations resulting from reduced availability of salmon could not be predicted. Such impacts may occur however (especially during years when berry crops fail), if salmon are an important buffer food.

Reproductive rates for study-area black bears were low compared with rates from the Kenai Peninsula, the only other area in Alaska where comparable data are available. Mean litter size was 2.1 cubs (1-4) and 1.9 yearlings (1-3). Offspring mortality during the first season out of dens was 35% and appeared higher in the upstream study area (47%) than in the downstream area (6%). Such mortalities are very rare on the Kenai Peninsula where yearling bears weigh significantly more than in the Su-Hydro area. Intervals between successive production of litters averaged at least 2.7 years. Mean age at first litter production was 6.4 years (5-8); about half of the bears produced their first litters at age 7.

Reported hunter harvests of black bears in the study area averaged 13 bears/year during 1973-1985. Black bear harvests in the upstream study area are thought to be stable and low because of difficulty of access. This situation will change when roads are built to the impoundment area and after use of the impoundment itself, by hunters in boats, begins. Currently, relatively few hunters are thought to be willing to pay for a fly-in hunt for black bear.

Home ranges of black bears averaged 134.6 km², 251.5 km² for males, and 67.1 km² for females. Black bears tended to remain in the immediate vicinity of the Susitna River during most seasons except late summer when berries were ripening. At this time bears tended to move into shrub-land habitats adjacent to the forested habitats along the river to forage for ripening berries, primarily blueberries (Vaccinium uliginosum). During years of berry crop failure late-summer movements for some bears are much more extensive and suggest the importance of this food source.

Predation rates for black bear, recorded during periods of intensive monitoring in the spring, were 2 kills/100 consecutive observation days. This rate is lower than observed for brown bears. At this predation rate each adult black bear in the impoundment study area would kill an average of 0.7 moose calves/year.

Unlike brown bear dens, dens of black bears were located in the immediate vicinity of the Susitna River. Over half of the black bear dens in the vicinity of the proposed Watana Impoundment would be inundated by the proposed project compared with 3.3% of the dens in the vicinity of the Devils Canyon Impoundment. Reuse of den sites was common in the study area. This and other observations suggest that competition for good den sites may be occurring at existing black bear densities.

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5. INTRODUCTION

5.A. Project Background

5.A.1. Organization and Objectives

This is the final report for black bear (Ursus americanus) and brown bear (Ursus arctos) studies conducted by the Alaska Department of Fish and Game, Division of Game, under contract to the Alaska Power Authority as part of impact assessment studies for the proposed Susitna Hydroelectric Project. Field studies were conducted from 1980 through 1985; analysis was conducted in 1986. The originally stated objectives of these studies were:

-- To determine the distribution and abundance of black and brown/grizzly bears in the vicinity of proposed impoundment areas;

-- to determine seasonal ranges, including denning areas, and movement patterns of bears; and

-- to determine seasonal habitat use by black and brown/grizzly bears.

These objectives were modified and others added during the course of study as information accumulated.

A 2-phase plan of study was developed to meet the project objectives. The first phase (1980 and 1981) was designed to provide an overview of bear movements in the study area. This overview was intended to identify the bear uses of the impoundment vicinity that were most likely to be affected by project construction and to result in impacts on bear populations. One progress report (Miller and McAllister 1981) and 1 summary report (Miller and McAllister 1982) describing Phase I studies were prepared. Continuation studies during Phase II (1982-spring 1985) were designed to quantify the most significant impacts on bears during Phase I. These results were reported in 2 progress reports (Miller 1984 and Miller 1985a) and in this final report. This report summarizes all pertinent information collected during the project. Publication of additional analyses of peripheral information collected during this project are planned. This analysis will include analyses of habitat selection by bears. These analyses were not completed for this report because project funding was terminated just as habitat-type mapping became available.

During Phase I of this project the proposed Watana Dam was identified as having a relatively large potential for affecting bear populations, compared with the Devils Canyon Dam

(Miller and McAllister 1982). For this reason Phase II studies concentrated on bear populations in the vicinity of the Watana Dam. My plan of study did not include consideration of a project design that included only the Devils Canyon dam and such analyses are not included here.

Prediction of project impacts is a very inexact science and little published work is available. Typically, impact assessment studies do not have a follow-up phase designed to evaluate the accuracy of the predictions that are made. In this project, commitments for such follow-up work were made. Correspondingly, my emphasis was to document, using replicable study designs, the current bear numbers and use patterns of the impact area. With this information available, post-construction studies could then quantify actual impacts and test the predictions. I have attempted to predict project impacts whenever some reasonable basis for such predictions could be derived. These predictions should be considered hypotheses that need to be tested by post-construction studies. These predictions are also offered as an aid in mitigation planning.

At the time this final report was in preparation it appeared that the construction phase of the proposed project would not soon, and may never, occur. Correspondingly, post-construction studies designed to evaluate the impact predictions may never result.

5.A.2. Hydro Project Design

This study was designed to evaluate impacts on bears of a proposed 2-dam project on the Susitna River. The lower dam, a concrete arch at Devils Canyon, would have a normal maximum operating level of 1,445 feet above mean sea level (MSL) (maximum = 1466 feet, minimum = 1,405 feet). The length of the impoundment would be 41.94 km (26 miles) and it would have a surface area of 31.58 km² (7,800 acres) at normal maximum operating level (NMOL). The upper impoundment, an earth/rockfill dam at the Watana Dam site, would have a normal maximum operating level of 2,185 feet above MSL (maximum = 2,202 and minimum = 2,054 feet). This impoundment would have a length of 77.42 km (48 miles) and an area at NMOL of 153.85 km² (38,000 acres). The NMOLs for each dam are illustrated in Fig. 1 and in other figures in this report where appropriate. Place names used in this report are also illustrated in Fig. 1.

5.B. Methods

Only general methods will be described here. Specific methods pertinent to each investigated topic are described along with the results.

Bears were captured with immobilization darts fired from a helicopter. Most bears were immobilized with etorphine (M99) but some were immobilized with Phencyclidine hydrochloride (Sernalyn) or Ketamine hydrochloride (Vetelar) and xylazine (Rompun) mixtures. Bears <1.0 year old were captured by hand and were not darted. Most bears were captured early in the year (April-June), but some were captured in August, at which time many bears were in relatively open habitats feeding on berries. Some black bears were immobilized in winter dens to allow replacement of collars and to make cub counts.

During 1980 through 1985, 97 different brown bears were captured. The total number of captures was 151, and 6 of these captures (4.0%) resulted in inadvertent capture-related bear mortalities. An additional 3-4 newborn cubs were abandoned and lost, probably as a result of our capture activities. Capture histories of all brown bears are presented in Table 1.

During 1978 and 1979, studies in areas adjacent to the Su-Hydro area were conducted on wolves, bears, moose and vegetation. Where pertinent, references to these results are used to supplement data collected during the course of this study.

During 1980 through 1985, 110 different black bears were captured. The total number of captures was 171, and 7 of these captures (4.1%) resulted in inadvertent capture-related bear mortality. Black bear capture histories are presented in Table 2.

All bears were marked with ear tags and lip tattoos. Bears judged to have completed 80% or more of their growth were fitted with radio collars (Telonics Inc., Mesa Arizona). Radio-marked bears were periodically tracked with fixed-wing aircraft (usually a Cessna 180 or a Super Cub) and locations of bears were recorded on 1:63,360 scale (1 inch = 1 mile) USGS maps.

In general, monitoring frequency during periods when bears were out of dens was every 7-10 days depending on weather conditions. For specialized studies, monitoring frequencies for individual bears were as frequent as twice daily. These specialized studies included density-estimation techniques (spring 1985), predation studies (springs of 1981 and 1984), and estimates of bear numbers at Prairie Creek (summers of 1984 and 1985).

Point locations were digitized and analyzed using geoprocessing software on a Data General computer system. Much of this analysis was done on the computer system maintained by the

Department of Natural Resources. Descriptive information associated with each radiotelemetry point location was used to sort these data and produce plots and figures. Codes and formats associated with this descriptive information are provided in Appendix 5 of this report.

5.C. Acknowledgments

Many individuals contributed to this project. Of primary importance was Dennis McAllister (ADF&G) who was of invaluable assistance in all portions of the project, especially the field work. My supervisor, Karl Schneider, also made many valuable contributions. Many ADF&G employees made valuable contributions to many different aspects of the project including: Bill Taylor, Warren Ballard, Jack Whitman, Earl Becker, Al Franzman, Charles Schwartz, Craig Gardiner, Enid Goodwin, Mark Chihuly, SuzAnne Miller, Bob Tobey, Sterling Eide, Dan Timm, Herman Griese, John Westlund, Roger Smith, Jim Faro, Paul Arneson, Jim Lieb, Earl Becker, Ted Spraker, Larry Van Daele, Danny Anctil, Harry Reynolds, Phil Mieczynski, Jim Dau, Becky Strauch, Tammy Otto, Carol Reidner, Patsy Martin, Ray Kramer, Nancy Graves, Nancy Tankersley, Steve Albert, Ron Modafferi, Lee Glenn, Lee Miller, Ken Pitcher, Dave Holderman, Tina Cunning, Greg Bos, Polly Hessing, Bob Cassell, Larry Aumiller, Paul Smith, Kent Bovee, Jon Lewis, Carolyn Crouch, Gail Roberson, Susan Lawler, and Penny Miles. Granville Cooey (Harza-Ebasco) was always of great assistance in accomplishing what needed to be done. Earl Becker and Bill Steigers collected data for me on abundance of berries and berry bushes. Steve Peterson and Barbara Townsend reviewed an earlier draft of this manuscript and offered many helpful suggestions. Craig and Vern Lofstedt (Kenai Air Alaska) flew the helicopter during most of the tagging portions of this work and several pilots for Air Logistics or ERA helicopters flew helicopters at other times. Many different pilots flew fixed-wing aircraft during tracking or tagging operations, including: Monte Hauke and Larry Rogers (Kenai Air), Al and Jerry Lee (Lee's Air Taxi), Harley and Chuck McMahan (McMahan Flying Service), Don Deering (Deering Air Taxi), Ken Bunch (Sportsman's Flying Service) and Charlie Allen. My sincere thanks to all pilots for their safe and efficient flying. Mike Mayberry and Dan Funselmier (Fish and Wildlife Protection) assisted in tagging during 1981. Bruce Barrett and his staff, who were conducting Su-Hydro fisheries studies, were of great help in providing logistic support during the downstream scat collection portions of this study. Special thanks are due to Senator Rick Halford for permitting us to use his airstrip at Susitna Lodge to store our aviation fuel, and for providing accommodations at Susitna Lodge. The Denali Mining Co. and Adventures Unlimited also assisted in fuel storage and

accommodations. Dick Taber (University of Washington), Robin Sener (LGL and Associates), Randy Fairbanks (Harza Ebasco) and Richard Flemming (APA) also assisted in various ways. No doubt I have forgotten to mention others who also assisted. I offer these people my apologies and my thanks.

6. THE STUDY AREAS

The area in which bears would be affected by the proposed impoundments was defined as the study area. The size of this area was determined from data collected in this study. The size of this area is an important parameter, as the number of bears that would be affected by the impoundment was estimated by applying a density estimate, obtained in a portion of this area, to the whole area.

6.A. Upstream brown bear study area

The initial capture locations of 53 brown bears that were fitted with radio transmitters is illustrated in Fig. 2. These bears were captured in an area of 2,170 km² centered approximately at the confluence of the Susitna River and Watana Creek. Movements of these bears, as determined by telemetry (2901 points during 1980-1985), incorporated an area totaling 13,912 km² (excluding dispersals and atypically large movements to den sites) (Fig. 3).

The area illustrated in Fig. 3 is 1 estimate of the size of the impact area of the proposed impoundments. Another estimate was obtained using the average home range size. Standard minimum home range grids (Mohr 1947) were used to calculate home range sizes for individual bears and for bears according to sex and reproductive status categories. Mean total home range sizes for males and females were 1941 and 501 km² respectively, (Section 7.G.3, this report). Circles of this size would have diameters of 49.7 and 25.3 km, respectively. The mean of these 2 diameters was 37.5 km. We defined the area in which brown bears would be affected by the proposed project as the area within 37.5 km on either side of the Susitna River, from the Devils Canyon dam site to the confluence of the Susitna and Oshetna Rivers. This area totaled 12,127 km² (Fig. 4), a value only slightly lower than the area, mentioned above, that was occupied by radio-marked bears (Fig. 3). Use of an equivalent home range criterion for each of the impoundments, considered separately, yielded an impact area of 9,452 km² for the Watana Impoundment, 7,121 km² for the Devils Canyon Impoundment, and 4,425 km² common to both impoundments (Fig. 4).

Errors are associated with any method of identifying the area in which impacts on bear populations would result. The biases in the method used here result in a conservative estimate of the affected area's size. This is because home ranges are not circular, as assumed, but are ellipses with (typically) longitudinal axes perpendicular to the river. These longitudinal axes connect spring habitats along the Susitna River with denning habitats in the mountains away from the river.

6.B. Upstream Black Bear Study Area

The upstream black bear study area was relatively easy to define based on relocations of radio-marked individuals. This is because black bear habitat is largely restricted to the immediate vicinity of the Susitna River and its major tributaries such as Watana and Tsusena Creeks (Fig. 5). The initial capture locations of 32 bears that were radio-collared incorporated an area of 1,120 km^2 (Fig. 5). Subsequent radio locations (N = 2195) of these bears (excluding dispersers) incorporated an area of 2,950 km^2 (Fig. 6). This area is an overestimate of the amount of black bear habitat in the study area as the convex polygon method of delineating home ranges incorporates areas where radio-marked black bears were never located (Fig. 6).

Black bear habitat in the study area was more precisely defined using locations of all bears spotted (N = 282) and radio-tracked (N = 2,273) during the period 1980-1984. These points were plotted (1:63,360 scale) and a line was manually drawn around them such that all points were included except those considered to represent erratic movements (N = 54 for radio locations and 27 for locations of non-radioed bears). This area totaled 1,191 km^2 (Fig. 7).

6.C. Downstream Black Bear Study Area

The area downstream from Devils Canyon was defined as the downstream study area. Bears were studied in this area to determine what impacts anticipated project-related reductions in salmon spawning habitats (especially sloughs) would have on bear populations. Capture locations for 22 downstream black bears that were radio-collared incorporated an area of 250 km^2 (Fig. 8). Subsequent relocations (N = 616) of these bears incorporated an area of 1,949 km^2 (Fig. 9). This area was defined as the downstream black bear study area. Unlike the upstream black bear study area, most of the area incorporated in the polygon illustrated in Fig. 9 is black bear habitat. Bears that moved between upstream and downstream areas were not included for the purposes of defining these study areas.

7. BROWN BEAR RESULTS

7.A. Number of Bears in Impoundment Impact Zones

In Section 9 of this report I derive an estimate of the number of bears in the impoundment impact zone (Fig. 4). This estimate is based on extrapolation to brown bear habitat in the impoundment impact zone, from a density estimate (2.97 bears/100 km^2) obtained in part of this zone. The 95% confidence interval for this density estimate is similarly extrapolated to the impact zone without modifications designed to reflect the extrapolation. The resulting estimate for the number of brown bears in the impoundment impact zone was 327 (295-386). I estimate that 68% of these bears were 2.0 years old or older (Miller et al. in press, Appendix 2). This is a larger number of bears than I estimated in previous reports (e.g., Miller and McAllister 1982). This difference is primarily the result of estimates being based on lower bear densities (2.44 bears/100 km^2) estimated in 1979 in an adjacent study area (Miller et al. 1982).

7.B. Use of Impoundment Impact Zones by Brown Bears

7.B.1. Use by season, sex, age, and reproductive status

Miller and McAllister (1982:58-60) provided a preliminary assessment of brown bear use of impoundment area proximity zones; that analysis was combined with data collected subsequently (1980-1984) for the analysis presented here. Three zones were identified for each impoundment area: within the area that would be flooded by the proposed impoundments (zone 1), within 1 mile of the normal maximum operating level (NMOL) shoreline of the proposed impoundments (zone 2), and from 1 to 5 miles from the NMOL shoreline of the proposed impoundments (zone 3). An illustration of these impoundment impact zones is presented in Fig. 10. Data collected farther than 5 miles from the NMOL shoreline of the proposed impoundments ("zone 4") are also reported but not included in the analysis. A vertical north-south line was drawn to separate the 5-mile polygons of each impoundment which would, otherwise, have overlapped.

The purpose of this analysis was to determine whether bears were selecting for the impoundment area and, if so, at which periods of the year selection occurred. Chi-square analyses were used to make this determination under the null hypothesis that the number of point locations found in each of these 3 zones was in the same proportion as the area in each zone. Not all assumptions of the Chi-square analyses were met because multiple observations were made of the same bear so the data points were not independent of each other. Seasons considered included "spring" (April 1-June 30) and the rest of the year. Data collected in 1980 through 1984 are analyzed.

7.B.1.a. Watana Impoundment

In the Watana Impoundment area, brown bear use of the 3 impoundment zones was significantly different than expected for all months lumped and in the spring (Table 3). Use of the impoundment zone was over twice the expected values (Table 3). No significant variations from expected values were observed during the period July 1-March 31 (Table 3).

Brown bear males also used the 3 Watana Impoundment zones significantly differently than was expected under the null hypothesis (Table 4). In all months and in both periods, use of the impoundment zone was higher than expected values (Table 4).

Brown bear females also used the 3 impoundment zones of the Watana Impoundment differently than expected under the null hypothesis (Table 5). This difference was significant for all months lumped and in the spring period, but did not differ from expected values during the July 1-March 31 period (Table 5).

When a similar analysis was done for brown bear females with cubs-of-the-year, no significant variations from expected values were observed for all periods lumped, or for either of the two time periods (Table 6). This is because these bears tend to stay at higher elevations, well away from the impoundment area, during years when they have newborn cubs. I suspect that this behavioral trait is designed to reduce predation on their cubs, by other brown bears (especially adult males) that are concentrated in lower-elevation habitats early in the year. To test this hypothesis I compared the use of these 3 impoundment zones (both impoundments lumped), during years when the same set of females had cubs-of-the-year with the years when they did not (Table 7). During years when they had newborn cubs these bears utilized these 3 zones differently than during years when they did not have newborn cubs; use of the impoundment zone was less than expected when these females had cubs (Table 7).

The proportion of time spent in the actual impoundment zone was highest during the period 1-15 June for all bears (18.4%, Table 3), and for female bears (25.5%, Table 5). The impoundment zone was most heavily used by males during the last 2 weeks of June (23.2%, Table 4).

The percent of point locations in each proximity zone in each month is illustrated in Fig. 11 for the Watana and Devils Canyon impoundment areas. Comparison of these 2 impoundments illustrates the greater degree of selectivity for the Watana Impoundment zone than for the Devils Canyon Impoundment zone (Fig. 11).

7.B.1.a. Devils Canyon Impoundment

Similar analyses were conducted for observations within the 3 proximity zones of the Devils Canyon Impoundment but because of the smaller sample of point-locations in this area and because of the much smaller area that is anticipated to be flooded by the Devils Canyon Impoundment, analyses by season were not possible. Use of these 3 zones (all months lumped) was significantly different for females without cubs-of-the-year and for all bears lumped. Use was not significantly different for males (Table 8). The most significant deviations from expected values were observed in zone 3, which was used more than expected. Zone 1, the impoundment area, was also used more than expected (Table 8). However, because zone 1 was so small in area, it had only slight use altogether (Table 8).

7.B.2. Prediction of impacts

The above analysis demonstrates that the area to be flooded by the proposed Watana Impoundment, as well as the area within 1 mile of the impoundment shoreline, is important habitat to brown bears. Use of this habitat is especially intense during the spring, but is significant throughout the year as well.

Conversion of this evident selectivity to estimates of impacts on the brown bear population when impoundment area habitats are no longer available is not straightforward. I suspect the impact on brown bear populations will be expressed through reductions in bear productivity and in population density. Such reductions from existing population levels might not occur or might be dampened in magnitude if there currently is substantial excess carrying capacity which is not being used by bears and that could be substituted for the habitat that would be lost to the impoundment. Such substitutions would have to be available during the same season. Loss of important spring habitats where bears are foraging for roots and new spring growth, for example, would likely not be fully compensated for by increases (that might result from mitigation efforts for example), in late summer food sources (e.g., salmon or berries). Even if the current population is below carrying capacity, project-related losses of carrying capacity need to be considered in mitigation planning. These losses can be considered loss of bear habitat potential.

The conceptual model I used to estimate impacts from the point location data includes the following assumptions:

1. The proportion of point locations found in a geographic zone represents a corresponding proportion of the bears' total energy budget acquired from resources found in that

zone (this assumption will lead to an underestimate of the importance of the zone in cases where positive selection for that zone is occurring).

2. Substitute resources are not available (in cases where the population is below carrying capacity this assumption will overestimate the impact of loss of the geographic zone).

3. Loss of resources that are especially heavily used during 1 season of the year cannot be made up through extra use, at other seasons, of resources available in other zones (this assumption, also, will probably yield an overestimate of impact).

4. Impact on habitat carrying capacity can be expressed by summing the impacts on individuals (determined in #1).

5. Radio-marked bears in this study are representative of the population estimated to use the impoundment impact area (Section 7-A of this report).

6. Reduction in carrying capacity would result only from flooding of the impoundment area; no reduction would result from displacement to habitats along the shoreline of the impoundment (this assumption would certainly result in an underestimate of impoundment impacts).

Data obtained in this study were analyzed under these assumptions. Nine radio-marked males and 25 radio-marked females averaged 13.3% of point locations during the spring period in the impoundment zone; an additional 17.0% of point locations were within 1 mile of the impoundment shoreline (Table 9). If, as previously estimated, the impoundment impact zone includes 327 brown bears and 13.3% of the carrying capacity for this population will be eliminated, a decline in carrying capacity for an estimated 43 bears would be expected from habitat inundation under the above-listed assumptions.

Because some substitution of resources would undoubtedly occur, I expect that this estimated impact is more likely to be an overestimate than an underestimate of the project's impact resulting from inundation of habitat. This expectation is supported by the observation that 14 of the radio-marked bears (41%) had no point locations in the impoundment-impact area (Table 9). Nine of these bears (26%) had no locations within the 1-mile proximity zone either (Table 9). Although these bears may have used these zones without being detected, it is probable that these data indicate availability of spring food resources outside of the immediate impoundment impact area.

7.B.3. Mitigative Measures

Potential measures to mitigate for loss of spring foraging habitats resulting from inundation include:

1. Increasing the abundance of foods used in the spring in substitute areas;

2. substitution of foods utilized during other seasons for losses of spring carrying capacity; and

3. indirect mitigation (e.g., bear habitat protection elsewhere or transference of mitigation values to other species).

It is uncertain if measure #2 would be efficacious. Implementation of either measure 1 or 2 would be experimental as little is known about how to accomplish increases in bear habitat carrying capacity (Proceedings--Grizzly Bear Habitat Symposium, Missoula, Montana, 1985, Intermountain Research Station, Ogden, Utah, General Tech. Report INT-207 252pp.).

7.C. Disturbance-Displacement from Remaining Habitat

The degree to which brown bears are compatible with increased human presence is not completely clear. In most areas it appears that brown bears will tolerate the proximity of humans better than humans will tolerate the presence of brown bears. In large National Parks, like Denali National Park, where grizzlies are not hunted and special efforts are made to accommodate grizzly bear needs, bears remain abundant regardless of high levels of human use. More typically, however, increasing human activity in an area correlates with declines in grizzly numbers (Herrero 1985; Pulliainen 1972 and 1982; Horejsi 1986; Horejsi, in press; Elgmork 1983). Pulliainen (in press) observed that the population of bears in Finland declined as human populations and impacts increased. However, the decline was followed by an increase in absolute numbers resulting from immigration from Russia. Mattson et al. (in press) documented a retreat of grizzlies, especially females, from roads and developments in Yellowstone National Park. Archibald et al. (in press) also documented avoidance by adult female grizzly bears following logging development of an area.

Some of these declines result from humans killing bears in both sport and nonsport circumstances. Increased killing by sport hunters is a direct consequence of improvements in accessibility and interest in hunting; increased killing in nonsport circumstances results from intolerance or inability of humans to coexist with bears (Miller and Chihuly, in press). In addition, I suspect there is strong selective pressure for bears in populations that are heavily hunted, to learn to avoid man. Bears that fail to learn this behavior at an early age are easier prey for hunters. If this theory is correct, then increased human presence in the project area will result in abandonment of the area by adult bears that are displaced as a result of intolerance of people. This abandonment may also occur in areas where bears are not hunted (see Jope 1983), but is probably more evident in areas like the project area where bear hunting occurs. Young bears that have not learned this avoidance behavior may be especially vulnerable to nonselective hunting effort (Bunnell and Tait 1980).

Although most bear biologists would agree that disturbance displacement occurs, there is little direct quantitative documentation. The number of visitors to the bears' fishing area at McNeil River State Game Sanctuary is limited. This limitation is based on observations that too many visitors resulted in fewer bears visiting the portion of the sanctuary where bears were most concentrated (Faro and Eide 1974). In their preliminary assessment of the effects of construction of the Terror Lake Hydroelectric project on movements of Kodiak bears, Smith and Van Daele (1985) observed short-term shifts of activity areas of individual brown bears, away from construction sites. These authors observed no major movements away from construction activities and 1 bear denned within 0.4 km of an access road. Bear problems resulting from contractors' inadequate disposal of garbage were observed in this Kodiak study (Smith and Van Daele 1985).

7.C.1. Impoundments, access roads, and accidental mortalities

Although bears swim readily and are known to swim across impoundments, movements across the impoundment will probably be restrained, to some degree, compared with movements bears currently make across the river. Simpson (1986:21) studied movements of grizzly bears in the vicinity of the Revelstoke Reservoir in British Columbia and noted that "grizzlies would cross a river but not the reservoir." At Revelstoke, Richard L. Bonar (April 18, 1985, interview transcribed by Bill Steigers of the Susitna Project Group of LGL) noted "the radio-collared bears [both species] haven't crossed as often as they did before the water came up."

Although some impact is probable, it is impossible to guess how much movements across the river will be restrained by the Susitna impoundments. In this study we concentrated on documenting how frequent crossings were during the preconstruction phase so comparisons could be made during a post-construction study. Such comparisons will permit more accurate predictions of effects in future impact assessment studies.

The number of river crossings for each radio-marked bear in each year with >5 non-den observations varied from 0 to 10 (Table 10). Clearly, the number of documented river crossings is directly related to frequency of observation, so the number of observations is also provided in Table 10. For the purpose of this analysis a "bear-year" was defined as a year in which we obtained more than 5 radio-locations of a radio-marked bear away from its den site. For males, crossings were observed for 27 of 32 bear-years (84.4%); for females crossings were observed for 38 of 77 bear-years (49.4%) (Table 10). Of 658 point locations for males, 98 (14.9%) had a documented crossing of the Susitna River after the preceding location (Table 10). Of 1,668 point locations for females, 152 (9.1%) had a documented crossing of the Susitna River after the preceding location (Table 10). No doubt these values were larger for males than for females because males had larger home ranges and, as a result, the home ranges of a higher proportion of males incorporated both sides of the river. Movements of bears living north of the river to the Prairie Creek salmon fishing area could be restrained by the impoundment and associated facilities.

In addition to inhibiting movements across the reservoir, movements up and down the river would likely be restricted to some degree by inundation of tributaries. These tributaries, such as Watana Creek (Fig. 1), can be easily crossed at present.

Increased human activity in the vicinity of the impoundment would also likely act to displace bears from habitats along the reservoir shoreline. This disturbance would be greatest in the vicinity of communities established to house construction and operation workers.

Disturbance would also be significant in the vicinity of recreational facilities established as outlined in the recreational plan. The objective of these facilities is to provide increased recreation opportunities for as many people as possible. I suspect this objective is inimical to maintaining the present population of adult brown bears in the project area. The area affected by the proposed recreation plan is much larger than the area that would be directly affected by impoundments and construction facilities. Anticipated recreational developments and trails are expected to be built many miles away from the dam sites, reservoirs, and access roads.

The proposed route of the access road (Fig. 1) is in heavily used brown bear habitat along most of its length from the Denali Highway to the Devils Canyon dam site. This route would bisect the home ranges of many brown bears. Miller and Ballard (1982b) noted that movements of transplanted brown bears appeared to be inhibited by roads and it is probable that the access road would also modify normal bear movements in the impoundment area. Smith and Van Daele (1985) observed little displacement of brown bear by traffic on roads built for construction of the Terror Lake hydroelectric project.

Increased human presence in brown bear habitat is likely to result in additional mortalities of bears through killing of nuisance or dangerous bears (Miller and Chihuly, in press, Appendix 3) and accidents. Such mortalities and problems were observed for both species of bears during construction of the trans-Alaska oil pipeline (Follmann and Hechtel, in press). Many of these problems resulted from feeding of bears and from inadequate garbage disposal (Follmann and Hechtel, in press). During construction of the Terror Lake hydroelectric project on Kodiak Island no mortalities from these causes were documented but bear problems resulting from inadequate garbage disposal were observed (Smith and Van Daele 1985).

7.C.2. Levels of impact and mitigation measures

Maximum estimated level of impact from disturbance displacement was estimated in the same manner as loss of carrying capacity due to inundation. For this purpose it was assumed that all carrying capacity in the zone from the proposed impoundment shoreline to a distance of 1 mile (Zone 2 in the proximity analysis) would become unavailable to brown bears as a result of disturbance displacement. Point locations in this zone totaled 17% of all point locations (Table 9). For the brown bear population estimate of 327 in the impoundment area, a loss of 17% of carrying capacity would result in an estimated decline of carrying capacity for 60 brown bears. This estimate is subject to the same qualifications outlined above for loss of carrying capacity due to inundation. In addition, I suspect that loss of carrying capacity due to disturbance displacement would be proportionately less than loss of carrying capacity due to inundation; more bears could coexist with disturbance than could obtain forage from flooded habitats.

The most effective mitigation measures designed to minimize losses of habitat due to disturbance displacement will be those that restrict human activities and facilities to the smallest possible area. Concentration of construction facilities and human habitations will have this effect, as will minimizing the area in which access by the public will be facilitated. Disturbance-displacement of brown bears in the area between Kosina Creek and Prairie Creek can be minimized, for example, if public access by road to the south side of the Susitna River is not provided and if recreation facilities in this area are not built. Strict enforcement of state regulations regarding feeding of wildlife and disposal of garbage will also help reduce incidence of bear problems and killing of bears that have become nuisances.

7.D. Brown Bear Use of Prairie Creek Fishing Area

7.D.1. Level and time of use

Each year many brown bears in the Su-Hydro study area move in July and August to Prairie Creek, a tributary of the Talkeetna River that runs out of Stephan Lake. The purpose of these movements is to fish for king salmon (*Oncorhynchus tshawytscha*) which run in this small creek at this time. Sport fisheries biologists with the Department of Fish and Game report that Prairie Creek supports the most concentrated king salmon spawning area in the upper Cook Inlet region (Larry Engle, pers. commun.). Salmon are relatively easy for bears to catch in Prairie Creek compared with larger rivers like the Gulkana.

Radio-marked brown bears have been documented moving from an area of 15,300 km^2 to utilize Prairie Creek salmon resources (Fig. 12). For just radio-marked males the area was 15,285 km^2, for just females it was 3,300 km^2. The actual area of attraction to brown bears is larger than this because these data are biased as a result of tagging radio-marked bears only in the Su-Hydro study area which is north and east of Prairie Creek. Bears moving to Prairie Creek from south and west directions would have had no chance of being radio-marked in this study. One radio-marked bear (G407) moved to Prairie Creek to fish for salmon from upper Gold Creek (downstream from Devils Canyon) at a time when pink and chum salmon (O. gorbuscha and O. keta) were abundant and much closer in lower Gold Creek. This movement may indicate that the king salmon in Prairie Creek may be preferred over salmon resources elsewhere.

The proportion of radio-marked Su-Hydro study area bears that have been documented moving to Prairie Creek to fish for salmon has ranged from 13% in 1981 (a year when little monitoring was done as a result of poor flying conditions) to 38% in 1984 (Table 11). This proportion appears higher for radio-marked males (50% in 1984, excluding dispersers) than for radio-marked females (33% in 1984) (Table 11).

In summer 1984 and 1985, efforts were made to estimate the number of bears at Prairie Creek at 1 time during the salmon run. This number is difficult to determine from direct counts because of dense vegetation along the banks of Prairie Creek. This vegetation makes it very difficult to spot the bears from the air as bears need only to move a few feet from the creek to be well hidden from sight in alders. Correspondingly, we attempted to census the bears in this area using the ratio of radio-marked to unmarked bears spotted during intensive search efforts along the length of the creek between upper Murder Lake and the Talkeetna River. The search area was a strip of about 1 km on each side of Prairie Creek and about 0.5 km on each side of salmon-carrying tributaries of Prairie Creek. Marked bears that were spotted were identified by their radio frequencies but radio-tracking gear was not utilized in finding the bears during the search effort. The search pattern flown was a circular one overlapping Prairie Creek from both sides and following the tributaries on both sides of Prairie Creek to the limit of salmon spawning. Subsequent to the search effort, radio-tracking gear was utilized to determine how many radio-marked bears were present in the area previously searched. These surveys were flown by experienced bear spotters in both years: pilot Al Lee (Lee's Air Taxi) in 1984 and Harley McMahan in 1985. I was present as spotter and radio-tracker both years.

Results of flights on 29 July and 1 August 1984 are presented in Table 12. On 29 July an estimate of 48 bears (95% confidence interval = 12-180) was obtained; on 1 August an estimate of 33 bears (95% confidence interval = 10-62 bears) was obtained (Table 12). These estimates include only bears that were not accompanied by their mothers (or bears at least 2.0 years old). An estimate including these subadults would be 30-40% higher, or about 44-65 bears. The large confidence intervals of this estimate result from a low number of marked bears being present in the search area when the census was conducted (only 4-5, Table 12).

Equivalent data were collected in mid summer 1985 (23-27 July) during replicated morning and evening flights in a Piper Super Cub (PA 18), for a total of 8 counts. On 6 August another flight was conducted in a Cessna 180 flown by Larry Rogers (Kenai Air Alaska) with Randy Fairbanks, Richard Fleming, and me as observers. This flight was incomplete at the lower end of Prairie Creek because of fuel shortage. The 6 August flight was poorest in terms of visibility because of the larger airplane and increased number of observers; however, it may have provided the best estimate because of the larger number of marked bears that were present (Table 13). Summarized results of these 9 flights are presented in Table 14.

The data in Table 26C were used to calculate 9 separate Petersen Indices. These estimates varied from 27 to 107 bears and averaged 51 bears. The 95% confidence interval for this average was +22 bears or 43.7%. Another estimate was obtained using the bear-days estimator (Miller et al., in press, see

Appendix 2). Using this estimator, the estimate for the average number of bears present in the search area was 59 with a 95% CI of +23 bears (Table 14). These estimates include subadults.

The estimates from 1984 and 1985 both indicate that an average of 50-60 brown bears used Prairie Creek at any 1 time. Because some bears were just out of the search area and because bears come and go from Prairie Creek, the total number of different individuals that use Prairie Creek during the salmon-spawning period (1 July-15 August) is higher than this estimate by some unknown amount. My guess is that 70-120 different brown bears may use Prairie Creek salmon resources at some time during the king salmon run.

The areas occupied by 6 radio-marked brown bears during the period 23 July-6 August 1985 are illustrated in Fig. 13. These 6 bears moved an average of 2.4 km between successive locations during this period (range = 0.2-7.4 km). The mean distance between points 24 hours apart was 3.3 km (range = 0.4-7.9 km). Only points on the periphery of these movements are illustrated in Fig. 13. Locations of all bears spotted between 23 July and 6 August are illustrated in Fig. 14.

I believe that most bears that utilize Prairie Creek are offspring of females that used Prairie Creek. However, my sample of marked subadults is too small to demonstrate this. Some bears that live near Prairie Creek (e.g., female 299 in the Fog Lakes area) do not go there, while others travel from great distances (e.g., female 407 from upper Gold Creek). Some bears find out about Prairie Creek on their own. Male 382 was weaned in 1983, at age 2, from a mother that did not use Prairie Creek (313). This subadult male stayed near his maternal home range (centered on Tsusena Butte) in 1983 and 1984, but in 1985 he dispersed south and fished along lower Prairie Creek. This bear shed his drop-off collar at Prairie Creek in August 1985 and his subsequent movements are unknown.

7.D.2. Potential impacts of project on brown bear use of Prairie Creek

The amount of disturbance which will occur in the Prairie Creek area is uncertain, as are the relative impacts of different levels of disturbance on bears. Increasing levels of disturbance through increased recreational use of the area are currently evident and likely to continue regardless of whether the dam is built. If the dam is built, however, the improved access to the area will result in greatly accelerated disturbance impacts. There is a real potential that this disturbance will become so great that bears may be excluded altogether from this habitat. This has nearly happened elsewhere in Alaska; for example, along sections of the Kenai and Russian Rivers that are currently heavily utilized by humans during salmon runs.

Our work at Prairie Creek was designed to estimate the number of bears using Prairie Creek during the salmon run. I also wanted to provide the baseline data needed to document the anticipated decline in bear use of Prairie Creek, which will occur if the impoundment is built and the Prairie Creek area is developed. This documentation will result from replicated surveys flown subsequent to construction. These surveys should reveal whether development has resulted in the anticipated exclusion of many brown bears from this resource. In order to assist in this documentation, the human habitations present in 1985 in the Prairie Creek-Stephan Lake area are documented in Fig. 15. Many of these habitations were built in recent years and it is clear that human presence and impact in this area is increasing.

The exclusion of brown bears from Prairie Creek will result, in part, from increased numbers of non-sport brown bear kills by the increased number of recreational users who will have access to the area subsequent to construction of access routes from the Denali Highway to and across the impoundment. More important, however, will be the effects of disturbance exclusion wherein brown bears will abandon the area because of the anticipated large increase there in numbers of humans. Increased disturbance-displacement will result from increased recreational use of the Prairie Creek area by boaters (especially those floating down Prairie Creek from Stephan Lake), fishermen, hikers, and other recreational activities, as well as from increased industrial activities (mining, logging, tourist lodges, etc.). These activities will increase markedly in the Prairie Creek area once public access is provided by means of the proposed access road to the project area. Disturbance to the Prairie Creek area can be minimized if public access by roads crossing the Watana dam site is not allowed.

All of these activities are not inherently incompatible with bears. In Katmai National Monument, tourism and recreational activities coexist with many salmon-fishing brown bears at Brooks Camp (B. Gilbert and K. Jope, pers. commun.). One important difference between Brooks Camp and the Susitna project area is that bears are protected from hunting in national parks. Where hunting is legal, bears likely develop a more wary reaction to human presence.

7.D.3. Level of impact on brown bear

The worst-case scenario is used here to estimate impacts of the project on brown bears using Prairie Creek. Research subsequent to the project will likely reveal less of an impact, but at this time, I have no realistic method of estimating how much less this could be. The worst-case scenario is that 100-120 brown bears use Prairie Creek salmon resources annually and that the project and related disturbances will accelerate development of the Prairie Creek area until bears are completely excluded from Prairie Creek, the only salmon stream with readily catchable fish that is available in the study area around the Watana Impoundment. Absence of this food resource would likely act to reduce bear density in this area and to lower the reproductive rates of remaining bears (see Section 7.G.1, this report). No estimate of how much lower reproductive rates might be is offered here; this would probably be expressed as a longer reproductive interval.

Assuming that all of the difference in bear density between the Su-Hydro study area (2.79/100 km²) and the upper Susitna River study area (2.44/100 km²) (Miller and Ballard 1982a) results from availability of Prairie Creek salmon, a reduction in density of about 0.35 bears/100 km² is indicated. In the Su-Hydro study area of 11,704 km² this would mean an estimated elimination of average annual carrying capacity potential for 41 bears. By these calculations 59% of the estimated 100 bears currently using Prairie Creek salmon resources would find acceptable alternatives to these resources.

This model of impact levels is certainly simplistic as, among other things, there are no data indicating bears are currently at carrying capacity. If bears are currently below carrying capacity, reduction in availability of any single food resource would have less impact on the existing population. However, this estimate provides a reasonable starting place for mitigation planning.

7.D.4. Potential mitigation efforts

Prairie Creek is the clearest example of a critical habitat for brown bears that I found in the vicinity of the proposed hydroelectric project. As such, protection of this area from the impacts discussed above offers an obvious opportunity to mitigate for losses of brown bear habitat that will occur as a result of the project. This mitigation could be achieved if the area surrounding Prairie Creek were obtained by the State and put into an appropriate land-use designation such as a state game refuge. This protection would not result in any absolute increase in numbers of brown bears in the study area. Protection of Prairie Creek as a salmon fishing area for bears probably would, however, help maintain larger populations of bears than would be able to exist in this area without such protection of this habitat. As this is the only kind of mitigation that is likely to be effective for the losses that the project would cause to brown bear populations in the study area, protection of Prairie Creek as a food source for salmon-fishing brown bears should receive the attention of mitigation planners. The factors necessary to adequately protect Prairie Creek from exclusion impacts include:

1. Restrictions on human use (including float traffic on Prairie Creek) between 1 July and 15 August, at least; and

2. Minimal human development and impacts in the larger area surrounding Prairie Creek, such as the Fog Lakes area.

It is noteworthy that the recreational plan currently under consideration as part of the Federal Energy Regulatory Commission license application would most likely be incompatible with either of these requirements. Among other things it is highly questionable whether, for example, there would be any point in protecting Prairie Creek as a state game refuge or critical habitat area if road access to the south side of the Susitna River is provided as a result of the project. Such access would almost certainly result in levels of increased human use of the Prairie Creek area. This increased use would, in my view, result in reduced brown bear use of the area and the degree of reduction would be directly related to the level of disturbance.

7.E. Downstream Impacts, Brown Bears

During this study little emphasis was given to brown bear populations downstream from the Devils Canyon Dam site. As part of downstream black bear studies (Section 8E, this report) and from observations of 3 radio-marked brown bears, however, some insights into potential sources of impact in this area were gained.

Brown bear populations occur along the Susitna River to its mouth on Cook Inlet. It is my impression that these populations become progressively less dense downstream from the Devils Canyon Dam site. Brown bear tracks along the salmon-spawning sloughs off the Susitna River were very common, especially above the confluence with the Indian River. I expect most of this use was by locally residing bears, because except for 1 dispersing subadult (342), no brown bears radio-marked upstream from Devils Canyon moved downstream during this study. Such downstream movements might become evident if upstream bears were displaced from Prairie Creek (Section 7D, this report).

The project's major downstream impact on brown bears would likely result from the anticipated reduced availability of salmon in these sloughs. Estimates of the levels of salmon reduction that would occur are not available. Correspondingly, much speculation on potential secondary impacts on bears is not warranted. It is noteworthy, however, that there has been a dramatic increase in the resident human population in the area between Devils Canyon and Talkeetna in recent years; most of this increase is the result of state land disposals in the area. I expect that the effect of this human presence on bear populations in the downstream area will be many times greater than effects resulting from construction of the impoundments. These human-caused impacts would be the result of increased sport and non-sport kills and disturbance displacement.

7.F. Cumulative Impacts, Brown Bear

The proposed project's cumulative effects on brown bears may be greater than the sum of individual effects. This is because impact mechanisms that would have little or no impact considered separately may act synergistically and, in total, produce significant impacts. Methodology to identify and quantify such cumulative impacts on brown bears has been described by Christensen (1985), Young (1985), Winn and Barber (1985), and Weaver et al. (1985). An effort to conduct similar cumulative effects analyses should be accomplished as part of environmental impact assessments undertaken for the Susitna Hydroelectric Project. In this report only some examples of such impacts will be discussed.

Adequate high-quality food is probably the single most important life requisite for bears of both species. This is because bears have only 5-7 months of activity. During this time bears must obtain the energy reserves needed to reproduce and to sustain themselves in their dens. If a pregnant female does not attain a sufficient threshold of condition to permit successful rearing of a litter of cubs prior to den entrance, then she should not invest energy in gestation and lactation. In such cases implantation of the embryo into the uterus may not occur and the female will "try again" the following year.

Energy budgets of bears have not been adequately studied, but it is reasonable to assume that super-abundance of foods in 1 season cannot completely compensate for substandard foods in another season. In such a model, superabundance of late summer foods (berries and salmon for example) would not compensate for loss of early spring foods (through inundation by impoundments, for example). In similar fashion, reduced availability of early spring foods combined with reduced quality or availability of late summer foods (loss of Prairie Creek salmon or blockage of travel corridors to berry feeding areas, for example) would likely have synergistic effects on bear numbers. The net impact would be greater than the sum of the individual parts.

In preceding sections I made estimates of carrying capacity losses that might result from various impact mechanisms. Loss of bear habitat carrying capacity would cause reductions in the existing bear populations only if these populations are currently at or above carrying capacity of the habitat. If not, these estimates represent losses in carrying capacity potential. Carrying capacity is a useful theoretical concept but techniques to evaluate it are lacking for most species. Density can be a direct estimate of carrying capacity, as existing density must be at or below carrying capacity unless the population is declining, or about to decline, as a result of lack of resources.

I do not know how to measure bear carrying capacity in the Su-Hydro area or elsewhere but I can subjectively evaluate where the existing population is relative to its theoretical carrying capacity based on density, reproduction, and resource-availability comparisons with other areas. Brown bear density and reproductive rates are high in the Su-Hydro area compared with other interior Alaskan areas (Miller and Ballard 1982a; Miller et al., in press, Appendix 2; and Section 7.G.1 of this report). The most obvious difference in resource availability between the Su-Hydro area and other interior Alaskan areas is the seasonal availability, to many bears, of salmon in Prairie Creek.

The high productivity of the existing Su-Hydro bear population indicates that this population is certainly not above the habitat's carrying capacity. At present the primary factor that could cause existing bear populations to be below carrying capacity in the Su-Hydro area is hunting. Since 1980 liberalized seasons and bag limits in Unit 13 have resulted in increased bear harvests in the study area and elsewhere in Unit 13 (Section 7.G.2 of this report). It is probable that these increased harvests have reduced bear population density in the study area below levels that existed prior to 1980. If this is true, excess carrying capacity may exist which could buffer the existing population from project-related reductions in carrying capacity.

7.G. Brown Bear Biology

7.G.1. Brown bear productivity

Along with changes in bear numbers and density, I suspect that reductions in food supply that would result from the project would cause changes in productivity. Currently this population appears to be one of the most productive that has been documented. The primary factor in this high productivity is the short reproductive interval; females were never observed to keep their offspring with them longer than 2.8

years. This leads, commonly, to a reproductive interval of 3 years. In no case during this study did a female enter a winter den with 2-year-old offspring. In Denali National Park, 7% of litters (5 of 69) of 2-year-olds remained with their mothers another year (Murie 1981). Entering dens with 2-year-old or older offspring is common for brown bears in other areas (Bunnell and Tait 1981; Reynolds and Hechtel 1976, 1984, and 1985), including areas where bears live in apparently much more productive habitats such as Kodiak Island (Smith and Van Daele 1985 and 1986, Barnes 1985) and the Alaska Peninsula (Glenn et al. 1976).

Data on productivity are provided in this section to provide the baseline data needed to measure changes if the proposed project is completed. No estimates of project-caused changes in productivity are offered. I suspect an increase in reproductive interval and age at first reproduction would be the parameters most likely to be affected. In a study just north of the Alaska Range from our study area, Reynolds and Hechtel (1985) found that some females entered dens with 2-year-old offspring. Their study area is equivalent in many respects to our study area except that salmon are unavailable in their area. Salmon are available to some Su-Hydro study area bears at Prairie Creek (Section 7.C.2 this report).

7.G.1.a. Litter Size and Offspring Mortality

Thirty-eight litters of newborn cubs that were observed following their emergence from dens averaged 2.1 cubs (range = 1-4) (Table 15). These data exclude project-related mortalities. Twenty-two of 59 cubs were lost before they emerged from their dens in the following year (37.7% mortality) (Table 15). The mortality rates for newborn brown bears observed in this study were near the upper limit for the studies reviewed by Bunnell and Tait (1985), at 30%-40%. Higher mortality rates have been found in southeast Alaska (Schoen, pers. commun.).

Causes of mortality were investigated using expandable drop-off transmitter collars (Strathearn et al. 1984). These transmitters were on very slow pulse when active (17 pulses/minute or "ppm"), speeding up to about 45 ppm on inactive mode. This pulse rate was acceptable because as long as these cubs were with their mother and on active mode, the mothers' collars could be used for radio-tracking. These collars were placed on 6 cubs in 3 litters in 1983 (females 281, 283 and 299) and on 7 cubs in 4 litters in 1984 (females 340, 337, 423, and 281). Seven of these 13 cubs survived to their yearling year (46% mortality). Cause of death for 5 cubs was determined to be predation by unknown brown bears. Cause of death for the remaining 2 cubs was not determined as the bodies could not be found when their radio-signals disappeared. I suspect that these cubs were either drowned and swept downriver during river crossings or that they were preyed upon and their transmitters destroyed. In one of these cases of unknown cause of mortality, the lost cub was markedly the smallest cub in a litter of 4 (with female 423); the other 3 cubs survived.

It is noteworthy that 4 of the lost radio-marked cubs were with female 281 who had litters of 2 newborns in 1983 and in 1984. In both years this female left her high-elevation den site and moved to lower elevations along the Susitna River early in the year, following the typical pattern for bears not accompanied by newborn cubs. In both years she lost her cubs (3 to brown bear predation, 1 to cause unknown) within days of moving to lower elevations (cubs were lost on 1 June in 1983 and on about 28 May 1984). This was a young female that had her first litter in 1983. In 1985 she had another litter of 2 and followed the same pattern of moving to lower elevations; this time she lost one of her cubs between 5 June and 26 June; the other survived through September 1986.

An additional 2 cubs were radio-marked with female 388 in 1984. This capture resulted in a capture-induced separation which ended in the death of the cubs despite 3 efforts we made to reunite this family. Separation occurred on 16 May and reunion efforts occurred on 18, 23 and 24 May. In the first effort we herded the female toward the cubs with a helicopter. In the second we air-dropped the cubs about 10 feet from a helicopter near the female. In the third effort we immobilized the female with Sernylan and released the cubs nearby; the cubs began to nurse immediately. At this last effort 1 cub had a nose full of porcupine quills which we pulled. One cub died on 29 May, most likely of starvation. Nearby feces of the other cub were full of overwintered Empetrum berries. The other cub survived until mid-June at least; its collar was picked up on 23 June but no sign of the cub was found nearby. This collar was unexpanded, evidence indicating the cub was killed by a predator rather than having shed the collar. On other occasions reunion efforts like those described above were successful. The lack of success in this case may have resulted from the delay in attempting the reunion; the female may have physiologically changed from a lactating mode to an estrous mode. She was seen with another large bear on 3 June and with a known male on 7 June and she had cubs again the following year.

Thirty-six litters of yearling cubs observed following emergence from dens averaged 1.7 offspring (range = 1-3) (Table 16). Eight of 37 yearlings (21.6%) were lost before their mothers emerged from their dens in the following year

(Table 16). I suspect most or all of these were mortalities but it is possible that some of the yearlings defined as "lost" may have separated from their radio-marked mothers as yearlings. None of the bears defined as "lost" as yearlings have subsequently appeared in the hunter harvest.

Implant transmitters were surgically implanted in 6 yearlings (in 3 litters) in an effort to determine causes of mortality. Only 1 of these bears died before transmitter failure the following year; the body of this bear could not be found to determine the cause of death as a fox carried the transmitter away from the carcass (determined from tooth marks on the transmitter). Causes of yearling mortality are largely unknown, but Dean et al. (1986) documented 2 instances in Denali National Park where yearlings were killed by adult males.

Twenty litters of 2-year-old offspring averaged 1.7 offspring (range = 1-3) (Table 17). All but 1 of these litters separated from their mothers prior to den entrance the following fall. Female 337 may prove to be an exception, as she still had her 2-year-olds when last seen on 24 September 1986 (Table 17). Separation from the mother at age 2 was defined as "weaning."

Reproductive histories of individual females are given in Table 18. A summary of losses of cubs and yearlings in these litters is given by year in Table 19. Measurements of cubs and yearlings handled in this study are given in Tables 20 and 21.

7.G.1.b. Reproductive Interval

There are numerous ways to calculate reproductive interval. The interval between successive production of litters of newborn cubs is not a good statistic because complete loss of a litter of cubs would frequently yield an interval of 1 year. Inclusion of such intervals in a calculation of mean reproductive interval would underestimate the interval that is needed to calculate population growth rate. The best interval to use would be the interval between successive successful separations ("weanings") of offspring from their mothers; however this method requires many years of data. Reproductive histories for individual radio-marked female brown bears are given in Table 22. Reproductive status of bears was determined during visual observation of radio-located females.

Reynolds and Hechtel (1985) defined reproductive interval as the period between successful breeding (as evidenced by cub production the following year) and the next successful separation of mother and offspring ("weaning"). Their method provides intervals that are 1 year longer than the one used in this study. I defined reproductive interval as the interval between production of a litter (as evidenced by observation of that litter following emergence from the den) and the next successful weaning of a litter. This interval definition will be shorter than that used by Reynolds and Hechtel (1985), as our definition does not include years of apparent conception failure unless these instances occurred subsequent to a successful weaning. With my definition I was able to include intervals for those females initially captured in the spring and accompanied by yearling offspring (back-dated to the year these yearlings were born); these intervals will be biased toward short intervals as litters could have been lost prior to the litter first observed as yearlings. We defined successful separation as occurring when 2-year-olds separated from their mothers after den exit (no cases of females entering dens with 2-year-old offspring were observed although female 337 still had her 2-year-old offspring with her in September 1986).

Following this definition I observed 17 reproductive intervals; 14 of these were 3 years (Table 22). The year in which 1 capture-related loss of a cub litter occurred (388 in 1984 [Table 22]) was not counted. Intervals of longer than 3 years were observed in 3 cases. In all of these, intermediate litters were completely lost in the year of their birth or in the following year (Table 22). Of these intervals, 1 was 4 years, 1 was 5 years, and 1 was 6 years. The mean reproductive interval for these 17 cases was 3.4 years (Table 22).

This estimate of mean reproductive interval is an underestimate as it is biased toward 3-year intervals, the minimum possible in natural conditions (Bunnell and Tait 1985). This bias results from shortness of the study period, losses of radio-marked bears, and back-dating from litters first observed as yearlings. For example, 5 females would have had intervals >3 years. These intervals were not counted because a complete interval, according to the above definition, was not obtained. Failure to complete these intervals resulted because the study ended, because the bear was shot by a hunter, or because the radio transmitter failed before the interval was completed. These incomplete intervals resulted from complete loss of a litter; the intervals would have been at least 4-7 years in different cases (Table 22). If the minimum values for these incomplete intervals are included, the estimated mean interval for 17 complete and 5 incomplete intervals would be 3.8 years (Table 22). This is still an underestimate as minimum possible values were used for incomplete intervals (396, for example, lost litters of newborns in 1984 and 1985, and was alone in 1986; the minimum interval of 6 years was obtained for her by assuming she will have cubs in 1987 and will successfully wean this litter in 1989).

Other methods of calculating reproductive interval are possible. The interval from birth of a litter which was successfully weaned and birth of the next litter was observed for 3 cases (312, 337, and 420); all of these intervals were 3 years (Table 18). The interval between successful weaning of 1 litter and successful weaning of the next litter was observed in 1 case (337); in another case (388) this interval should be completed in 1987. In both cases the interval was (or will be) 3 years (Table 18). As above, these intervals are biased toward the short intervals by the limited period of study.

7.G.1.c. Age at First Reproduction

Ages used in calculating age at first reproduction were estimated from counting cementum lines in a sectioned and stained premolar extracted during tagging. Some error in these estimates (probably nonsystematic) is likely. Age at first successful breeding is 1 year less than the age at first litter production.

As with reproductive interval, age at first reproduction (defined as production of a litter seen at emergence from natal den, not as breeding activity) can be calculated in different ways. The best way is to annually observe bears from immaturity through the time they are seen with litters. This is difficult because: 1) problems exist with attaching transmitters to subadults; 2) it requires long-term studies; and 3) it requires not utilizing data from other sources. Four bears aged as subadults when originally captured were followed to production of their first litter; all first produced cubs at age 6 (Table 18). Another bear in this category (407 at age 8) produced no litters I could see when she was age 4 through age 7 (Table 23). The earliest 407 could produce a litter would be in 1987 when she will be age 8. For these 5 bears, mean age at first reproduction (including 407) averaged 6.4 years (Table 23).

Young adults accompanied by cub, yearling, or 2-year-old offspring when first captured, can be back-dated to determine their mother's age at the time that litter was born (data in Table 22). With these data there is no way of knowing for certain whether a litter was previously produced and lost. This source of error would yield overestimates of age of first litter production. Using such back-dated data, I calculated that 4 bears produced their first observed litters at age 4; 4 at age 5; 4 at age 6; and 1 at age 7 (Table 23). For these 13 bears, apparent age at first reproduction averaged 5.2 years. These data were back-dated from newborn cub litters (N = 4), from yearling litters (N = 7), and from litters with 2-year-old offspring (N = 2) (Table 23). No back-dating of litters to determine mothers' age when the litter was born was included for bears aged ≥ 8 years old when first captured. Such bears had a high likelihood of having had litters prior to the one they had when first captured.

When these two data sets are combined, an estimate of 5.5 years was obtained for average age of females producing first litters (N = 18 female brown bears; range 4-8) (Table 23). This is not the same as mean age at first reproduction, as this statistic is based on the proportion within each age class producing first litters. The frequency distribution for these combined data shows that age 6 is the most common age for production of first litter (44%) (Table 23).

7.G.2. Sources of brown bear mortality

The Su-Hydro study area is in Game Management Unit 13. Since 1980 brown bear hunting regulations have been liberalized in GMU 13 in an effort to increase bear harvests, and thereby, to accelerate moose population growth. These changes have increased reported bear harvests in the study area to an average of 32 bears/year in 1983-85 compared with 14.3 in the period 1978-80 (Table 24). In Table 24, harvests in the Su-Hydro study area are compared with harvests in the Denali Highway areas used for comparison. The locations of the areas used in these comparisons are illustrated in Fig. 16. Harvests along the Denali Highway have been relatively constant since 1980 although harvests have doubled in the Su-Hydro area (Table 24).

Frequency with which marked bears are taken by hunters is an index to harvest effort. Data on hunter kills of bears marked during the period 1978-1986 are presented in Tables 25-27, and summarized in Table 28. Percentage values in Tables 25-27 are underestimates because there are unrecorded natural mortalities of marked bears and because some marked bears are not recognized as marked during the sealing process. The percentage values are not harvest rates of the whole population because cub and yearling bears which compose a large proportion of the bear population were not considered part of the marked population.

The minimum percentage of marked bears shot in a year in the Su-Hydro area varied from 3% to 15% (Table 28). This is an underestimate because it assumes no natural mortalities or failure to recognize marks when bears are sealed. A more probable estimate, based on bears known to be alive and including bears suspected (not just known) to have been shot, was 4%-22% (Table 27). Frequency with which marked bears are shot has increased in recent years (Table 27). This is in line with increasing harvests of bears in the study area as discussed above (Table 24).

Three cases of apparent natural mortalities of adult radio-marked brown bears were observed during the course of this study. These instances are described in Table 29. Mortality rates for subadult brown bears are discussed in Section 7.G.1.a of this report.

7.G.3. Brown bear movements

7.G.3.a. Home range size

Home range was calculated using the standard minimum grid described by Mohr (1947). Data for individual bears in individual years and for all years lumped are given in Table 30; these data are summarized by sex; age and reproductive status in Table 31. When years are lumped for individuals with more than 1 year's data, home ranges averaged 1,022 km^2 (1941 km^2 for males and 501 km^2 for females) (Table 31). Home range variances determined by standard minimum grids were large (Table 31). Males' home ranges varied little between years while home ranges for females without newborn cubs varied more (Fig. 17).

7.G.3.b. Movements to hunting and fishing areas

Peak of caribou calving occurs 20-25 May for the Nelchina herd, but calves can be born through 15 June. The main caribou calving area used by Nelchina caribou during the period of this study was between Kosina Creek and the Oshetna River (Pitcher, in press). This area is southeast of the largest part of the Watana Impoundment and outside the home ranges of most radio-marked bears. For this reason, movements of bears to the caribou calving area at the time caribou calves are available can reasonably be interpreted as movements motivated by intent to prey on caribou calves. Murie (1981:173) noted that although grizzlies could catch some calves, "... [I] noted no special movement of bears into a calving area for the purpose of preying on calves." Murie suggested that such movements could occur for some bears in circumstances where calving is concentrated. Reynolds and Garner (in press) noted such movements on Alaska's north slope. Histories of individual bears that made such movements are given below.

Brown bear female 340 (age 3 in 1981 when first captured) was intensively monitored in spring 1981. Until 14 June, she lived in the Deadman Creek-Watana Creek area; on 15-16 June she moved to the Clarence Lake area and then returned. This movement was not classified as related to caribou predation because it occurred 2-3 weeks after the peak of caribou calving. In late May 1982 this bear moved into the Kosina Creek calving area, returning by 9 June. Between 15 May and

23 May 1983, this bear was twice located in caribou calving areas on lower Kosina Creek In 1984 this bear had newborn cubs and was again intensively monitored in the spring (starting 28 May), but no movements to caribou calving areas were documented. In 1985, with yearling offspring, she was in the caribou calving areas on 23 May (no locations were made between 16 May and 23 May). On 24 May 1986 this bear (without offspring) was again located on Gilbert Creek in the midst of the caribou calving area, and although a kill was not seen, blood was seen on the snow near her. Except during the caribou calving period, this bear was never found south of an east-west line through Watana Mountain. I conclude that this bear regularly, probably annually, moved to caribou calving areas to prey on caribou.

Female brown bear 331, age 6 when captured in 1981 with two 2-year-old offspring, weaned her young after 15 May. She was next seen on 15 June in the upper Oshetna River country where she remained until the end of June when she returned to her normal home range along Tsusena Creek (Fig. 18). This bear made no similar movements in spring 1982 although she left her home range after 29 June and in mid-August was found dead on Tsisi Creek, of unknown causes. I considered the movement in 1981 a movement to the caribou calving grounds.

Male 280, age 5 in 1980, was originally captured in the upper Kosina caribou calving grounds in early May 1980. Subsequently, most of its movements were between Tsisi Creek and upper Watana Creek except on 16 May, 1983, when it moved to the caribou calving area around Gilbert Creek, and in early June 1984, when it was around Clarence Lake. I considered these movements probable forays into the caribou calving area.

Movements into caribou calving areas (less clearly motivated by predation) were made by bears 293, 381, 384, and 299. These bears all had year-round home ranges near or overlapping the caribou calving area.

There are only a few instances of clearly defined movements to caribou calving grounds in the Su-Hydro study area. When such movements occurred, bears typically spent little time in these calving areas. These data suggest that the impoundments' blockage of bear movements to caribou calving areas is likely to have little impact on bear nutrition. It is possible that Su-Hydro area bears are little motivated to move very far to caribou calving grounds because numerous moose calves are equally good prey and these can be found within their annual home ranges (Section 7.G.4, this report).

7.G.3. Brown bear dispersal

The pattern for brown bears in the Su-Hydro area is for subadult males to disperse from maternal home ranges as 2- or 3-year-olds. Female subadults typically set up home ranges within their maternal home ranges. Subadult dispersal was studied using drop-off radio collars and surgically implanted transmitters.

One male (342) dispersed as a 2-year-old from the Watana dam site to the Kashwitna River in 1981 (Fig. 19). This dispersal was in a southwesterly direction and covered, in a direct line measurement, a distance of about 120 km. In subsequent years this bear gradually worked his way back toward the study area and was last found on Prairie Creek in July 1984.

Two 2-year-old sibling males (391 and 392) dispersed about 70 km in a northeasterly direction from their maternal home range following weaning in spring 1983. They stayed together until just prior to den entrance. Another bear thought to be a female sibling of these bears (393) remained near her maternal home range (Fig. 20).

A different pattern was found for 2 male 2-year-old siblings in spring 1983. One male (389) dispersed about 80 km in an easterly direction following weaning while the other (390) remained within the maternal home range at least until the following spring (Fig. 21).

Another 2-year-old male (386) dispersed in a northerly direction from its maternal home range in spring 1983. The dispersal distance was approximately 52 km (Fig. 22).

These movements suggest that the Su-Hydro study area is a source of recruits through emigration to surrounding areas. There is evidence as well that subadults from surrounding areas immigrate to the Su-Hydro area. Male 214 was originally tagged as a 2-year-old during earlier studies in 1978. The tagging location was north of the Denali Highway on Valdez Creek. In spring 1980 this bear was recaptured near Clarence Creek (between Vee Canyon and Jay Creek). A similar pattern was observed for female 273, originally captured and transplanted from north of the Denali Highway in 1979 as a 3-year-old. This bear returned to its capture site (Miller and Ballard 1982b), but was recaptured in the middle of the Su-Hydro study area in 1985.

I suspect that reduction of brown bear carrying capacity in the Su-Hydro area will likely decrease the number of emigrants available for dispersal to surrounding areas as a result of lowered productivity. I also suspect that survivorship of immigrants to the Su-Hydro area will be lowered as a result of the anticipated decline in carrying capacity resulting from the proposed project.

7.G.4. Brown bear predation on ungulates

Earlier studies have shown that brown bears are significant predators on newborn calves in Game Management Unit 13 (Ballard et al. 1981 and 1985). Black bears were also shown to be important predators on moose calves on the Kenai Peninsula (Franzmann et al. 1980). Just north of the Alaska Range, in Unit 20, wolf predation was shown to limit predation in a system where bears are rare (Gasaway et al. 1983, Ballard and Larson, in press). Previous studies on predation by bears have not been conducted in an area, such as the Su-Hydro location, where each of these 3 predator species is abundant. Our predation studies were initiated in an effort to better understand the dynamics of predation on moose in a system that includes all 3 predators. The information obtained can be used to test hypotheses about the effects, on predators and on prey, of impoundment-related impacts which alter predator-prey ratios.

Brown bear predation on ungulates was evaluated by intensive monitoring of radio-marked bears. Intensive monitoring was conducted on 21 May-23 June 1981 (Miller and McAllister 1982), on 28 May-7 June 1984, and on 29 May-1 August 1984 (Miller 1985a). Monitoring was done once per day except during 29 May through 7 June 1984 when bears were monitored twice per day. Coordinated studies of causes of mortality of radio-marked moose calves were conducted in spring 1984 (Ballard et al. 1985). These studies were similar to those conducted in 1978 and 1979 near the headwaters of the Susitna River and elsewhere in Game Management Unit 13 (Ballard et al. 1981). Papers on these data are in preparation (Ballard and Miller, in prep., and Ballard et al., in prep.).

Results from intensive monitoring of brown bears during spring studies are presented in Table 32. For the purposes of these analyses, "consecutive observation days" summed all days in periods of >2 consecutive days when a radio-marked bear was seen at least once.

In 1978 spring predation rates were 1 kill/4.9 consecutive observation days or 1 moose calf kill/8.4 consecutive observation days (Table 32) (Ballard et al., in prep.). In our spring 1981 and 1984 studies, observed kills were less frequent: 1 kill/7.5 consecutive observation days and 1 moose calf kill/11.8 consecutive observation days (Table 32). Rates of loss of radio-marked moose calves to brown bear predation was similar in the 1977-1978 Unit 13 studies and in the 1984

Su-Hydro studies (Ballard et al. 1985). In both studies predation accounted for 86% of natural mortalities, with brown bears responsible for 65% of mortalities in 1984 and 79% in the earlier studies (Ballard et al. 1985). Of predator-related mortalities, brown bears accounted for 75% in 1984 compared with 91% in 1977-78 (Ballard et al. 1985).

Unlike these earlier studies, the Su-Hydro studies were undertaken in an area where black bears were abundant. Here black bears accounted for 12.5% of predator-related deaths in 1984 (Ballard et al. 1985). In 1984, then, black and brown bears were responsible for 87.5% of predator-related deaths, almost equal to the 1977-78 figure of 91%. In both studies moose calf losses were largely confined to the 6 weeks following birth. In the Su-Hydro studies, predation was much lower during late July through August, 1984 (Table 33).

In the 1978 studies significant differences could not be detected between bear predation rates (on ungulates), based on sex or reproductive status categories, but it was suspected that female bears accompanied by offspring older than 1.0 years could have higher predation rates than other bears (Spraker et al. 1981). Predation rates (all known and probable kills of ungulates throughout a year) based on all visual observations during radio-tracking (except those at den sites) for radio-marked bears from 1978 through 1985 are presented in Table 34. For these analyses the presence of a bear on a kill was assumed to reflect predation. This assumption is biased to the degree that bears usurp kills made by other species, or other bears, or scavenge natural mortalities.

Chi-square analyses indicate no differences between sex and reproductive status groups in the 1978 studies ($P < 0.10$). No differences in observed predation rates were observed between males and females in 1978, in 1981 and 1984 combined, or in combined results ($P > 0.10$). Neither were there significant differences in predation rates between females with yearling offspring and females without offspring (includes those with 2-year-olds in early spring) in either study or in combined results ($P > 0.10$). In combined data from these 2 studies, females with newborn cubs had lower predation rates than either females without offspring or females with yearling offspring ($P < 0.05$). In the Su-Hydro data ("area 1"), females with newborn offspring had significantly lower predation rates than females with yearlings ($P < 0.05$) but not lower than rates for females without offspring ($P > 0.05$). These analyses support the conclusions that females with newborn cubs tend to have lower predation rates on ungulates (moose and caribou) than other bears, and that all other brown bear categories, based on sex or reproductive status, have similar predation rates. Similar analyses were done for observations of brown bears on moose calf kills (Table 34). Again, there were no differences between male and female predation rates ($P > 0.10$) or between females with yearlings and females without offspring ($P > 0.05$). Females with newborn cubs, again, had lower predation rates than either single females or females with yearling offspring ($P < 0.05$).

The lower predation rates observed for females with newborn cubs probably reflect the geographic separation of this group from prey concentrations (see Section 7.B, this report). Females with newborn cubs tend to remain at higher elevations near their den sites for 3-8 weeks longer than other bears (including years when the same females have older offspring or no offspring). Moose calve at lower elevations where they are available to bears that move down in the spring in the typical pattern, but not to the bears that remain at higher elevations. This behavior pattern by females with newborn cubs may minimize predation on cubs by other bears; some females, such as 281 and 396, which did not follow this pattern, had especially high rates of cub loss (Section 7.G.1, this report).

During intensive monitoring in spring 1981 and 1984 we saw radio-marked brown bears on 25.5 moose calf kills during a total of 302 consecutive observation-days (Table 32) (half kills result from joint occupancy, with another predator, of a kill site). This provides a minimum estimate of predation rate (1 calf kill/11.8 consecutive observation days) because unobserved kills could easily occur between observations and because kills cannot always be seen or identified. Regardless, this estimate can be combined with other data to estimate the total number of moose calves killed by brown bears in the study area.

If all predation on moose calves occurred during a 6-week period in the spring, at an average rate of 1 kill/11.8 days, an average bear would kill 3.6 calves. If, as estimated in Section 7.A of this report, there are 327 brown bears in the impoundment impact zone and 32% of these are cubs and yearlings (Miller et al., in press), then there are about 222 brown bears age 2 or older in the study area. At the above predation rate these bears would kill 799 moose calves/year. Similar estimates were independently derived from models of moose populations (Ballard et al., 1984).

7.G.5. Brown bear denning ecology

Den sites of radio-marked brown bears were located during winters of 1980-81 through 1984-85. Dens were initially located from fixed-wing aircraft and most dens were visited on the ground in May or June following bears' emergence from dens. During these visits dens were measured, and slope, aspect, and other characteristics recorded when possible. These measurements have been described by Schwartz et al. (in press). Dens were frequently collapsed when visited in the spring; interior measurements were impossible in these cases. In some cases where dens were collapsed, the den site was not physically visited and slope, aspect, and elevation were recorded from a helicopter hovering at the den site. Some data were also collected from dens made by bears that were not radio-marked; these dens were spotted during aerial tracking flights.

7.G.5.a. Den entrance and emergence dates

Entrance and emergence dates were estimated from the radio telemetry data in 3 ways. For entrance dates, the last time a bear was seen outside its den was considered the minimum (earliest) entrance date and the first time a bear was found in its den was considered the maximum (latest) possible entrance date. The midpoint between these 2 dates was considered the "most likely" entrance date for use in calculating means. Similar procedures were followed for den exit dates. The maximum period a bear spent in its den was the period between its minimum entrance date and maximum exit date; the minimum period was that between its maximum entrance date and minimum exit date. The midpoint for period spent in the den was that period between the "most likely" entrance and exit dates. Data on entrance and exit dates for each radio-marked bear for each year of the study are provided in Tables 35-39.

Based on most likely dates, the earliest den entrance was 24 September (pregnant female 313 in 1980) and the latest was 10 November (male 400 in 1984). The average most likely entrance date varied from 6 to 18 October in different years (Tables 35-39).

The earliest den exit date based on "most likely" calculations was 11 April (for downstream females 379 and 403 in 1984) and the latest exit date was 28 May (for female 388 with newborn cubs in 1985). The average most likely exit date varied from 23 April in 1980 to 10 May in 1985. Heavy spring snowfall was thought to delay den exit for brown bears in spring 1985. Available data on snow conditions are based on once-a-month readings of 4 snow stations in the impoundment vicinity by th-e U.S. Soil Conservation Service. These data (illustrated in Fig. 23) are inadequate to document the abnormally late and heavy snow conditions in spring 1985 but these conditions were evident to me.

Using the most likely dates for den entrance and emergence, average number of days spent in dens varied from 187 in 1980-81 to 214 in 1981-82 (Tables 35-39). Using these most likely dates, I calculated the average time spent in dens for 74 bear-years during the study to be 201 days (S.D. = 16.6).

7.G.5.b. Characteristics of dens

Measurements, and other characteristics of 96 brown bear dens for which some data are available, are presented in Table 40. Only 2 dens were in natural cavities and one of these was partially excavated. Dug dens totaled 75; undetermined cavity types totaled 19 (Table 40). Dug dens predominated in dens on Kodiak Island examined by Lentfer et al. (1972), and natural cavity dens were more common in parts of southeastern Alaska (Schoen et al., in press) and northern Alaska (Reynolds et al. 1976).

Brown bear den sites were found on all aspects, but dens on south aspects were approximately twice as common as on any other aspect (Fig. 24). South aspects seemed to be more strongly selected by females who were pregnant at den entrance than for females who were not, or for males (Fig. 25).

No brown bear den sites were found in the area that would be inundated by either of the proposed impoundments. Elevations of den sites in the upstream study area ranged from 2010 to 5330 feet (Table 41). The lowest den site would have been inundated if it had been in the vicinity of the Watana Impoundment but it was in the vicinity of the lower, Devils Canyon, impoundment. This den site, that of pregnant female 396, was so atypical for a brown bear that I initially thought it represented a shed collar or dead bear rather than a den site. This female lost her litter of newborn cubs shortly after emergence from this den. Den sites were lower in the downstream study area (Table 41) where higher elevations were not as available to bears.

Locations of den sites in upstream and downstream study areas are illustrated in Fig. 26 and Fig. 27. The impoundment itself will likely have little impact on brown bear denning habitat but winter activities along the access road, borrow sites, and other construction areas that occur in brown bear denning habitat could disturb denning bears. Reynolds et al. (in press) observed responses in denning bears to disturbances within 1.6 km and suggested rerouting aircraft and other disturbances away from known den sites during denning. I found no evidence that availability of denning habitat was a limiting factor for brown bears in the study area. Bears may be able to find adequate den sites away from the source of disturbance. If disturbance causes bears to abandon dens after the period of den entrance, however, these bears may find it very difficult to find and dig dens in alternative areas when the soils are frozen.

Most bears showed a tendency to den in the same general location year after year but considerable variation was observed. Den sites used in different years by the same individual were separated by a mean distance of 3.8 miles (Table 42). One bear, male 400, moved from his spring home range near Watana Creek to den sites north of the Denali Highway on the upper McLaren River in 3 successive winters. There could be strong selective pressures on bears to return to areas that are known, based on previous experience, to be good denning areas, rather than risk denning in an area with equivalent characteristics but where an individual had no previous experience. Good sites are those where wind currents assure that the den entrance will be well-sealed with deep snow and where soil and permafrost characteristics are such that dug dens are unlikely to collapse during the winter.

8. Black Bear Results

8.A. Number of black bears in impoundment impact zone

In part 9 of this report I derived an estimate of the number of bears in the impoundment impact zone. This estimate was based on extrapolation to black bear habitat in the entire zone from a density estimate (8.97 bears/100 km^2) obtained in part of this zone. The 95% confidence interval for this density estimate was similarly extrapolated to the impact zone without modifications designed to reflect the extrapolation. The area defined as black bear habitat (1191 km^2) was determined by drawing a line around point locations of radio-marked bears (Section 6.B of this report). The resulting estimate was 107 black bears (95% CI = 93-122). I estimated that 35% of these bears were cubs and yearlings (Miller et al., in press; see Appendix 2). This estimate was lower than earlier estimates I made for this area based on a rough density estimate of 24 bears/100 km^2 (Miller and McAllister 1982), perhaps because the population declined significantly during the course of this study. This decline may have resulted from the poor berry crop in 1981 (Miller 1983, 1984, and 1985a).

Because the impact zones of each impoundment overlap, over half of the estimated population in the 2-impoundment area would be in the impact zone of either impoundment considered separately. However, it is difficult to estimate the size of the zone of overlap. In order to divide the whole study area into impact areas for each impoundment a line between the impoundments was drawn. This was a north-south line through the confluence of Tsusena Creek and the Susitna River (this location is about 2.5 miles downstream from the Watana dam site). Within the area defined as black bear habitat (Fig. 7), the area east of this line (658 km^2) was defined as the area inhabited by the Watana Dam population of black bears, and the area west of this line (533 km^2), as the area inhabited by the Devils Canyon population. At the above-estimated density the Watana Dam population would then have had 59 black bears (51-67), and the Devils Canyon population 48 (42-55).

8.B. Black Bear Use of Impoundment Proximity Zones

8.B.1. Levels and seasons of use

Black bear use of nested zones of proximity to the Devils Canyon and Watana Impoundments was analyzed using the same methods and procedures previously discussed for brown bears (see Section 7.B of this report and Miller and McAllister 1982). In this analysis relocations of radio-marked bears were allocated to 1 of 4 zones: within the area that would be flooded (zone 1), from the impoundment high water line to 1 mile from this line (zone 2), from 1 to 5 miles from the high water line (zone 3), and more than 5 miles from the high water line (zone 4). Use of these 4 zones for each month for the impoundment zones of each proposed impoundment is illustrated in Fig. 28. Monthly percentage use of the area to be flooded (zone 1) is higher for the Watana Impoundment zone than for the Devils Canyon zone (Fig. 28).

Black bear use of the areas that would be inundated by the Watana Impoundment was highly significant when compared with the adjacent zone or the 2 adjacent zones (Table 43). Overall, 42% of the observations of radio-marked black bears made in the vicinity of the Watana Impoundment were in the area that would be inundated by that dam (Table 43). This percentage value was highest in May and June (52% and 46%, respectively), the same time period when brown bear use of the impoundment area was highest (Fig. 11). No doubt at this time the black bears and brown bears are using the same spring food resources that are available earliest on the south-facing slopes along the Susitna River and its tributaries: carrion, newly-emerged plants, overwintered berries, and moose calves.

This same pattern is not evident for the Devils Canyon Impoundment. This is probably because of the very small area that would be inundated by this impoundment (only 3.3% of the area within 5 miles of the Susitna River along the section of the river that would be inundated by the Devils Canyon Impoundment) (Table 44). In the spring period when the Devils Canyon Impoundment zone is most used (May 1-June 30), observed use was lower than expected values for zone 1, for the comparison between zones 1 and 2 (Table 44). In the area around the Devils Canyon Impoundment the distribution of acceptable black bear habitat is much wider than farther upstream and as a result, dependence of bears on the habitat in the immediate vicinity of the river is less in the lower portion of the study area.

8.B.2. Prediction of impacts

Reductions in black bear populations, resulting from habitat loss, were estimated for black bears in the same manner as for brown bears (see Section 7.B.2). Rather than using just spring data, however, data on annual use were used for the black bear analysis because less seasonal variation in use of the impoundment zone was evident for black bears than for brown bears (Figs. 11 and 28).

Radiotelemetry data for 17 male and 14 female black bears using the Watana Impoundment impact area show that 43% of all point locations were within the zone that would be inundated; an additional 36% were within 1 mile of the impoundment shoreline (Table 45). Under the assumptions used for these analyses (Section 7.B.2), I estimate that the carrying capacity for the estimated Watana population of 59 black bears would be reduced by 43% due to habitat inundation; this is a reduction of 26 bears.

Radiotelemetry data for 9 male and 10 female black bears using the Devils Canyon Impoundment impact area show that only 3% of point locations were within the zone that would be inundated, and an additional 43% were within 1 mile of the impoundment shoreline (Figure 45). Under the assumptions used in this analysis, the carrying capacity of Devils Canyon's estimated population of 48 black bears would be reduced by 3% due to habitat inundation, this is a reduction from existing numbers, of only 2 bears (existing numbers are not necessarily at carrying capacity, however).

Considering both impoundments together, 30% of point locations were within the area that would be inundated by one of the impoundments (Table 45). Using this value, I estimated that the carrying capacity of the whole study area's population of 107 black bears would be reduced by 32 bears. This estimate is close to that obtained by summing the values for each impoundment separately (28 bears).

Of the 31 bears used for the Watana Impoundment analysis, 24 (77%) had point locations within the area that would be inundated by the proposed impoundment (Table 45). Of the 19 bears used for the Devils Canyon Impoundment analysis, 8 (42%)

had point locations within the area that would be inundated by this impoundment (Table 45). These data may indicate that inundation by the impoundments could result in a more severe decline in availability of bear habitat than I estimated above (using the proportion of point locations in the impoundment zone).

8.B.3. Mitigation measures

As with brown bears, potential measures to mitigate for loss of black bear habitat resulting from inundation are limited. Possibilities include:

1. Increasing the abundance of foods used by black bears throughout the year; or

2. Indirect mitigation (out-of-kind substitution of other benefits for the resources, for bears, that are lost as a result of the project).

One of the reasons black bears may utilize so little of the habitat available in the study area, compared with brown bears, may be competitive exclusion of black bears by brown bears. To the degree that this is a factor, the anticipated reduction in brown bear numbers through habitat loss and displacement disturbance may make more habitat available for black bears. Although this is possible, I consider it unlikely, as in most cases, I suspect that black bears' recognition of acceptable black bear habitat is genetically based (most black bears are unlikely to venture into more open areas even if brown bears are not present).

Prairie Creek may be an exception to this rule. Black bears make only slight utilization of Prairie Creek salmon resources. This is probably because of competitive exclusion by the many brown bears utilizing the area. If, as anticipated (see Section 7.D of this report), brown bear use of Prairie Creek greatly declines because of displacement disturbance caused by humans, I would expect that black bears would exhibit increased utilization of Prairie Creek. This is because black bears are more tolerant of humans than brown bears are and because humans are more tolerant of black bears than they are of brown bears. Prairie Creek is in a forested area that, except for the presence of brown bears, seems to be good habitat for black bears.

8.C. Other Impacts

8.C.1. Berry-foraging areas

In the 6-8 weeks prior to denning, berries constitute a highly important source of food for bears. Berries are highly digestible and easily converted to fat (Bunnell and Hamilton 1983; Bunnell, in press) and therefore they are particularly appropriate foods for the period of hyperphagia prior to den entrance (Nelson et al., in press). In the upstream study area the most abundant and important berry for bears of both species is probably blueberry (Vaccinium uliginosum). Lowbush cranberry (V. vitis-idaea) is also abundant in the upstream study area. In the downstream area devils club (Oplopanax horridus) is heavily utilized (Section 8.E of this report). Based on scats collected in the early spring, overwintered berries (especially crowberries, Empetrum nigrum) appear to be important foods in spring as well (Sections 8.E and 8.G.4). During August, movements of black bears become more extensive and many bears travel to habitats little utilized at other times of the year. These habitats are the semi-open shrublands adjacent to the spruce forests.

During years of berry crop failure, such as in 1981, movements of some bears may become much more extensive and include utilization of very open habitats distant from forests that are more typically utilized by brown bears (Section 8.G.3, this report).

The limited data we gathered during 1982-1984 on berry abundance in these shrublands is consistent with a hypothesis that blueberries are more abundant in this habitat than in the adjacent spruce forest where bears spend most of their time during the rest of the year (Section 8.G.4.b). Information on abundance of berries and berry-producing bushes is presented in Section 10 of this report.

These shrubland sites used in late summer by black bears foraging for berries are the favored sites for construction camps, borrow areas, and permanent residences. The area between Tsusena Creek and Deadman Creek will be especially heavily affected by these activities as this is a highly favored foraging area for black bears during late summer. Although black bears are not as prone to disturbance displacement resulting from these activities as brown bears, it is likely that black bears will come into conflict with man in these sites.

8.C.2. Blockage of movements

As discussed previously for brown bears (Section 7.C), black bears swim readily and are known to swim across impoundments. Movements across the reservoir will probably be restrained to some degree, relative to movements bears currently make across the river. Simpson (1986:21) studied movements of grizzly bears in the vicinity of the Revelstoke Reservoir in British Columbia and noted that "grizzlies would cross a river but not the reservoir." Relative to this same reservoir, Richard L. Bonar (18 April, 1985, interview transcribed by Bill Steigers of the Susitna Project Group of LGL) noted "...the radio-collared bears [both species] haven't crossed as often as they did before the water came up."

Although some impact is probable, it is impossible to guess how much movements across the river will be restrained by the Susitna impoundments. Movements across impoundments are not the only movements that may be inhibited. Black bears frequently make extensive seasonal movements both up and down the river and, unlike brown bears, these movements occur largely in and along the forested corridor of the Susitna River. Following flooding of the impoundment, such movements will require crossing or circling around inundated tributaries. The greatest barrier to these movements following filling of the reservoir will be the large bay at what is now Watana Creek.

In this study I concentrated on documenting frequency of crossing so that these data from the preconstruction phase could be compared with data collected during a post-construction study. Such comparisons will permit more accurate predictions of impacts in future impact assessment studies.

The number of river crossings for each radio-marked bear in each year with >5 non-den observations varied from 0 to 12 (Table 46). For purposes of this analysis, a "bear-year" was defined as a year in which a radio-marked bear received more than 5 radio locations (excluding observations at its den site). For males, crossings were observed for 36 of 56 bear-years (64%); for females crossings were observed for 18 of 57 bear-years (32%) (Table 46). The average number of crossings for males that crossed was 3.3; for females it was 3.8 crossings (data in Table 46).

8.C.3. Mitigative measures

The potential methods of mitigating for loss of berry foraging areas or for inhibition of movements resulting from impoundments are very limited. It would be advantageous to establish facilities and communities in areas where they are not in the middle of bear movement corridors. However, I doubt that efforts to situate these facilities in areas where they are distant from the river and, correspondingly, distant from black bear transportation corridors, can be justified on the basis of certainty that this effort would significantly benefit the black bear population remaining after the post-impoundment period. This is because such relocation would likely be very costly and because the black bear population in the vicinity of the upper impoundment will probably be so greatly reduced by other impoundment-related impacts that few bears will be left to benefit. It is worth noting that most black bear movements up- and downstream occur on the north side of the river. Correspondingly, facilities situated on the south side are likely to have less impact than those on the north side.

8.D. Interspecific Effects

8.D.1. Moose and brown bears

As with brown bears, it is difficult to estimate the effects on black bears of project-caused changes in abundance of other species. Nevertheless, such impacts are likely to occur and their probable direction can be reasonably predicted.

The predicted reductions in numbers of brown bears, as a result of the project, could only be beneficial to remnant black bear populations. Brown bears are suspected of killing some black bears and attacks have been documented in this area (Miller 1985b). Also, I suspect that with reduced brown bear populations, black bears would probably forage somewhat further from forested escape habitats. If this happened, it would effectively expand the amount of habitat available for black bears. Conversely, black bears forced to move into more open habitats as a result of flooding of current habitats could be more exposed to predation from brown bears.

Reduction of brown bears may increase the number of moose calves available as prey to black bears. Black bears in the Susitna area currently kill fewer moose calves than black bears on the Kenai Peninsula (see Section 8.G.4 of this report). In part, at least, this may be because brown bears are much more abundant in the Susitna area than on the Kenai. This possible increase in spring food supply would result only if moose populations remained constant or increased. If moose populations declined as a result of the project (Ballard et al. 1985), then more calves would not necessarily be available to black bears regardless of reduced brown bear predation on moose calves.

8.D.2. Human/bear interactions

Compared with brown bears, black bears are tolerant of human presence (Herrero 1985). Correspondingly, I would expect much less human-caused disturbance displacement to occur for black bears than for brown bears. Because of this tolerance, however, black bears are likely to thoroughly explore the food-producing potential of the new human communities in the impoundment area. In this way bears will inevitably come into conflict with man. Problems, including killing of nuisance bears, can best be minimized by very careful handling of garbage and other human foods and by strict enforcement of regulations against feeding wildlife. The recommendations of Bromley (1985) should be reviewed and followed during construction and operation of the project to minimize these conflicts. Especially in the vicinity of the Watana Impoundment, the amount of forested habitat that remains along the fringe of the impoundment shoreline will be greatly reduced by impoundment flooding. Black bears will be increasingly vulnerable to hunting by humans in the remaining forested habitat.

8.E. Downstream Impacts on Black Bears

Negative impacts on black bears downstream from the proposed impoundments were anticipated during Phase I of this project (Miller and McAllister 1982). I thought these impacts would likely result primarily from reduced availability of salmon, especially spawning salmon, in sloughs and tributaries between Talkeetna and Devils Canyon and especially between Curry and Devil's Canyon (Miller and McAllister 1982). Only rarely are salmon able to swim upstream through Devils Canyon so reduction of salmon is not a consideration in the upstream study area.

I anticipated reductions of salmon in the downstream area based on fisheries studies then occurring as part of Su-Hydro investigations. No final report on these studies of project-related impacts on salmon in the Susitna River is available. Correspondingly, without a documented level of reduction of salmon availability, I am unable to predict impacts on bears. Given this lack of information, it is fortunate in terms of prediction of impact on bears, that the data I collected on bear use of salmon in the downstream study area suggest salmon availability is not as important as hypothesized earlier.

Studies of bears downstream from Devils Canyon began in 1982. Additional bears were captured and marked in 1983. Radio-tracking data on these bears revealed that most utilized the slough and riparian areas along the main Susitna River especially heavily during the July-August period when salmon were spawning in these areas (Miller 1983, 1984, and 1985a). Correspondingly, in 1982, 1983, and 1984 I visited this area, inspected the sloughs, and collected fresh bear scats. Most scats collected in mid-August were found along the Susitna River or sloughs along the Susitna in the zone between Curry and Portage Creeks. Nomenclature of sloughs follows Su-Hydro fisheries studies for the anadromous adult project. Analyses of scats were made by Paul Smith following procedures outlined by Smith (1984). Data on contents of the scats collected each year are presented in Tables 47-49. In most cases it was impossible to differentiate between black bear and brown bear scats; efforts to develop differentiation techniques were unsuccessful (Appendix 4). Numbers of salmon counted in sloughs and tributaries by Su-Hydro fisheries staff in each year from 1981 through 1984 are presented in Table 50.

Fish were present in identifiable amounts in only 3 of 76 scats collected in the downstream study area. In 2 of these, fish were present in trace amounts and in one it was present in "category 2" amounts (6-25% of scat contents). The low number of fish remains in these scats was puzzling to us as we saw many fish that had been killed and partially eaten by bears during our inspection of the downstream sloughs (Tables 51 and 52). Fame (1974) observed heavy use of salmon by black bears in Prince William Sound, Alaska. I doubt that the absence of salmon in the scats we analyzed resulted from lack of ability to recognize salmon in scats due to differential digestibility or other reasons. At McNeil River and along Prairie Creek I have seen many scats from bears that have been eating salmon and have noted that these are readily identifiable based on superficial inspection. These scats frequently contain bones, are diarrhetic, and have a distinctive unpleasant smell.

By far the most abundant item in the scats collected in the downstream area in August was berries of devil's club (<u>Oplopanax horridus</u>) which occurred in 75 of the 76 scats. Amount of scat represented by devils club was: trace (3% of scats), 6-25%(9%), 26-50%(25%), 51-75%(17%), and 76-100%(45%). Devil's club was not an abundant plant in the downstream area. It occurred primarily in the zone between the scoured riparian flats and the adjacent forest. Farther upstream from Devils Canyon, in the upstream study area, this plant was rarely found and seldom seen with berries. Based on available data it appears that the July-August movements of black bears to riparian areas (movements documented with telemetry data) were more likely motivated by the presence of ripening devil's club berries than by spawning salmon. On the Kenai Peninsula, Schwartz et al. (1983a, 1983b) have documented late summer movements of black bears to hillsides of mature upland forests containing devil's club. In these summer feeding areas black bear scats indicated bears were feeding almost exclusively on devil's club berries (Schwartz et al. 1983a & b). The relative absence of devil's club in the upstream study area may cause or contribute to this area's carrying capacity being much lower, in average years, than in the downstream area or in the Kenai Peninsula area studied by Schwartz.

Our data may not accurately represent the importance of salmon to bears in the downstream study area. It is possible that bear use of salmon in downstream sloughs was more prevalent in

July and early August than in late August when we collected most of our scats. In late August it is possible that bears switch from an earlier and greater dependence on salmon to ripening berries. It is also possible that salmon are an important buffer food source that is more heavily used in years of berry-crop failure. Finally, bears may use both salmon and berries in a daily cycle that makes it unlikely that salmon-rich feces would be found at the salmon-spawning areas. Based on available information, however, there is no reason to conclude that reduction from salmon availability in sloughs and tributaries downstream of the impoundment area would impact carrying capacity for black bear populations in this area.

8.F. Cumulative Impacts, Black Bears

For black bears, cumulative impacts of the proposed project may be greater than the sum of individual impacts. Methodology to identify and quantify such cumulative impacts on brown bears has been described by Christensen (1985), Young (1985), Winn and Barber (1985), and Weaver et al. (1985).

No effort to conduct similar cumulative-effects analyses was made as part of this report, but such an effort should be undertaken as part of environmental impact assessments for the Susitna hydroelectric project. I suspect that such analyses would lead to the conclusion that the combination of habitat destruction through inundation, reduced berry-foraging areas because of construction sites and other facilities, reduced availability of good den sites, increased disturbance and hunting in the remaining habitat, increased destruction of "nuisance" bears, road kills on access routes, and other factors, will, in total, result in the complete elimination of the black bear population in the vicinity of the Watana Impoundment. As discussed elsewhere in this report, I think the upstream black bear population is only marginally secure at present and may be subject to periodic wide fluctuations in numbers, based on annual environmental differences. Superimposition of additional sources of stress on such a marginal population would likely result in complete loss of the ability of the habitat to support black bears.

8.G. Background Information on Black Bear Biology

8.G.1. Black Bear Productivity

As for brown bear (Section 7.G.1), I suspect that the impoundment will result in declines in availability of foods currently utilized by black bears and that these declines will be reflected in changes in bear numbers as well as in declines in productivity. Changes in productivity are difficult to predict, so my effort has concentrated, primarily, on documenting existing levels of productivity so that changes can be measured during post-impoundment studies. Currently, the upstream population is less productive than a Kenai Peninsula population of black bears intensively studied by Schwartz et al. (1983b). The major difference in these 2 areas is that cub mortality is much higher in the upper Susitna. I suspect that the major difference in food supply between the Kenai and upper Susitna populations is that devils club berries, important on the Kenai and lower Susitna River in late summer, are essentially not available to black bears in the impoundment area. I also suspect that black bears in the upper Susitna are highly dependent on blueberry crops and have fewer buffer foods to turn to when blueberry crops fail (Section 8.G.4.a, this report).

Reproductive data discussed in this section are derived largely from observations of radio-marked bears. This source of data is subject to sighting errors. Such errors were especially likely in the downstream study area where heavy vegetation frequently prevented visual observation of the bear at the time it was radio-located. Reproductive status could not be confirmed unless the bear was seen. Especially in the early spring, newborn black bear cubs frequently hide in trees when approached by radio-tracking aircraft. This made sighting and counting of cubs very difficult. These problems are much more likely with the black bear data than with the brown bear data discussed earlier because brown bears were more frequently in open country where they, and their offspring, could be easily seen.

8.G.1.a. Litter Size and Offspring Mortality

Mean litter size at the time radio-marked females were first observed for 42 litters of newborn cubs was 2.1 (range = 1-4) (Table 53) and for 28 litters of yearling offspring it was 1.9 (range = 1-3) (Table 54). At time of first observation 74% of litters had 2 cubs; 17%--3 cubs; 7%--1 cub; and 2%--4 cubs (Table 53). Litter sizes were approximately equivalent on the Kenai (1.9 for 15 litters of newborns, Schwartz et al. 1983). Sex ratios of newborn cubs handled (N = 44) was 76 males:100 females, and for 10 yearlings the ratio was 100:100 (Tables 55 and 56).

In Su-Hydro studies, I defined as "mortalities" cases in which a female was observed with newborn offspring (either in her den or following emergence) but did not have the same number of offspring at the time of entrance into her next den. For 60 newborn cubs in both the upstream and downstream study areas, 35% experienced such mortalities (Table 57). This percentage was much higher in the upstream study area (47%

mortalities for 43 cubs) than in the downstream study area (6% mortalities for 17 cubs) (Table 57). In Kenai Peninsula studies, no mortalities were observed for 13 newborn cubs between ages 0.3 (emergence) and 1.7 years (separation from mother), but a third of 9 radio-marked yearlings died (Schwartz et al. 1983b). We had only 2 radio-marked yearlings and one of these died during its yearling summer; the other (329) survived into adulthood.

Schwartz et al. (1983a & b) provided weights for 16 yearlings captured in dens or shortly after emergence in the period February-June 1983. These bears ranged in weight from 29 to 126 lbs (mean = 83 lbs., S.D. = 30 lbs). During the course of my studies in the upstream black bear study area, I weighed 7 yearlings and estimated weights during handling for 3 more during April through June of different years. These 10 bears weighed an average of 24 lbs (range = 14-33 lbs., S.D. = 7 lbs.) (Table 56). Although these data sets are of different sizes and represent somewhat different periods they suggest that Kenai Peninsula black bears are in much better condition following their first summer than are upper Susitna bears. The high mortality of newborn black bear cubs in the upper Susitna and the relatively slow growth rate of these cubs in their first year of life most likely reflects relatively poorer habitat and foraging conditions for black bears in the upper Susitna compared with the Kenai Peninsula. Two of the lightest Kenai yearlings (20 and 22 pounds--Schwartz et al. 1982) died of malnutrition as yearlings (Schwartz et al. 1983).

There are other factors which may contribute to high cub mortality in the upstream Susitna area. Some black bear mortality in the Su-Hydro area is probably caused by brown bear predation. Brown bears are much less common in the Kenai Peninsula area studied by Schwartz. It is also possible that the Kenai Peninsula area as well as the downstream Susitna study area have lower cub mortalities than the upstream Susitna area because the proportion of adult male bears is lower as a result of relatively high hunter effort. Bunnell and Tait (1980) noted that hunting typically results in skewed sex ratios and Young and Ruff (1982) observed apparent increases in cub survivorship following experimental reduction of adult males in an Alberta black bear population. Tietje et al. (1986) noted an instance of interspecific predation on young black bears.

Measurements of newborn cubs are presented in Table 55.

8.G.1.b. Reproductive Interval

Methods of measuring reproductive interval were discussed in Section 7.G.1 of this report. Following Reynolds and Hechtel (1985) I defined reproductive interval as the period between successful breeding (as evidenced by cub production the following year) or successful weaning of a previous litter and the next successful separation of mother and offspring ("weaning"). Intervals based on females initially captured with yearlings were not counted by back-dating this litter. I considered it to be a successful separation if the adult female was seen with those yearling offspring following emergence from the den shared with her yearling offspring. With this definition it is usually not possible to distinguish between mortality experienced by yearlings while accompanied by their mothers and "successful separation". Since in most cases separation occurs relatively early, in May or June, this source of error is probably small. Separation from yearling offspring occurred in 23 cases (289 [3 cases], 290, 301 [2], 317 [2], 321, 327, 349, 354, 363, 364, 369, 375, 376, 378, 402 [2], 411 [2], and 432) and from 2-year-old offspring in 2 cases (verified in den for female 361 and based on sightings for female 405) (Table 58).

In some instances a female would separate from her yearling offspring in the spring, during breeding season, but they would apparently reunite later in the summer (sometimes just before den entrance). At least in cases where the female was pregnant it appeared that the yearling and its mother would not den together following such a reunion (e.g. 289 in 1984, and 317 in 1985). In some cases, the female was apparently not pregnant (had no newborn upon exit) but was seen with a smaller bear (probably her 2-year-old offspring) at exit from the den the following year (e.g., 317 in 1981, 364 in 1984, and 376 in 1984). In these cases I am uncertain whether the bears denned together or whether they denned near each other. Denning together by unrelated bears has been recorded but is rare (Schwartz et al., in press).

Reproductive histories of individual females are presented in Table 58. Reproductive intervals based on these histories are summarized in Table 59. Counting only reproductive intervals for which complete data were available (N = 25), I found that intervals ranged from 2 to 5 years and averaged 2.4 years for bears in upstream and downstream areas combined (Table 59). As previously mentioned for brown bears, using only complete intervals underestimates the true reproductive interval. This is because many intervals are incomplete and, in a short study period, the incomplete intervals tend to be those that are longer than minimum length. If one assumes no more skipped years or lost litters for the bears with currently incomplete intervals (N = 15), the calculated mean interval for these bears averages 3.1 years (Table 59). When completed, some of these intervals will be longer than the minimum value. For example, 9-year-old female 441 was alone when captured in 1985; she apparently bred in that year but did not have cubs in 1986 (Table 58). If she has cubs in 1987 and weans these in 1988, she will have had an interval of 3 years and this is the value included for her "incomplete interval" (Table 59). Combining available complete intervals and minimum values for incomplete intervals (N = 40) provides an average reproductive interval estimate of 2.7 years (range 1-5 years) (Table 59). Intervals appear equivalent in the downstream study area (2.6 years, N = 12) and upstream (2.7 years, N = 28) study areas (Table 59). Counting incomplete intervals, 2-year intervals were most common (53%), followed by 3-year intervals (33%), 4-year intervals (10%), and 5-year intervals (5%) (Table 59).

Schwartz et al. (1983b) reported 1 interval of 2 years and 5 intervals of 3 years on the Kenai Peninsula. This yields an average interval of 2.8 years for his data. Schwartz did not report incomplete intervals which would probably have raised this average value. Based on available information I cannot conclude that reproductive intervals were different in the Kenai and Susitna studies.

8.G.1.c. Age at First Reproduction

In this study I defined "age at first reproduction" as the age when the first observed litter was produced. This definition will overestimate actual age at production of first litter when whole litters are lost before they are observed. Other errors may be introduced through errors in aging based on cementum lines.

Limited data are available for age at first reproduction because few transmitters were placed on subadult bears. Black bear 329, tagged as a yearling in 1981, still had not produced a verified litter through 1986 when she was 6 years old (Table 58). She was seen with males during breeding seasons when she was 3, 4, and 5 years old (Table 58). The earliest this bear could produce a litter is age 7 (in 1987). For all other bears, age at first reproduction is based on cementum age. Bear 448 had no observed litters when it was either 6 or 7 years old (Table 58). If we assume no litter was produced before she was captured at age 6, the earliest this bear could produce a litter is at age 8 (in 1987). In the following calculations bears 329 and 448 are assumed to produce first litters in 1987 when they will be 7 and 8 years old respectively. Summary data used in calculating age at first reproduction are presented in Table 60. For 14 black bears for which reasonable data are available (Table 60), mean age at first reproduction was 6.4 years. Half of these bears produced first litters at age 7 (Table 60).

On the Kenai Peninsula Schwartz et al. (1983b) found 6 females that produced first litters at age 4 while 2 others had not produced litters yet by ages 4 and 5. If we assume that these last 2 females produced cubs the following year, the mean age at first reproduction was 4.4 years (range = 4-6). Based on these data, Kenai Peninsula black bears reach reproductive maturity at a younger mean age than bears in my study area ($t = 25.9$, 20 d.f., $P < 0.001$). This result could be predicted from the slower growth rate of Su-Hydro bears as indicated by lighter weights of yearlings in the Su-Hydro area, discussed above.

8.G.2. Sources of black bear mortality

As for brown bears, hunter kills of black bears in the Su-Hydro study area have generally increased during the period 1973-85. Reported kills averaged 13 bears/year during this period (Table 61). This is lower than the hunter kill of brown bears which averaged 19/year in the same area during the same period (Table 24). In the last 5 years (1981-1985) hunters have killed an average of 14.6 black bears and 27.6 brown bears (Tables 24 and 61). I suspect that at least some of the increase in bear harvest in this area, especially for black bears, resulted from augmented interest in and knowledge of the area on the part of staff working on various projects associated with the proposed Susitna hydroelectric dams. This suspicion is based on personal knowledge of hunting by such staff. Increases in harvest are expected when formerly remote areas are opened up by improved access or publicity of available game. Additional increases can be expected if roads to the dam sites are built. Under these circumstances regulations may need to be adopted to prevent harvests of bears and other wildlife from exceeding acceptable levels. Because black bears inhabit the forested fringe along the shores to the proposed impoundment, remnant black bear populations in the impoundment area would be especially vulnerable, in the very narrow post-impoundment fringe of forested habitat, to hunters using boats on the reservoirs.

The proportion of the marked black bear population that is taken by hunters is an index to the population exploitation rate. These data are provided in Table 62. If both upstream and downstream black bears are included, annual kill rates of marked black bears ranged from 6% to 17% (Table 62). Exploitation rates were higher in the downstream study area than upstream from Devils Canyon (Table 63). This is probably because downstream from Devils Canyon, bears can be hunted easily from a river boat while upstream from Devils Canyon access is primarily by float plane. Natural mortality of radio-marked black bears during the study period was high compared with that of brown bears (Table 29). A total of 13 black bears died, mostly from unknown causes (Table 29). I suspect a couple of these deaths may have resulted from gunshot wounds. Available indications suggested that others resulted from natural causes including predation by brown bears (Table 29). The apparent high natural mortality of adult bears in the upstream study area is another indication suggesting that this area may be marginal habitat for black bears.

8.G.3. Black bear movements

8.G.3.a. Home range size

As for brown bears, black bear home ranges were calculated using minimum home range polygons (Mohr 1947). In many cases these home ranges were not accurate representations of the areas utilized by individuals. This was because black bears were largely restricted to movements up and down the river, but since the river does not run in a straight line, the minimum home range polygons include areas not utilized by bears between river meanders. This point is illustrated in Figures 29-33 for annual home ranges of 5 black bears. Home ranges for individual bears in specific years, and for all years combined, are presented in Table 64. Annual home ranges for all bears averaged 134.6 km^2; male home ranges (251.5 km^2) were larger than female home ranges (67.1) ($t = 13.1$, 121 d.f. $P < 0.001$). Home ranges of females in years they had newborn cubs (69.2 km^2) were not significantly different from those of females in years they did not have cubs (77.3 km^2) ($t = 0.05$, 64 d.f., $P > 0.5$) (Table 65).

Average male home range size varied little in different years of the study except for the first year (Fig. 34). The first year had a lower average because some bears were not captured until August. Home range for females without newborn cubs was larger in 1981 than in other years (Fig. 34). In 1981 there was an apparent failure of the berry crop which probably accounted for the larger home ranges in that year.

8.G.3.b. Seasonal movements

The basic seasonal pattern for black bear movements in the study area is for black bears to remain in the forested riparian zone along the river for denning and during spring and early summer. When berries are ripening in late summer and fall, black bear movements become more extensive in both upstream and downstream directions. At this time black bears may also venture out of the forested zone into the adjacent shrub zone.

Variations in this pattern were observed in 1981 when, in response to an apparent berry crop failure, bears moved much more extensively in both upstream and downstream directions

(Figs. 29-33). Most bears did not make equivalent movements in other years but male 343 (Fig. 32) continued to make similar movements downstream each year in late summer. These movements were probably motivated by increased availability of devil's club berries downstream or, possibly, the availability of salmon in downstream sloughs.

Another variation in this pattern was observed in spring 1985, when black bears appeared to be more abundant at higher elevations away from the Susitna River. I suspect this difference was related to availability of overwintered berries. Overwintered berries, especially crowberry (Empetrum nigrum) are an important spring food for bears. Winter 1984-85 had little snow cover at lower elevations along the river until February. I suspect that lack of snow cover reduced overwinter survival of berries at lower elevations, forcing some bears to forage at higher elevations distant from the riparian forest. These areas are thought to be less preferred by black bears as they may be more vulnerable there to attack by brown bears.

8.G.3.c. Dispersal from study area

Only 1 dispersal into or out of the study area was documented for subadult black bears. Little effort was made to obtain such documentation by placing radio-transmitters on subadult black bears. Only 1 yearling was radio-marked and survived for more than 5 months; this bear (female 329) did not disperse. Another male marked as a 2-year-old in the upstream study area in 1980 (323) did not disperse and was shot by a hunter in September, 1983. A male marked in the upstream study area (Clark Creek) in May 1980 did disperse. This bear, 307, was shot by a hunter 1 year later near Hurricane on the Parks Highway.

8.G.4. Black bear food habits

8.G.4.a. Predation rates

Black bears are known to be effective predators on moose calves (Franzmann et al. 1980) but, in 1 case at least, black bears were observed to be inhibited, compared with brown bears, in killing moose calves (Miller 1985b). In this case a black bear watched a cow moose with 2 newborn calves for over 24 hours without successfully attacking, but a brown bear attacked and killed the calves as soon as it found them (Miller 1985b). Simultaneous with intensive monitoring of brown bears (Section 7.G.4.b this report), radio-marked black bears were intensively monitored in 1981 and 1984 to estimate predation rates (Table 66). During periods of intensive monitoring in the spring, 16 black bears were observed on 13 calf moose kills, 1 adult caribou kill, and 1 probable kill during a total of 460 visual sightings. This translates to 2.8 moose calf kills/100 visual sightings, 4.1 kills of all kinds/100 observation-days, and 5.4 kills (all kinds)/100 consecutive observation-days (Table 66). An "observation-day" was defined as a day on which a bear was seen at least once and a "consecutive observation-day" summed all periods of >2 consecutive observation-days.

This kill rate is about 25% of that observed for brown bears (Section 7.G.4, this report). Brown bears were observed during intensive monitoring at the same time on 16.5 kills/100 consecutive observation-days (Table 32), compared with 4.1 for black bears. If one considers just moose calves, brown bears were observed on 9.9 kills/100 consecutive observation-days and black bears on 1.9 (Tables 66 and 32).

A kill rate of 2 calves/100 consecutive observation-days during a 5-week period when moose calves are most vulnerable would result in an average estimated kill of 0.7 calves/bear/ year. In Section 8.A of this report I estimated black bear populations in the impoundment impact area to be 107 bears. If one assumed 35% of this population was cub and yearling bears (Miller et al., in press; Appendix 2), about 70 bears were available to prey on moose calves. At 0.7 calf kills/bear, these bears would kill about 50 calves/year in the Su-Hydro study area.

These kill rates are minimum estimates because it is easy to miss kills during radio-location flights. Regardless, it appears probable that at this low kill rate predation on moose calves by adult black bears is unlikely to contribute significantly to the spring nutrition needs of these black bears. It may be a more significant source of nutrition for some individuals that are particularly adept at killing calves. For example, of the 13 calves observed killed, 7 were killed by 2 of the 16 intensively monitored bears.

8.G.4.b. Annual variation in berry abundance

As discussed in Miller and McAllister (1982), a berry-crop failure apparently occurred in summer 1981. I first suspected a berry crop failure because movements of black bears in late summer of that year appeared much more extensive than in 1980; radio-locations in subsequent years verified that movements in 1981 were extensive. In late summer 1981, black bears made atypical movements in both upstream and downstream directions. These movements were discussed for each individual in Miller and McAllister (1982:103) and are illustrated, for 4 bears, in Figs. 29-33). Observations on the ground in late summer 1981 provided subjective verification that berry crops were exceptionally low in 1981 compared with other years of this study (Table 67). Years during which these data were collected were subjectively appraised as "near typical" for the upstream study area. This is different from the preceding year, 1981, when berry crops in black bear habitat were thought to have had a widespread failure (Table 67).

8.G.4.c. Scat analyses

Food-habits data based on scat analyses were of limited value because few scats were collected in upstream areas, and because of the difficulties in differentiating between black and brown bear scats (Appendix 4). Most scats were collected along sloughs and streams in the downstream study area in an effort to evaluate the importance of salmon to bears in this area (Section 8.E, this report). Scat data are presented in Tables 47-49.

8.G.5. Black bear denning ecology

My data on the denning ecology of black bears have been analyzed and contrasted with data from 2 other parts of south central Alaska by Schwartz et al. (in press, see Appendix 1). Only those components of the black bear denning data that are directly related to the proposed hydroelectric project will be discussed in this report.

Den entrance and emergence dates for each individual black bear in each year are given in Tables 68-72. No differences were observed between males and females but pregnant females entered dens earlier than males or non-pregnant females (Schwartz et al., in press).

Locations of black bear dens in upstream and downstream study areas are illustrated in Figs. 35-36. Characteristics of these dens are presented in Table 73 and the tendency to prefer southern aspects is illustrated in Fig. 37. History of den use by individual bears is presented in Table 74 and by individual dens in Table 75. These data demonstrate a high rate of reuse of individual dens by bears in the upstream Su-Hydro area compared with other study areas (Schwartz et al., in press) and suggest that good den sites may be limited in the upstream study area.

Forty-four different dens were found in the vicinity of the Watana Impoundment; 55% of these were dug, 41% were in natural cavities, and 2% were of unknown cavity type (Table 75). Of these dens, 55% would be flooded by the proposed impoundment and 46% would not be flooded (Table 75).

Thirty different dens were found in the vicinity of the Devils Canyon Impoundment; 33% of these were dug, 43% were in natural cavities, and 7% were of unknown cavity type (Table 75). Of these dens only 1 (3.3%) would be flooded by the proposed impoundment (Table 75).

In the downstream study area 29 black bear dens were found. Compared with the upstream area, fewer downstream dens were in natural rock cavities and more were dug (Table 75).

These data suggest that the Watana Impoundment would probably result in a reduction of acceptable denning sites for black bears resident in this area. This factor might become limiting for black bear populations in this area if populations remained at pre-impoundment levels. Since black bears in the Watana Impoundment area are expected to decline greatly in number based on reductions in habitat and carrying capacity, it is likely that the population will actually be limited by habitat shortage before the bears are limited by a shortage of den sites. The Devils Canyon dam is likely to have little impact through inundation on black bear denning habitat.

Black bears den in the forested habitats along the Susitna River in the vicinity of both the upper and lower impoundments. Pre-inundation clearing of forests in and adjacent to the proposed impoundment during the denning period would probably result in disturbance of many black bears and additional mortalities, to some individuals, resulting from den abandonment. If logging occurs during the denning period, as anticipated, black bears should be radio-marked and monitored prior to the clearing in order to document the impact of this source of disturbance.

9. BEAR DENSITY AND POPULATION ESTIMATION

Standardized methods for estimating bear numbers have not been developed. Even in very intensively studied populations where all bears are marked or radio-collared, it can be difficult to convert these data to meaningful density estimates (Schwartz et al. 1983a).

In this study I attempted to estimate black bear density using Lincoln-Petersen Indices where radio-marked bears constituted the marked sample. In summer 1982, when black bears were in relatively open habitats feeding on berries, and in spring 1983, before leaf emergence restricted visability, I attempted to estimate bear numbers using ratios of marked to unmarked bears observed in a single flight. In these efforts the number of marked bears present in the search area was determined through radio-tracking flights before and after the observation flight. Estimates with very large variance were achieved with this procedure, probably because observability was so low (see Miller 1984 for these results).

Work conducted in spring 1985 was designed to provide an improved density estimate for both black and brown bears in the Su-Hydro study area. This work was essentially a series of replications, in a well-defined smaller area, of the technique used in the 1982 and 1983 studies. Consecutive days of search effort were combined to provide a series of independent estimates over time and a single combined estimate of the number of bears present in the search area during an average day of the search period. This technique has been published (Miller et al., in press, see Appendix 2) and only those site-specific details not included in this publication will be repeated here.

The search area and quadrats used to allocate search effort are illustrated in Fig. 38; time spent actually searching in each quadrat is presented in Table 76 (commuting time and time spent circling bears prior to capture is excluded). We were forced to base this census effort from Talkeetna which greatly increased commuting time to the search area. Total fixed-wing charter time was 264 hours, twice the number of hours spent in actual search (Table 76). Because this was a newly developed technique some errors were made which should be avoided in future applications. The most serious of these errors was failure to search each quadrat on each day of the search effort (Table 76). This was not considered a problem at the time because I originally intended to combine a number of days' data to obtain an estimate for that period. If this had been done the missed quadrats on a single day would not have been such a serious problem if all quadrats were searched equally over the period.

The problem with combining days, however, is that one could potentially have more marked bears seen during a period than were "present" during that period (where presence for each bear is a fraction equaling the proportion of time the marked animal spent in the search area). In illustration, a marked bear that was present half of the time in the period would be counted as 0.5 marked bears present, but if seen one or more times it would be counted as 1.0 marked bears seen.

This problem was eliminated through use of the bear-days estimator described by Miller et al. (in press, Appendix 2). This estimator provided a brown bear density estimate of 2.79 bears/100 km^2 (95% CI = 2.52-3.30 bears/100 km^2) and a black bear density estimate of 8.97 bears/100 km^2 (95% CI = 7.74-10.21 bears/100 km^2).

These density estimates were extrapolated to the area identified as that in which bears would be affected by the proposed hydroelectric project. This extrapolation provided an estimate of the number of bears that would be impacted by the proposed project. Evidence based on relocations of radio-marked brown bears during 1980 through 1984 illustrate that all of the search area was brown bear habitat (Fig. 40). The density estimate for brown bears represented density in habitats below 5,000 feet elevation; the amount of area below 5,000 feet elevation in the brown bear impact area was 11,704 km2 (12,127 minus 423 km2 above 5,000 feet elevation). For just Devils Canyon the impact area was 6,833 km2 (7,120 minus 287 above 5,000 feet) while for just the Watana Impoundment the area was 9,056 km2 (9,452 minus 398 above 5,000 feet). At the density estimated above, the estimated number of bears in the impoundment study area was 327 (95% CI = 295-386).

The density estimate for black bears was extrapolated to the area (1195 km2) identified as black bear habitat based on radio-locations of marked bears and habitat considerations (Figure 7), resulting in an estimate of 107 black bears in the impoundment impact area (95% CI = 93-122). Because of overlaps of the impoundments' impact zones, over half of this value would be within the impact zone of either impoundment considered separately.

The 1985 estimated population of 107 black bears may be less than maximum carrying capacity of this habitat following a series of good years for food crops. I suspect the poor berry crop in 1981 resulted in a reduced black bear population in this area, although there is little objective data available to support this conclusion. I based my suspicion on less frequent sightings of black bears, in 1982 and subsequently, than in 1980 and 1981.

10. BERRY ABUNDANCE AND CANOPY COVERAGE

Personnel conducting Su-Hydro studies designed to measure moose forage biomass in the impoundment area (Becker and Steigers 1986) simultaneously collected information on plants producing berries eaten by bears, as well as on horsetail (*Equisetum* spp.). The bear data were collected during 11 July-25 August 1986. Information was collected on transects including randomly spaced plots of 1 square meter. Transects were also identified as within willow (*Salix* spp.) biomass strata and plots were identified as being within vegetation types based on both vegetation mapping and on-ground classifications at the time data were collected. Transects were run from the Susitna River up to elevations of 3400 feet. Details of sampling schemes and mathematical treatments of these data are presented by Becker and Steigers (1986). Data on canopy coverage of berry-producing plants (as well as Equisetum), on berry abundance, and on berry ripeness were collected for blueberry (Vaccinium uliginosum), crowberry (Empetrum nigrum), and lowbush cranberry (also called lingonberry) (Vaccinium vitis-idaea). Six canopy-coverage categories were used: Absent, trace-5%, 6-25%, 26-50%, 51-75%, and 76-100%. Four berry-abundance categories were used: None, trace, 5-20 berries, and ¶20 berries. Five ripeness classifications were also used to represent average ripeness in each plot: green, starting, tart, sweet, and past. The first 2 and last 2 categories were lumped in my analysis of berry-ripening phenology. This analysis did not take elevation, slope, or habitat types into consideration (these factors may influence ripening phenology). For analysis of ripeness, data were lumped into 6 intervals of approximately 1 week each.

Data were weighted by willow biomass strata to reflect differing sampling intensities in these strata, and were analyzed to produce statistics on mean canopy coverage and berry abundance in each of 3 "populations" (within the flooded zone for each impoundment and outside of this zone up to an elevation of 3400 feet). This design was not optimal for collection of data on bear foods because this objective was incidental to the main purpose of the browse survey. I gratefully acknowledge the assistance of Earl Becker (ADF&G) and Bill Steigers (LGL) and their crew in collecting these data; Earl Becker also assisted in the analysis of these data.

Phenology

In 1985, phenology of berry ripening was similar for blueberry and crowberry; the incidence of green berries dropped rapidly during the first week of August and the incidence of sweet berries increasing rapidly during the third week of August (Figs. 40a &40b). For lowbush cranberry, this ripening pattern was about 2 weeks delayed and few plots with ripe berries were found during the 3rd week of August when the study ended (Fig. 40c). Since most black bears in this area enter dens during the last week of September and first week in October (Section 8.G.5, this report), these data illustrate that ripe berries are available to this population of black bears for a period of only 4-6 weeks.

Abundance and Canopy Coverage

The estimated proportion of berries and berry bushes and the standard error for this estimate (corrected for covariance effects) was calculated according to the methods described by Becker and Steigers (1984). These data are presented and illustrated in Figures 41-47. The estimated proportion was converted to a whole number by multiplying by the number of transects in each population (47 in the Devils Canyon vicinity below 2200 feet elevation, 165 in the Watana vicinity below 2200 feet, and 126 above 2200 feet). Following this multiplication, categories with <5 "observations" were lumped with the next lower category and Chi-square tests run. Results of these Chi-square tests are given in Figures 41-47.

For blueberry abundance and canopy coverage, the null hypothesis that the 3 populations were equivalent could not be rejected (Figures 41 and 45).

The null hypothesis for crowberry canopy coverage (Fig. 42). By inspection of Fig. 42 (lumping last 3 categories) it can be seen that the area outside of the impoundment had fewer crowberry bushes. These data are consistent with a hypothesis that the impoundment area may be especially important for spring foraging by bears for overwintered crowberries. Sample size was inadequate to say much about crowberry abundance, but berries appeared more abundant in Population A (Watana Impoundment) than in B (above 2200 feet elevation)and more abundant in B than in D (Devils Canyon Zone).

Lowbush cranberry bushes were unequally distributed in the 3 populations, with more cover in populations B and D (Devils Canyon and outside impoundments, respectively) than in A (Watana Impoundment) (Fig. 43). With reference to berry abundance, Population B is the most productive with A and D having equivalent productivity.

For Equisetum canopy coverage the categories with >5% coverage had to be lumped and the null hypothesis of equivalent distribution of Equisetum in the 3 populations was rejected (Fig. 44). This resulted from greater frequency of categories with >5% in the zone outside of the impoundments than within the impoundment zone (Fig. 44).

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Appendix 1.

A COMPARISON OF DENNING ECOLOGY OF THREE BLACK BEAR POPULATIONS IN ALASKA

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Abstract: Between 1978-1985, denning ecology of the black bear (*Ursus americanus*) was studied in the Kenai Peninsula, the Susitna River basin, and Prince William Sound, Alaska. All these populations are near the northern extension of their range. In different years the mean number of days spent in dens varied from 189 to 233 days; the maximum time spent in a den by an individual bear was 247 days. Timing of emergence in the spring and entrance in the fall appeared most related to time of year, and secondly, to weather, snow accumulation and melt, and food availability. Bears in the more severe climate along the Susitna River entered dens almost 2 weeks earlier and emerged later than bears on the warmer Kenai Peninsula. Chronology of denning differed between pregnant females and other sex and age groups, but overlap occurred with all age and sex groups. Site selection, vegetation type, and den type (cave, tree, excavated) varied between areas and was related to winter weather conditions (rain vs. snow), soil type (deep vs. shallow and rocky), and topography of the areas (mountains vs. flats). Den morphometry was compared between areas. Denning chronology was compared with that of other black bear populations in North America and with current theory on why bears den.

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Appendix 2.

BLACK AND BROWN BEAR DENSITY ESTIMATES USING MODIFIED CAPTURE-RECAPTURE TECHNIQUES IN ALASKA

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Abstract: Population density estimates were obtained for sympatric black bear (*Ursus americanus*) and brown bear (*U. arctos*) populations inhabiting a search area of 1,325 km² in south-central Alaska. Standard capture-recapture population estimation techniques were modified to correct for lack of geographic closure based on daily locations of radio-marked animals over a 7-day period. Calculated density estimates were based on available habitat in the search area (1,317 km² for brown bears and 531 km² for black bears). Calculated density was 2.79 brown bears/100 km² (2.52-3.30 bears/100 km²) and 8.97 black bears/100 km² (7.74-10.21 bears/100 km²). Calculated 95% confidence intervals were +13.7% of the estimate for black bears and 9.9% to +18.5% of the estimate for brown bears. Probabilities of capture based on calculated sightability indices were not equal in some instances, so confidence intervals should be interpreted cautiously. Increasing the number of marked bears during the study period resulted in altered brown bear estimates and smaller confidence intervals, but because closure was a relatively good assumption for black bears in our study area, had little effect on black bear estimates or confidence intervals. When telemetry data were used to correct input values for lack of geographic closure, the Schnabel estimator and the mean of 7 separate daily estimates both yielded estimates close to our results. We recommend our technique for additional testing as a method to objectively compare bear densities between different areas or between different times. These procedures may also be appropriate for use with other species.

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Appendix 3.

CHARACTERISTICS OF NONSPORT BROWN BEAR DEATHS IN ALASKA

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Abstract: The sex, age, and other characteristics of 668 brown bears (Ursus arctos) killed in nonsport circumstances in Alaska during the period 1970-85 were examined. These data represent an unknown fraction of total nonsport kills as not all kills were reported. Both sport harvests and nonsport kills are increasing in Alaska. Nonsport harvests averaged 5.1% of total sport and nonsport kills. Areas with the highest human density had the highest ratio of nonsport to sport harvests. Nonsport harvests are most common during periods when most people are in remote areas to hunt or fish. Males predominate in the nonsport kills of younger bears and females in the nonsport kills of older bears. Regulations and other factors make adult male bears more vulnerable to sport hunters than adult female bears. Partially as a result, nonsport kills contain more adult females than sport kills. An analysis based on affidavits from 224 persons killing bears revealed that bears were shot to avoid perceived danger (72%), to protect property (21%), and to eliminate nuisances (7%).

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Appendix 4.

Abstract of "Differentiation of Brown and Black Bear Scats: An Evaluation of Bile Acid Detection by Thin Layer Chromatography" by Enid Goodwin, ADF&G (full text of report in Appendix 1 of Miller 1984).

SUMMARY: A thin-layer chromatographic technique (TLC) for separation and detection of fecal bile acids was evaluated for use in differentiation of black bear scats from brown bear scats. Fecal samples from 22 known black bears and 19 known brown bears were tested. Bile samples from 4 black bears and 3 brown bears were also examined using TLC. Statistical analysis of Rf values obtained from the fecal samples indicated no significant difference between brown bear and black bear chromatograms. The numbers of bile samples were too small for statistical analysis, but indications of possible differences were noted. Variations among individuals within a species were documented, as were significant variations within individuals. Variations were hypothesized to be primarily caused by dietary influences on bile acid production mechanisms. Pigment removal methods were also evaluated. Alkaline distilled water was found to be effective in removing berry pigments, while hexane was a preferred solvent for removal of other types of plant pigments.

APPENDIX 5

Date: 1986

Susitna Hydroelectric Project Big Game Study

Data Component Descriptions and Coding Schemes
Black and Brown Bears

Alpha codes are left-justified, numeric codes are right-justified.

1. Species: 1 = moose
   2 = sheep
   3 = caribou
   4 = brown bear
   5 = wolf
   6 = black bear
   7 = goat
   8 = coyote
   9 = wolverine

2. Project: A one-digit code project ID:

   1 = upstream
   2 = downstream
   3 = GASAWAY
   4 = Denali Hwy.
   5 = Noatak

3-8. Individual ID: An integer number of up to six digits which will be unique for the individual animal it represents within the project. For Su-Hydro bears it is the tattoo number. If a bear is unmarked, ID=99.

9-12. Age (in years, no decimal).

13. Age code = A (decimal age).

14. Sex code: M = Male, F = Female, blank = unknown.

15-17. Observation number: An integer number up to three digits which uniquely identifies the sighting of an individual animal. The value must be right-justified.

18-23. Date: Two-digit integer for each: month, day, and year, respectively, each right-justified.

24-27. Time: Military time (by 24-hour clock), right-justified.

28. Visual: Was the individual actually sighted, or located only by radio?

Actually sighted		Radio located
H = able to map with a high degree of accuracy	(^{3}1/16" on 1:63,360)	B = located only within a broad range
M = able to map with a moderate degree of accuracy	(^{3}1/8" on 1:63,360)	I = located within an intermediate range
L = able to map only to a low degree of accuracy	(^{2}1/8" on 1:63,360)	C = located within a close range
Y = yes; level of mapping accuracy not recorded		N = no; not sighted, with no record of accuracy of radio relocation

29. Activity:

A = agonistic
B = bedded
D = at den site
E = digging
F = feeding
H = hiding
I = in den
J = den of unmarked bear
M = mating
N = nursing
O = other
P = apparent den site (bear not seen)
R = running
S = standing
T = treed
W = walking
X = swimming
Y = fishing
Z = sitting

42-45. Elevation: The elevation of the terrain upon which the animal was sighted, expressed in feet; up to four digits.

46. Slope: A code for the range of slope of the terrain upon which the animal was sighted.

F = flat (0° - 10°)
G = gentle (11° - 30°)
M = moderate (31° - 60°)
S = steep (61° - 90°)
R = w/in riverbank

48-49. Aspect: A code for the general direction of exposure of the terrain upon which the animal was sighted: N, NW, E, SE, S, SW, W, NW, or

F = flat
R = ridgetop
G = gully

the code is left-justified.

55-56. <u>Number of young/age class</u>: The number of young within a specific age class, for as many as two different age classes, sighted with (and directly associated with) the reported individual. Right-justified.

0 = young-of-the-year
1 = yearlings
2 = 2-year-olds

57-58. Same as 55-56, used if more than 1 age class of young is with bear.

59-62. <u>Group size</u>: The total number of individuals (<u>of the same species</u>) sighted within the group associated with the reported individual. Always will be at least 1 unless bear not seen (in this case leave blank).

63-65. <u>Number of adult males</u>: The total number of adult males (<u>of the same species</u>) within the group sighted in association with the reported individual.

66-68. <u>Number of adult females</u>: The total number of adult females (<u>of the same species</u>) within the group sighted in association with the reported individual.

69-71. <u>Number of young</u>: The total number of offspring (<u>of the same species</u>) within the group sighted in association with the reported individual.

72. <u>Other species</u>: If another species with the individual, enter the code for that species (see #1).

74. <u>Status</u>:

A = probably dead or shed
B = capture site of new bear or bear w/o functioning transmitter
C = see comment (use for "special" points)
D = known nonhunter mortality
F = probably subsequent collar failure
H = known hunter kill subsequently
S = known shed collar
U = uncollared, but marked bear

86. <u>Species</u>: A code for the species of a killed animal on which the recorded predator was found.

B = beaver
C = caribou
F = fish
H = snowshoe
M = moose

S = small mammal
U = unidentified
O = other

87. <u>Age class</u>: A code for the estimated age of the prey.

0 = young-of-the-year
1 = yearling
2 = 2-year-old
3 = adult
4 = unknown

88. <u>Sex</u>: Sex of the prey animal.

M = Male
F = Female
U - Unknown

89. <u>Killed by</u>: A code for the species which actually killed the prey, or how it was killed.

U = unknown
B = black bear
G = grizzly
S = winter kill
W = wolf
V = wolverine
A = accidental
O = other

90. <u>Freshness</u>:

F = fresh
O = old

<u>Percent consumed</u>: The approximate percent of the prey that has been consumed.

95-100. <u>Habitat</u>:

<u>SPRUCE</u>

1. Sparse-TALL
2. Mod.-TALL
3. Dense-TALL(rip.)
4. Sparse-MEDIUM
5. Mod.-MEDIUM
6. Dense-MEDIUM
7. Sparse-LOW
8. Sparse-LOW
9. Dense-LOW

<u>SHRUBLANDS</u>

10. Riparian willow
11. Upland willow
12. Willow/birch
16. Alder

<u>OTHER</u>

15. Marsh
17. Rock/ice/snow
22. Gravel bar

<u>TUNDRA</u>

18. Sedge-grass
19. Alpine herbaceous
20. Shrub (d. birch)
21. Mat & Cushion

<u>OTHER FOREST</u>

13. Aspen
14. Ripar. hardwood
23. Mixed birch/spruce
24. Birch (trees)

101. Movement: codes for suspected direction of bear movements, inferred after the fact, based on best guess.

N = No specialized movements suspected

B = In seasonal activity area -- caribou calving grounds
C = En route to or from caribou calving grounds
D = In season activity area -- salmon fishing area
E = En route to or from salmon fishing area
F = In seasonal activity area searching for food resources that are scarce in that year within normal home range (especially bad berry years) -- summer feeding grounds
G = En route to or from above area
H = In seasonal activity area -- denning behavior outside of known nondenning range
I = En route to or from above denning area
J = In seasonal activity area -- generalized early spring lowland foraging
K = Suspected dispersal movements
L = Initial capture site or recapture site of nonradioed bear
M = At or en route to or from den site within normal home range
O = Movement outside normal area based on suspected reproductive activity

102. Reproductive status codes -- Inferred after the fact, based on subsequent sightings.

A = With newborn cubs
B = With yearling offspring
C = With 2-year-old offspring
D = With 3-year-old offspring
E = Presence or absence of offspring unknown (had them previously but not subsequently)
F = Probable or known estrous female or breeding male (usually accompanied by another bear in the case of males)
G = Inactive, unknown or alone (cubs lost or weaned)
H = Subadult
M = Movement outside normal use based on suspected reproductive activity

Table 1. Brown bears captured in Susitna Dam Studies as of Nov. 1986.

Tattoo	Capture Sex	Capture Age (years)	Wt. (pounds)	Date	Ear Tags	Comments
(277)	F	10.5	225*	4/10/80	1065/1066	w/2 ylgs, not marked, collar shed 80/81 den
(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
214	M	4.5	300*	4/22/80	1072/1071	collar shed 9/9/80, recaptured 6/85
281	F	3.5	250*	4/22/80	16175/15950	not turgid, see 5/81 recapture
282	M	4.5	325*	4/22/80	1079/1080	see 6/82 recapture
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
(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
(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
(312)	F	10.5	319	5/7/80	1312/1311	w/311
(311)	M	2.5	227	5/7/80	-- --	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
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	estrous, missing in 1982
335	F	3.5	194	5/5/81	1220/1219	recaptured 5/14/83 and 6/86, age changed + 1 '83 tooth
281#2	F	4.5	--	5/6/81	1201/1202	estrous? recaptured 5/15/83
283#2	F	13.5	261	5/6/81	1089/1090	w/338 and 339, 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, sex 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
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
340	F	3.5	190	5/6/81	1225/1218	not estrous, recaptured 5/15/83
280#2	M	6.5	394	5/7/81	1097/1267	w/F 341, recaptured 5/16/83
341	F	6.5	224	5/7/81	(1208/1207)	w/M 280, collar failed, recaptured 6/81
299#2	F	14.5	291	5/7/81	1109/1110	w/2 @2.5 (297 and 298 - not recaptured), not estrous, recaptured 8/6/81
(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

(continued on next page)

Table 1. (continued)

Tattoo	Capture Sex	Age (years)	Wt. (pounds)	Date	Ear Tags	Comments
(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	recapture of marked bear, shed collar, recaptured 5/84 & 6/86
(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	(153.809)	(1588/532) w/2@1, not captured, shot 9/83
381	F	3.5	200*	6/12/82	(151.513)	533/1592 alone, recaptured 5/18/84 & 6/86
313#3	F	12.5	300*	5/14/83	same	w/2@1
382	M	1.5	66	5/14/83	2135/2134	w/313 and 383, recaptured 5/18/84
(383)	F	1.5	53	5/14/83	(2490/2491)	w/313 and 382, died unknown causes
283#3	F	15.5	--	5/14/83	same	w/cub #3, recaptured 6/86
(003)	F	0.5	--	5/14/83	(1360/1359)	w/283, special cub collar, no tattoo, cub eaten
337#2	F	15.5	--	5/14/83	same	w/385@2
385	F	2.5	60	5/14/83	(1695/1694)	w/337, breakaway 5B collar, recaptured 6/85, tags replaced
(312#2)	F	13.5	350*	5/14/83	(1299/1300)	w/386@2, died 5/16/84
386	M	2.5	200*	5/14/83	2146/2141	w/312, breakway 5B collar, dispersed
344#2	F	7.5	325*	5/14/83	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	same	alone, one year added to '81 age based on '83 tooth
388	F	14.5	450*	5/14/83	2478/2477	w/388 and 389@2, recaptured 5/16/84 & 6/86
(389)	M	(2.5)	135	5/14/83	2170/2171	w/388 and 390, breakaway 5B collar, died 10/83
390	M	2.5	125*	5/14/83	2148/2147	w/388 and 389, breakaway 5B collar shed
340#2	F	5.5	250*	5/15/83	same	recaptured 5/17/84, collar replaced 6/85
384	F	12.5	300*	5/15/83	2499/2500	w/391, 392, 393@2
(391)	M	2.5	140*	5/15/83	(2078/2079)	w/384 et al., breakaway 5B collar, shot 9/84
(392)	M	2.5	140*	5/15/83	(2111/2110)	w/384 et al., breakaway 4B collar, shot 5/84
393	F	2.5	105	5/15/83	1589/1598	w/384 et al., breakaway 4B collar
(293#3)	M	(6.5)	439	5/15/83	same	--, shot spring '85
(394)	F	6.5	250*	5/15/83	(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	(2415/2416)	alone, regular 6B collar, shot 9/4/83
281#3	F	6.5	325*	5/15/83	same	w/2@0 (#5 and #6), recollared 5/17/84
(005)	M	0.5	8.5	5/15/83	(1350/134)	w/281, expandable cub collar, no tattoo, eaten
(006)	F	0.5	8.3	5/15/83	(1346/1345)	w/281, expandable cub collar, no tattoo, eaten
280#3	M	8.5	482	5/16/83	same	recaptured 6/85
396	F	13.5	274	5/16/83	1685/1684	w/2@2 (397, 398), recaptured 6/86
(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	2087/2108	recaptured 5/15/84
400	M	20.5	542	5/17/83	2132/2133	recaptured 5/18/84
299#4	F	16.5	275*	5/18/83	same	w/3@0, darted in den, recaptured 5/15/84
418	M	0.5	13*	5/18/83	1347/1348	w/G299, special cub collar, shed 10/83, old #7
419	M	0.5	13*	5/18/83	1342/1343	w/G299, special cub collar, old #8
(417)	M	0.5	13*	5/18/83	(536/535)	w/G299, special cub collar, shed 7/83, old #9

(continued on next page)

Table 1. (continued)

Tattoo	Capture Sex	Age (years)	Wt. (pounds)	Date	Ear Tags	Comments
(279#2)	M	12.5	700*	5/18/83	1653/1100	recapture, previous shed collar, recaptured 5/16/84
315#2	F	5.5	203	5/18/83	15288	same estrous, alone, just marked previously
403	F	6.5	275*	5/18/83	1564/1565	w/2@0, not captured, downstream
407	F	4.5	220*	5/19/83	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	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	same	alone
388#2	F	15.5	400*	5/16/84	same	w/2c, replaced 6/86
(16)	M	0.5	--	5/16/84	(1389/1390)	w/G388, capture-induced separation, died/shed 6/84
(17)	F	0.5	00	5/16/84	(40/50)	w/G388, capture induced separation, died 5/84
312#3	F	14.5	300*	5/16/84	same	w/3c, old and new radio failures, capture mortality on 5/17/84
(279#3)	M	13.5	800*	5/16/84	same	large implant, shot 9/84
281#4	F	7.5	350*	5/17/84	same	w/2c
(21)	M	0.5	14	5/17/84	1386/1383	w/G281, drowned?
(22)	M	0.5	14	5/17/84	(1385/1384)	w/G281, killed by BrB
337#3	F	16.5	325	5/17/84	same	w/2c, recaptured 6/85
08	F	0.5	12	5/17/84	1338/1337	w/337
09	F	0.5	12	5/17/84	1340/1339	w/337
340#3	F	6.5	375*	5/17/84	same	w/2c, recaptured 6/85
23	?	0.5	17	5/17/84	45/28	w/340,
24	?	0.5	14	5/17/84	1706	44/27 w/340
420	F	19.5	350*	5/17/84	2447/2057	w/2@1, one is 421
421	M	1.5	78	5/17/84	1644/2086	w/420 & uncaptured sibling, large implant, female sibling, 437, captured 6/85
422	M	4.5	205	5/18/84	2136/2137	alone near camp
381#2	F	5.5	263	5/18/84	same	alone, color replaced on 6/86
400#2	M	21.5	600*	5/18/84	same	alone
382#2	M	2.5	148	5/18/84	same	w/G313, old implant = 8.110, breakaway, picked up 6/86
423	F	21.5	300*	5/18/84	none	w/4c, drug problem, recaptured 6/86
25	M	0.5	7	5/18/84	39/32	smallest cub w/G423
--	F	0.5	--	5/18/84	49/48	other sibling w/G413 not marked or sexed
425	F	8.5*	--	6/01/84	2486/2413	w/282 M, recaptured 6/86, 3 teeth misplaced
282#3	M	8.5	--	6/01/84	same	w/425, recapture of shed collar, recaptured 6/86
342#3	M	5.6	--	7/28/84	--	capture mortality
(427)	M	(3.5)	195	6/01/85	(1697/2113)	rot-away canvas spacer used, shot 9/19
(398#2)	F	(4.5)	200*	6/01/85	same	396's offspring @2 in 1983, shot 6/86
314#2	F	7.5	285*	6/01/85	same	w/1@1 2-yr-old w/G313 on 5/80; had litter at age 6
(429)	F	(1.5*)	104	6/01/85	(1514/1518)	w/G314 breakaway collar, shot 9/86
341#2	F	10.5	--	6/03/85	2174/1372	old collar failed prematurely added new tags to old
214#2	M	9.5	600*	6/03/85	(1071/1649)	previously shed collar, recaptured 5/86
437	F	2.5	175*	6/03/85	2082/2083	w/G421, probably sibling, rot-away collar
309/440	M	17.5	700*	6/04/85	2163/1523	old collar shed, tattoo 440 in upper left, break-away
(442)	M	(13.5)	750*	6/04/85	(1677/2117)	"Harley" yellow flag in rt. ear, shot 9/86, eartags gone
443	M	A	400*	6/04/85	2172/--	red flag in right, blond
(397#2)	F	(4.5)	300*	6/04/85	(1534/1597)	estrous w/443, was w/G396 in 1983@2, shot 9/85
447	F	7.5	400*	6/05/85	2430/2429	--, breakaway
347#2	M	18.5	650*	6/09/85	2184/2181	orange flags in ears, old eartags gone

(continued on next page)

Table 1. (continued)

	Capture					
Tattoo	Sex	Age (years)	Wt. (pounds)	Date	Ear Tags	Comments
(339/450 #2)	M	(4.5)	150*	6/09/85	(1221/2130)	originally captured in 1981 @Ow/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	alone drop-off feature added to collar
337#4	F	17.5	200*	6/09/85	same	w/2@1--these have no collars
273	F	9.5	200*	6/09/85	same	age=3 in 1979, transported, returned, old collar replaced
340#3	F	17.5	250*	6/10/85	same	replaced collar, w/2@1
280#4	M	10.5	400*	6/10/85	same	collar removed
388 #3	F	17.5	425*	6/5/86	same	w/2@1, not captured, collar replaced
335 #4	F	8.5	300*	6/5/86	same/2481	w/1@2=G466, collar replaced
466	F	2.5	150*	6/5/86	2097/2056	w/mother-335
396 #2	F	16.5	300*	6/6/86	same	estrous, collar replaced
381 #3	F	7.5	225*	6/6/86	--/same	w/2@1, not captured, collar replaced
214 #3	M	10.5	600*	6/6/86	none/2062	collar removed
283 #4	F	18.5	300*	6/6/86	same	w/2@1, not captured, collar replaced
423 #2	F	22.5	275*	6/6/86	1540/1541	w/3@2, not captured, collar replaced
425 #2	F	A	250*	6/6/86	same	w2@1, not captured, last tooth pulled, color replaced
282 #4	M	10.5	550*	6/6/86	2129/same	alone, collar removed, neck bad

* Weight estimated, ( ) indicates shed collar or dead bear; # recapture; - collar or mark replaced subsequently; last tattoo = 425; last cub = #25.

Table 2. Black bears captured in Susitna Dam Studies as of Nov. 1986

	Capture					
Tattoo	Sex	Age (years)	Wt. (pounds)	Date	Ear Tags	Comments
(287)	M	10.5	225*	5/1/80	1083/1084	shot on 9/8/82
(288)	F	10.5	125*	5/1/80	1095/1083	w/2 ylgs, turgid, collar shed by 8/27/80
289	F	9.5	130*	5/2/80	1103/1104	w/2 ylgs, turgid, had 3 cubs in 1981, see 4/82 recapture
(290)	F	8.5	103	5/2/80	1306/1305	w/2 ylgs, turgid, see 8/6/81 recapture
(291)	M	(3.5)	73	5/2/80	-- --	post-capture mortality
(296)	M	(10.5)	227	5/3/80	-- --	capture mortality
(300)	M	(7.5)	274	5/4/80	-- --	post-capture mortality
(301)	F	(7.5)	115	5/4/80	1043/1044	w/1 ylg., turgid, had 2 cubs in 1981, see 3/83 recapture, shot 9/84
(302)	M	8.5	287	5/4/80	1106/1105	collar shed by 8/4/80, recaptured 5/9/81
(303)	M	(8.5)	217	5/4/80	(1055/1056)	shot 9/8/83
(304)	M	10.5	235	5/4/80	1315/1316	collar shed in 1982
(305)	M	(9.5)	217	5/5/80		shot by hunter 8/30/80
(307)	M	2.5	105	5/5/80	1123/1124	shot by hunter on 5/17/81
310	M	2.5	85	5/6/80	(1122/1121)	recaptured 6/85
(316)	F	(12.5)	150*	5/7/80	-- --	w/1 newborn & 1 ylg. shot by hunter 8/28/80
317	F	7.8	133	8/18/80	1195/1196	w/2 cubs, see 3/83 recapture
(318)	F	5.8	126	8/18/80	1046/1045	w/1 cub, immobilized in den 3/81, 3/83, and 5/85 recaptures, shed 7/83
(319)	M	3.8	174	8/18/80	1194/1193	died summer 1981
(320)	M	(4.8)	200*	8/18/80	-- --	shot by hunter 9/9/80
321	F	10.8	175*	8/18/80	1243/1244	had 2 cubs in 1981, recaptured 5/15/83
(322)	M	4.8	154	8/19/80	1087/1088	w/324, collar shed in 80/81 den, see 5/26/82 recapture, died 1982
(323)	M	2.8	122	8/18/80	1200/1199	see 3/83 recapture, shot 9/83
(324)	M	(5.8)	190	8/19/80	(1252/1251)	w/322, see 3/83 recapture, shot 9/84
(325)	F	11.8	164	8/18/80	1191/1192	collar shed in 80/81 den, see 8/6/81 recapture
(326)	F	(5.8)	125	8/19/80	-- --	w/2 cubs, shot by hunter 8/28/80
(327)	F	(5.8)	118	8/19/80	1247/1248	w/2 cubs, immobilized in den 3/81, 3/83, died 7/83
328	F	6.8	150	8/19/80	1246/1245	collar shed 81/82 den, recaptured 5/16/84
(303#2)	M	(8.8)	260	8/19/80	-- --	recapture, shot 9/8/83
329	F	1.3	15*	3/23/81	1266/1265	w/327 and sibling, w/heavy collar, see 4/82 & 3/83 recaptures
318#2	F	6.3	--	3/25/81	same	in den
(330)	M	1.3	31	3/25/81	1276/1275	w/318, died summer 1981
(342B)	M	(5.5)	165	5/7/81	1206/1205	cinnamon color, shot on 9/15/81
(343)	M	(5.5)	184	5/7/81	(1214/1213)	alone, Devil Mountain, recaptured 5/16/83, died fall 1984
(346)	M	(9.5)	175*	5/9/81	(1226/1184)	alone, see 3/83 recapture, died 6/84
302#2	M	9.5	300*	5/9/81	1257/1105	alone, old collar previously shed
(290#2)	F	9.8	160+*	8/6/81	1306/1279	neck infected, collar not replaced
(304#2)	M	11.8	--	8/6/81	1286/1316	collar replaced, shed 6/82
(325#2)	F	12.8	150*	8/6/81	1191/1192	second collar shed in 81/82 den
(303#2)	M	(9.8)	250*	8/7/81	(1055/1056)	collar replaced, shot 9/8/83
(287#2)	M	11.8	200*	8/7/81	(1083/1084)	collar replaced, shot on 9/8/82
(348)	M	9.8	300*	8/6/81	1131/1132	alone, shot on 9/82
349	F	4.8	170*	8/6/81	1326/1325	alone, see 3/83 recapture, shed 7/83, recaptured 5/16/84
329#2	F	2.3	29	4/1/82	same	recapture in den, see 3/83 recapture
289#2	F	11.3	112	4/1/82	same	recapture in den w/350 and 351
350	M	1.3	14	4/1/82	514/513	capture in den
351	M	1.3	16	4/1/82	516/515	capture in den, recaptured 6/4/85

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Table 2. (continued)

Tattoo	Capture Sex	Capture Age (years)	Wt. (pounds)	Date	Ear Tags	Comments
(352)	M	2.5	100*	5/26/82	--	capture mortality
(353)	M	1.5	29	5/26/82	--	capture mortality of B301's yearling
354	F	5.5	150*	5/26/82	517/1600	w/2 cubs, recaptured 5/18/84
355	F	0.5	4*	5/26/82	518/519	w/354, no tattoo
356	M	0.5	4*	5/26/82	520/521	w/354, no tattoo
(357)	M	4.5	113	5/26/82	501/1651	died winter 82/83
(322#2)	M	(6.5)	90*	5/27/82	1662/525	recapture, previous shed collar, died summer '82
(358)	F	(2.5)	60*	5/27/82	502/1656	recaptured 5/15/84, died 8/84
359	M	4.5	118	5/27/82	512/1655	recaptured 5/15/84
(360)	M	7.5	250*	5/27/82	511/1657	----, collar shed 6/84
361	F	7.5	175*	5/27/82	522/1596	see 3/83 recapture
362	F	2.5*	40*	5/27/82	503/504	no tattoo
363	F	4.5	120*	5/27/82	505/1593	----
364	F	9.5	170*	5/27/82	521/1591	missing since Sept.'82, recaptured 5/18/84
(365)	M	5.5	100*	5/28/82	523/1626	downstream study, see 3/83 recapture-collar loosened, died 9/83
(366)	M	6.5	200*	5/28/82	538/1627	downstream study, shot on 8/5/82
(367)	F	4.5	100*	5/28/82		(524/1579) downstream study, shot, see below - 4/16/83 recapture
(368)	F	3.5	110*	5/28/82	--	capture mortality, downstream study
369	F	4.5	90*	5/28/82	527/1578	downstream study - age based on '83 tooth, recaptured 4/83, 4/84 tag shed 7/84
370	F	7.5	220*	5/28/82	528/1577	downstream study, disappeared 5/83 (shot?)
(371)	M	2.5	150*	5/28/82	--	capture mortality, downstream study
372	F	9.5	135*	5/28/82	537/1576	downstream study, disappeared 8/83 (shot?)
(374)	F	7.5	125*	6/11/82	(530/1584)	w/1@1, downstream study, recaptured 5/19/83, shot 9/83, aged + 1 ('83)
(375)	F	(9.5)	160*	6/11/82	(507/1630)	w/3@1, downstream study, recaptured 5/19/83, age changed (+ 4), shot 5/85
376	F	6.5	125*	6/11/82	527/1587	w/1@1, downstream study, see 9/2/82 recapture
377	F	4.5	126	6/11/82	509/1659	downstream study, recaptured 5/19/83, age changed (-1)
378	F	6.5	175*	6/11/82	510/1628	downstream study
376#2	F	6.7	160*	9/2/82	530/1584	recapture, slough 8B, snare
(301#2)	F	(10.3)	135	3/20/83	same	w/2@0, recapture in den, collar shed 7/83, shot 9/84
317#2	F	10.3	--	3/23/83	1547/1196	w/2@0, recapture in den
(318#3)	F	8.3	--	3/23/83	same	w/2@0, recapture in den, shed 7/83
(323#2)	M	(5.3)	--	3/21/83	(1696/1650)	recapture in den, Mort Mason shot (?) 9/83
(324#2)	M	8.3	--	3/22/83	(1661/1251)	recapture in den, shot 9/84
329#3	F	3.3	56	3/22/83	same	recapture in den, old collar loosened
(327#2)	F	8.3	--	3/23/83	same	w/2@0, recapture in den, died summer 1983
(346#2)	M	11.3	--	3/21/83	same	recapture in den, died 6/84
(349#2)	F	6.3	--	3/22/83	same	w/2@0, recapture in den, shed 7/83
361#2	F	8.3	--	3/21/83	same	w/4@0, recapture in den, recaptured 4/84, 2/85
(365#2)	M	6.3	--	3/23/83	same	recapture in den, collar loosened, died 9/83
(379)	F	9.3		3/24/83	none	w/3@0, captured in den #19, died 7/83
369#2	F	5.3	--	4/14/83	same	collar loosened in den, no cubs, recaptured 4/84
372#2	F	10.3	--	4/15/83	same	w/3@0, collar loosened in den
376#3	F	6.3	--	4/16/83	same	w/3@0, collar okay in den
370#2	F	8.3	--	4/16/83	same	w/2@0, collar loosened in den
(367#2)	F	5.3	--	4/16/83	same	collar loosened in den, no cubs, shot July 1983
378#2	F	7.3	--	4/16/83	same	w/2@0 (not sexed or weighed), collar okay in den
(387)	M	(4.5)	175*	5/14/83	(2126/2127)	-- shot 9/85

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Table 2. (continued)

Tattoo	Capture Sex	Capture Age (years)	Wt. (pounds)	Date	Ear Tags	Comments
321#2	F	13.5	115	5/15/83	same	had cubs (n=?), not captured
(343#2)	M	(7.5)	225*	5/16/83	same	-- died fall 1984
(401)	M	(3.5)	96	5/18/83	(2103/2102)	suspected shot, collar in lake by hunter's camp
402	F	10.5	130	5/18/83	2373/2372	w/3@1, not captured, downstream study
375#2	F	10.5	--	5/19/83	same	w/1@0, collar loosened, age changed + 4 ('83 tooth), shot 5/85
(374#2)	F	8.5	120*	5/19/83	(same)	w/3@0, all captured, old collar loosened, shot 9/83, aged + 1
010	F	0.5	--	5/19/83	1351/1352	w/374, no tattoo
011	F	0.5	--	5/19/83	1354/1353	w/374, no tattoo
012	F	0.5	--	5/19/83	1356/1355	w/374, no tattoo
377#2	F	5.5	--	5/19/83	same	alone, collar replaced, neck infected, age changed - 1 ('83 tooth)
(404)	F	11.5	135*	5/19/83	2449/2450	w/1@0, captured, downstream study, recaptured 3/85, shot spring 1985
013	F	0.5	10	5/19/83	2449/2450	no tattoo, w/404, downstream study
(405)	F	(17.5)	180*	5/19/83	(2418/2417)	W/2@0, both captured, downstream study.
014	F	0.5	6.5	5/19/83	1364/1366	w/405, downstream study, no tattoo
015	F	0.5	6.0	5/19/83	1365/1366	w/405, downstream study, no tattoo
406	F	11.5	125*	5/19/83	2444/2445	w/2@0, not captured, downstream study
408	M	3.5	160*	5/19/83	2119/2120	alone, Downstream study
409	F	5.5	90*	5/19/83	1527/1526	alone, downstream study
(410)	F	7.5	120*	5/19/83	(1536/1537)	w/2@0, not captured, downstream study, shot 7/19/83
411	F	8.5	130*	5/19/83	1548/1549	w/2@1, not captured, downstream study
363#2	F	6.3	--	4/6/84	same	w/2@0, recaptured in den, replaced collar
--	M	0.3	6.0	4/6/84	12/20	w/363 in den, neck = 190mm
--	M	0.3	6.8	4/6/84	11/24	w/363 in den, neck = 192mm
361#3	F	9.3	--	4/6/84	same	w/3@1, recaptured in den, collar good fit, replaced 2/85
412#2	M	1.3	30*	4/6/84	1678/2122	w/361 in den, neck = 285mm, 25+ lbs
413#2	F	1.3	30*	4/6/84	2476/2428	w/361 in den, neck = 286mm, 25+ lbs
414#2	F	1.3	19.5	4/6/84	2439/2432	w/361 in den, neck = 263mm
(360#2)	M	9.3	--	4/7/84	same	recaptured in den, replaced collar, shed 6/84
329#4	F	4.3	75*	4/7/84	same	recaptured in den #73, alone
289#3	F	13.3	--	4/7/84	same	w/1@1, recaptured in den, collar replaced, recaptured 3/85
415	F	1.3	23.5	4/7/84	1582/1590	w/289 in den
369#3	F	6.3	--	4/8/84	same	w/2@0, recaptured in den, replaced collar, ear tag 1578 found 7/84
--	M	0.3	4.0	4/8/84	3/4	w/369 in den
--	F	0.3	3.8	4/8/84	22/6	w/369 in den
(358#2)	F	(4.5)	70	5/15/84	same	sex changed, died 8/84
359#2	M	6.5	131	5/15/84	same	alone, collar replaced
302#3	M	12.5	350*	5/15/84	same	old collar not working
416	M	9.5	230*	5/15/84	2064/2054	(poor tooth age)
349#2	F	7.5	72	5/16/84	1326/1325	old collar previously shed, recaptured 2/85
328#2	F	10.5	110	5/16/84	1246/1245	old collar previously shed
364#2	F	11.5	108	5/18/84	1591/526	old collar not working
354#2	F	7.5	108	5/18/84	1600/517	with cubs
361#4	F	10.0	140*	2/25/85	same	w/3@2 in den, collar applied loosely

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Table 2. (continued)

Tattoo	Capture Sex	Capture Age (years)	Wt. (pounds)	Date	Ear Tags	Comments
412#3	M	2.0	80*	2/25/85	same	w/361 in den, applied green visual dropoff
413#3	F	2.0	65*	2/25/85	same	w/361 in den, applied red visual dropoff
414#3	F	2.0	55*	2/25/85	same	w/361 in den, applied white visual dropoff
349#3	F	8.0	--	2/28/85	same	in den w/at least 2@0, collar loosened 1½
001	M	0.0	1.8	2/28/85	--	w/349, at least one sibling not handled
289#4	F	14.3	--	3/1/85	same	w/at least 2@0 in den, cubs not handled
328#3	F	11.3	--	3/29/85	same	w/3@0 in den, loosened collar 1½ notches, rubbed
002	M	0.3	5.0	3/29/85	--	w/B328 and siblings
003	M	0.3	4.1	3/29/85	--	w/B328 and siblings
004	F	0.3	4.1	3/29/85	--	w/B328 and siblings
404#2	F	13.3		3/30/85	same	w/3@0 in den, collar fine, died (shot?) spring 1985, coys dispatched
005	M	0.3	4.1*	3/30/85	--	w/B404 and siblings
006	M	0.3	4.1*	3/30/85	--	w/B404 and siblings
007	F	0.3	3.5*	3/30/85	--	w/B404 and siblings
(426)	M	(2.5)	75*	6/1/85	--	capture mortality
428	M	5.5	175*	6/1/85	2109/2167	rot-away canvas spacer
430	M	9.5	285*	6/2/85	(2093/2088)	rot-away canvas spacer, pulled off collar 1986
431	F	11.5	116	6/2/85	1519/1520	----
310#2	M	7.5	225*	6/2/85	2185/2183	rot-away canvas spacer
432	F	6.5	124	6/2/85	1558/1557	w/ylg. 434
434	F	1.5	33	6/2/85	1552/1572	w/B432
433	M	3.5	68*	6/2/85	1647/2081	----
(435)	M	(7.5)	200*	6/2/85	2182/2186	----, shot 9/85
436	M	2.5*	40*	6/3/85	--/2121	w/B364-mother?
438	F	8.5	130*	6/3/85	1516/1521	w/B439 & uncaptured sibling
439	M	2.5*	40*	6/3/85	--/--	w/B438-and sibling, dart injured leg
441	F	9.5	195	6/4/85	2361/2362	----
351#2	M	4.5	140	6/4/85	2169/2175	old tags left in too (516/515)
444	M	3.5	78	6/4/85	2154/2153	dropoff visual collar
445	M	8.5	250*	6/4/85	2068/2164	dropoff collar
(446)	F	5.5	99	6/5/885	--/--	capture mortality
448	F	6.5	100	6/5/85	1544/1533	break-away collar
318#4	F	10.5	--	6/5/85	same	w/2@1 (not captured), recapture, old collar shed
449	M	6.5	165*	6/9/85	1640/2188	alone
451	F	2.5	54	6/10/85	2408/2484	alone

* Weight or age estimated; ( ) shed or replaced collar or dead bear; # recapture; __subsequently changed; last tattoo used = 425; last cub = 25.

Table 3. Number of observations of radio-marked brown bears (older than 2.0 years) within nested proximity zones of the Watana Impoundment (den-related activies are not included).

TIME PERIOD	ZONE 1 (impoundment)	ZONE 2 (shore-1 mile)	ZONE 3 (1-5 miles)	ZONE 4 (over 5 miles)	TOTAL
1. April 1-30	6	1	8	9	24
2. May 1-15	12	8	19	69	108
3. May 16-31	31	27	65	108	231
4. June 1-15	70	67	154	89	380
5. June 16-30	45	35	104	69	253
6. July 1-15	6	8	39	37	90
7. July 16-31	4	14	61	42	121
8. August 1-15	4	11	41	44	100
9. August 16-March 31	26	22	97	168	313
TOTALS	204	193	588	635	1620
Area within zone (km^2)	159.32	327.07	1233.51	--	1720
%	9.26	19.02	71.72	--	100.0

Value of Chi-Square test of the null hypothesis that use of each zone is equivalent to expected values based on the area of each zone for:

Period	ZONE 1 obs.	ZONE 1 E(x)	ZONE 2 obs.	ZONE 2 E(x)	ZONE 3 obs.	ZONE 3 E(x)	X^2	d.f.
All months	204	91.2	193	187.4	588	706.4	160**	2
April 1-June 30	164	60.4	138	124.0	350	467.6	209**	2
July 1-March 31	40	30.8	55	63.3	238	238.8	3.9	2

* Reject null hypothesis, p less than 0.10.

** Reject null hypothesis, p less than 0.05.

Table 4. Number of observations of radio-marked male brown bears (older than 2.0 years) within nested proximity zones of the Watana Impoundment (den-related activies are not included).

TIME PERIOD	ZONE 1 (impoundment)	ZONE 2 (shore-1 mile)	ZONE 3 (1-5 miles)	ZONE 4 (over 5 miles)	TOTAL
1. April 1-30	4	0	3	3	10
2. May 1-15	6	3	7	15	31
3. May 16-31	9	13	23	24	69
4. June 1-15	15	27	55	30	127
5. June 16-30	16	12	25	21	74
6. July 1-15	2	3	9	10	24
7. July 16-31	3	3	16	10	32
8. August 1-15	1	2	8	11	22
9. August 16-March 31	8	6	20	60	94
TOTALS	64	69	166	184	483
Area within zone (km^2)	159.32	327.07	1233.51	--	1720
%	9.26	19.02	71.72	--	100.0

Value of Chi-Square test of the null hypothesis that use of each zone is equivalent to expected values based on the area of each zone for:

Period	ZONE 1 obs.	ZONE 1 E(x)	ZONE 2 obs.	ZONE 2 E(x)	ZONE 3 obs.	ZONE 3 E(x)	X^2	d.f.
All months	64	27.7	69	56.9	166	214.4	61.1**	2
April 1-June 30	50	20.2	55	41.5	113	156.4	60.4**	2
July 1-March 31	14	7.5	14	15.4	53	58.1	6.2**	2

* Reject null hypothesis, p less than 0.10.

** Reject null hypothesis, p less than 0.05.

Table 5. Number of observations of radio-marked female brown bears (older than 2.0 years) within nested proximity zones of the Watana Impoundment (den-related activies are not included).

TIME PERIOD	ZONE 1 (impoundment)	ZONE 2 (shore-1 mile)	ZONE 3 (1-5 miles)	ZONE 4 (over 5 miles)	TOTAL
1. April 1-30	2	1	5	6	14
2. May 1-15	6	5	13	42	66
3. May 16-31	22	14	26	67	129
4. June 1-15	53	27	81	47	208
5. June 16-30	24	24	62	36	146
6. July 1-15	4	4	23	20	51
7. July 16-31	1	9	37	22	69
8. August 1-15	3	7	25	26	61
9. August 16-March 31	21	14	55	86	176
TOTALS	136	105	327	352	920
Area within zone (km^2)	159.32	327.07	1233.51	--	1720
%	9.26	19.02	71.72	--	100.0

Value of Chi-Square test of the null hypothesis that use of each zone is equivalent to expected values based on the area of each zone for:

Period	ZONE 1 obs.	ZONE 1 E(x)	ZONE 2 obs.	ZONE 2 E(x)	ZONE 3 obs.	ZONE 3 E(x)	X^2	d.f.
All months	136	52.6	105	108.0	327	407.4	148**	2
April 1-June 30	107	33.8	71	69.4	187	261.8	180**	2
July 1-March 31	29	18.8	34	38.6	140	145.6	6.3**	2

* Reject null hypothesis, p less than 0.10.

** Reject null hypothesis, p less than 0.05.

Table 6. Number of observations of radio-marked female brown bears with coy (on 15 June) within nested proximity zones of the Watana Impoundment (den-related activies are not included).

TIME PERIOD	ZONE 1 (impoundment)	ZONE 2 (shore-1 mile)	ZONE 3 (1-5 miles)	ZONE 4 (over 5 miles)	TOTAL
1. April 1-30	0	0	0	1	1
2. May 1-15	0	0	1	12	13
3. May 16-31	0	0	16	17	33
4. June 1-15	2	13	18	13	46
5. June 16-30	5	9	17	12	43
6. July 1-15	0	1	7	7	15
7. July 16-31	0	2	8	11	21
8. August 1-15	0	2	8	7	17
9. August 16-March 31	1	2	22	26	51
TOTALS	8	29	97	106	240
Area within zone (km^2)	159.32	327.07	1233.51	--	1720
%	9.26	19.02	71.72	--	100.0

Value of Chi-Square test of the null hypothesis that the use of each zone is equivalent to expected values based on the area of each zone for:

Period	ZONE 1 obs.	ZONE 1 E(x)	ZONE 2 obs.	ZONE 2 E(x)	ZONE 3 obs.	ZONE 3 E(x)	X^2	d.f.
All months	8	12.5	29	25.5	97	96.0	2.1	2
April 1-June 30	7	7.5	22	15.4	52	58.1	3.5	2
July 1-March 31	1	4.9	7	10.1	45	38.0	3.0	2

* Reject null hypothesis, p less than 0.10.

** Reject null hypothesis, p less than 0.05.

Table 7. Chi-square test of null hypothesis that the proportion of observations in impoundment proximity zones is the same, for a group of radio-marked female brown bears, during years when they have cubs-of-the-year ("coy") as during years when they do not. (Includes both impoundments, lumps years 1980-1984, cub status is on 15 June, and observation associated with den-related activities are not included).

	Females without coy		Females with coy	
	No. of observations	%	No. of observations	Expected number of observations*
Proximity Zone 1 (inundation area)	59	18.7	8	30.1
Proximity Zone 2 (impoundment shore-line - 1 mile)	58	18.4	32	29.4
Proximity Zone 3 (1-5 miles from impoundment shore-line)	198	62.9	120	100.6
Totals:	315	100%	160	160.1

Chi Square, 2 d.f =20.2*
* significant, P less than 0.01

BEARS INCLUDED:

Bear ID	years without coy	years with coy
283	80, 82, 83, 84	81
299	80, 81, 82, 84	83
312	80, 82, 83	81, 84
313	80, 81, 83, 84	82
335	81, 82, 83	84
337	82, 83	81, 84
340	81, 82, 83	84
341	81	82
344	82	81, 83
384	83	84

Table 8. Number of observed and expected observations of radio-marked brown bears (excluding females with coy and bears less than 2.0 years old) within nested impoundment proximity zones of the Devils Canyon Impoundment (den-related activities are not included).

TIME PERIOD	ZONE 1 (impoundment)	ZONE 2 (shore-1 mile)	ZONE 3 (1-5 miles)	ZONE 4 (over 5 miles)	TOTAL
All males	4	17	38	107	166
All females	10	76	165	174	425
All females without cubs-of-year	10	76	161	158	405
TOTALS					
Area within zone (km^2)	28.92	164.78	689.01	--	882.71
%	3.28	18.67	78.06	--	100.0

Value of Chi-Square test of the null hypothesis that the use of each zone is equivalent to expected values based on the area of each zone for:

Sex group	ZONE 1 obs.	ZONE 1 E(x)	ZONE 2 obs.	ZONE 2 E(x)	ZONE 3 obs.	ZONE 3 E(x)	X^2	d.f.
Males and females w/o cubs (whole year)	14	10.0	93	57.1	199	238.9	30.8**	2
Males (whole year)	4	1.9	17	11.0	38	46.1	3.0	2
Females w/o cubs	10	8.1	76	46.1	161	192.8	25.1**	2

* Reject null hypothesis, p less than 0.10.

** Reject null hypothesis, p less than 0.05.

Table 9. Number of brown bear point locations in each of 4 impoundment proximity zones from 1 April-15 June. All years lumped and both impoundments lumped, subadult dispersers and bears from downstream study area are not included.

Bear ID	Sex	Zone 1	Zone 2	Zone 3	Zone 4	All Zones
279	M	1	1	8	26	36
280	M	13	8	23	7	51
282	M	1	2	13	4	20
293	M	1	0	1	7	9
294	M	1	3	1	1	6
382	M	11	12	3	5	31
399	M	2	4	15	11	32
400	M	0	1	14	13	28
422	M	0	11	13	1	25
All Males		30	42	91	75	238
%		12.6	17.6	38.2	31.5	100
281	F	25	12	21	9	67
283	F	1	5	17	30	53
299	F	29	5	8	9	51
312	F	1	2	5	18	26
313	F	2	9	0	43	54
315	F	0	5	6	0	11
331	F	1	2	2	6	11
334	F	0	0	10	11	21
335	F	0	0	12	32	44
337	F	0	0	1	27	28
340	F	9	19	28	10	66
341	F	7	5	6	0	18
344	F	0	2	9	8	19
379	F	0	0	0	9	9
381	F	5	8	15	4	32
384	F	0	1	1	5	7
385	F	0	0	0	14	14
388	F	0	0	12	17	29
394	F	2	6	7	0	15
395	F	2	0	3	1	6
396	F	0	1	9	1	11
420	F	0	18	11	0	29
423	F	0	0	5	0	5
425	F	2	4	7	0	13
308	F	2	5	4	0	11
All Females		88	109	199	254	650
%		13.5	16.8	30.6	39.1	100
ALL BEARS		118	151	290	329	888
%		13.3	17.0	32.7	37.0	100

Table 10. Number of Susitna river crossings by radio-marked brown bears, 1980-1984. Includes only years with >5 observations.

Bear ID	Yr. initial capture (age)	No. of river crossings (No. of observations***)					All years	Comments
		1980	1981	1982	1983	1984		
Males								
389	1983(2)	-	-	-	1(16)	-	1(16)	388's cub, died fall '83
390	1983(2)	-	-	-	0(10)	-	0(10)	388's cub, missing 5/84
391	1983(2)	-	-	-	1(14)	-	1(14)	384's cub
392	1983(2)	-	-	-	0(14)	-	0(14)	384's cub
393	1983(2)	-	-	-	4(14)	-	4(14)	384's cub, missing **
293	1980(3)	2(8)	0(11)	1(12)	2(10)	-	5(41)	wide-ranging
214	1980(4)	0(11)	-	-	-	-	0(11)	shed collar in '80
399	1983(4)	-	-	-	4(18)	2(52)	6(70)	active
280	1980(5)	2(9)	10(23)	3(15)	8(15)	5(42)	28(104)	active, missing 10/84
282	1982(6)	-	-	6(15)	4(18)	6(47)	16(80)	active
279	1980(9)	-	-	-	3(19)	4(39)	7(58)	shot (hunter) 9/84
373	1982(9)	-	-	3(11)	-	-	3(11)	shed collar
294	1980(10)	1(13)	0(8)	-	-	-	1(21)	recapture mortality
400	1983(20)	-	-	-	1(13)	6(41)	7(54)	active
342A@	1981(2)	-	1(7)	0(15)	2(13)	-	3(35)	capture mortality 7/84
382	1983(1)	-	-	-	-	6(58)	6(58)	active
422	1984(A)	-	-	-	-	10(47)	10(47)	active
Total males		5(41)	11(49)	13(68)	30(174)	39(326)	98(658)	

(continued)

Table 10. (cont'd)

Bear ID	Yr. initial capture (age)	No. of river crossings (No. of observations***) 1980	1981	1982	1983	1984	All years	Comments
Females								
315	1980(2)	-	-	-	4(17)	2(22)	6(39)	radio-collared in 1983, active
385	1983(2)	-	-	-	0(15)	0(17)	0(32)	337's cub, missing 10/84
386	1983(2)	-	-	-	0(12)	-	0(12)	shot (hunter) 5/84
281	1980(3)	1(12)	6(39)	5(20)	6_{*2}(17)	6_{*2}(54)	24(142)	cubs killed by other bears (83 & 84)
335	1981(3)	-	0(32)	0(17)	0(17)	0_{*2}(34)	0(100)	334's cub, active
340	1981(3)	-	6(38)	8(19)	4(16)	2_{*2}(57)	20(130)	active
381	1982(3)	-	-	4(15)	1(17)	8(41)	13(73)	active
395	1983(3)	-	-	-	1(11)	-	1(11)	shot (hunter) '83
308B	1980(5)	5(14)	7(13)	-	-	-	12(27)	recapture mortality
344	1981(5)	-	0_{*2}(18)	0_{y2}(19)	0_{*2}(15)	0_{y1}(12)	0(64)	active, missing 9/84
331	1981(6)	-	4_{+2}(23)	3(9)	-	-	7(32)	died July 1982
341	1981(6)	-	9(25)	0_{*2}(7)	-	-	9(32)	missing 1982 **
394	1983(6)	-	-	-	10(19)	3(24)	13(43)	lost cub as capture mortality?, shot (hunter) 9/84
313	1980(9)	0(13)	0(23)	0_{*2}(18)	2_{y1}(18)	0(59)	2(131)	active, missing 10/84
277	1980(10)	0_{y2}(5)	-	-	-	-	0(5)	collar shed in 1980
312	1980(10)	0(12)	0_{*2}(22)	0_{y1}(18)	0_{+1}(14)	-	0(66)	capture mortality
334	1981(10)	-	0_{+1}(31)	-	-	-	0(31)	missing 1982 **
283	1980(12)	0_{+2}(10)	0_{*2}(18)	4(17)	2(18)	2(59)	8(122)	1983 cub killed by another bear
384	1983(12)	-	-	-	0_{*2-3}(15)	0_{*2}(8)	0(23)	active, missing 9/84
299	1980(13)	2_{y2}(9)	2(22)	2(19)	0_{*3}(20)	6_{y3}(58)	12(128)	active
337	1981(13)	-	0_{*3}(17)	0_{y2}(18)	0(17)	0_{*2}(24)	0(76)	active
396	1983(13)	-	-	-	0_{*1}(15)	0(21)	0(36)	

(continued)

Table 10. (cont'd)

Bear ID	Yr. initial capture (age)	No. of river crossings (No. of observations***) 1980	1981	1982	1983	1984	All years	Comments
388	1983(14)	-	-	-	0_{+2}(15)	0_{*2}(45)	0(60)	active
380	1982(15)	-	-	0_{y2}(8)	0(11)	-	0(19)	shot
407 @	1983(4)	-	-	-	0(16)	0(17)	0(33)	active
379 @	1982(5)	-	-	1_{*2}(18)	5_{y1}(17)	4_{+1}(11)	10(46)	active
403 @	1983(6)	-	-	-	1_{*2}(18)	6_{y1}(16)	7(34)	active
420	1984(19)	-	-	-		6_{y2}(60)	6(60)	active
423	1984(A)	-	-	-		2_{*4}(23)	2(23)	active
425	1984(A)					0(38)	0(38)	active
Total females		8(75)	34(321)	27(222)	36(350)	47(700)	152(1,668)	
Total both sexes		13(116)	45(370)	40(290)	66(524)	86(1,026)	250(2,326)	

@ = Downstream bears

Reprod. status as of 31 May: * = cub

y = yrlg

+ = 2 yr old

** possible unreported hunter kill, collar failure, or emigration.
*** excludes observations at den sites.

Table 11. Annual use of Prairie Ck. area by radio-collared brown bears during July and August king salmon spawning period (1980-1985). Reproductive status reflects July data for females (c=newborn cubs).

Males (age in year first captured)	1980	1981**	1982	1983	1984***	1985****
214 @ 4(80)	no	shed	-	-	-	no
279 @ 9(80)	ND(shed)	ND	ND	yes	yes	dead
280 @ 5(80)	no	no	no	no	no	no collar
282 @ 4(80)	-	-	yes	yes	yes	yes
293 @ 3(80)	yes	yes	yes	no	(shed)	-
294 @ 10(80)	yes	yes	-(dead)	-	-	-
342a*@ 2(81)	-	no	no	no	yes (dead)	-
373 @ 9(82)	-	-	yes	ND(shed)	-	-
382 @ 2(84)	-	-	-	-	-	yes
386 @ 2(83)	-	-	-	no	dead	-
389 @ 2(83)	-	-	-	no	dead	-
390 @ 2(83)	-	-	-	no	missing	-
391 @ 2(83)	-	-	-	no	dead	-
392 @ 2(83)	-	-	-	no	dead	-
399 @ 9(83)	-	-	-	yes	yes	missing
400 @ 20(83)	-	-	-	no	no	missing
422 @ A(84)	-	-	-	-	yes	dead
427 @ A(85)	-	-	-	-	-	yes
Subtotals for MALES:						
No. using Prairie Ck. (males)	2	2	3	3	4	3
Total No. of collared males	4	4	5	12	8	4
No. collared males excluding subadult dispersers	4	3	4	7	8	4
Subadult dispersers out of study area (Bear ID)	-	342a	342a	342a, 386, 389, 391, 392	-	-
% males using Prairie Ck. (excludes dispersers)	50	67	75	43	50	75

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Table 11. (cont.)

Females (age in year first captured)	1980	1981**	1982	1983	1984***	1985****
273 @ 9(85)	-	-	-	-	-	no, alone
277 @ 10(80)	no?	ND-(shed)	ND	ND	ND	ND
281 @ 3(80)	no, alone	no, alone	no, alone	no, alone	no, alone	no w/2c
283 @ 12(80)	yes, alone	no, w/2c	yes, alone	yes, alone	yes, alon	yes, w/2c
299 @ 13(80)	no, w/2@1	no, alone	no, alone	no, w/3c	no, w/3@1	missing
308b @ 5(80)	yes, alone	no?, alone	-dead	-	-	-
312 @ 10(80)	no, alone	no, w/1c	no, w/1@1	no, alone	dead	-
313 @ 9(80)	no, alone	no, alone	no, w/2c	no, w/1@1	no, alone	missing
314 @ 7(85)	-	-	-	-	-	no, alone
315 @ 2(80)	-	-	-	yes, alone	yes, alone	missing
331 @ 6(81)	-	no, alone	-dead	-	-	-
334 @ 10(81)	-	no, alone	-missing	-	-	-
335 @ 2(81)	-	no, alone	no, alone	no, alone	no, w/2c	no, w/2@1
337 @ 13(81)	-	no, w/3c	no, w/1@1	no, alone	no, w/2c	no, w/2@1
340 @ 3(81)	-	no, alone	no, alone	no, alone	no, w/2c	no, w/2@1
341 @ 6(81)	-	no, alone	no, w/2c	-missing	-	no, alone
344 @ 5(81)	-	no, w/2c	no, w1@1	no, alone	no, alone	missing
379* @ 5(82)	-	-	no, w/2c*	no, w/2@1*	no, alone?*	no, alone*
380 @ 15(82)	-	-	yes, w/2@1	yes, alone	dead	-
381 @ 3(82)	-	-	no, alone	no, alone	no, alone	no, w/2c
384 @ 12(83)	-	-	-	-	no, w/2c	missing
385 @ 2(83)	-	-	-	no, alone	no, alone	no collar
388 @ 14(83)	-	-	-	no, alone	no, alone	no, w/2c
393 @ 2(83)	-	-	-	no, alone	dead	-
394 @ 6(83)	-	-	-	yes, alone	yes - dead	-
395 @ 3(83)	-	-	-	no, alone	dead	-
396 @ 13(83)	-	-	-	yes, alone	yes, alone	yes, alone
397 @ 4	-	-	-	-	-	yes, alone
398 @ 4	-	-	-	-	-	yes, alone
403* @ 6(83)	-	-	-	no, w/2c*	no, w/1@1?*	no, alone
407* @ 4(83)	-	-	-	yes, alone*	yes, alone*	yes, alone
420 @ 19(84)	-	-	-	-	yes, w/2@1	yes, alone
423 @ A(84)	-	-	-	-	yes, w/3c	yes, w/3/@1
425 @ A(84)	-	-	-	-	no, alone	no, w/2c
437 @ 2 (85)	-	-	-	-	-	no, alone
447 @ A (85)	-	-	-	-	-	no, alone

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Table 11. (cont.)

Females (age in year first captured)	1980	1981**	1982	1983	1984***	1985****
Subtotals for FEMALES No. using Prairie Ck. (females)	2	0	2	6	7	7
Total No. of collared females	7	13	13	22	21	21
% females using Prairie Ck.	29	0	15	27	33	33
TOTALS:						
No. bears using Prairie Ck.	4	2	5	9	11	10
No. bears radio-collared (excluding dispersing males)	11	16	17	29	29	25
% bears using Prairie Ck.	36	13**	29	31	38	40

* Bear occurs in the downstream study area
** Poor monitoring conditions in 1981
*** Intensively monitored in 1984
**** No routine monitoring, monitored only on 7/23-27 and 8/6 because of study termination

Table 12. Results of brown bear census on Prairie Creek in 1984. Flights started at 0800 hrs. and pilot Al Lee flew the plane. Bear IDs are given in parentheses. Includes only bears older than 2.0.

Date of flight	7/29	8/1
Minutes spent on survey	82	94
Number of adult unmarked brown bears seen	14	17
Number of marked bears seen (M_2)	1 (399)	2 (399, 407)
Number of marked bears present but not seen	4 (407, 282, 394, 420)	2 (420, 394)
Number of marked bears in the general areas but outside of search pattern	3 (315, 423, 396)	5 (282, 315, 423, 396, 283)
	(95% CI)	(95% CI)

N_1 (# of marks present) =	5		4	
N_2 (# of bears seen) =	15		19	
M_2 (# of marks seen) =	1		2	
$\frac{(N_1+1)(N_2+1)}{(M_2+1)}$ = N =	48	(12-180)	33	(10-62)

Table 13. Brown bear census on Prairie Creek, July-August 1985.

Parameter	7/23/85 PM	7/24/85 AM	7/24/85 PM	7/25/85 AM	7/25/85 PM	7/26/85 AM	7/26/85 PM	7/27/85 AM	8/6/85* PM
Time start	1945	0752	1945	0755	2010	0753	2014	0755	1948
Time end	2108	0933	2145	1000	2148	0926	2155	0923	2144
Total minutes searching (additional minutes spent radio tracking)	83 (27)	101 (37)	120 (5)	125 (21)	98 (17)	93 (24)	101 (35)	88 (33)	116 (23)
Number of black bears seen	1	0	1	1	0	1	1	1	0
A) Unmarked brown bears (≧2.0) spotted during search	4	5	16	16	12	8	17	9	11
B) Additional unmarked brown bears (≧2.0) spotted in search area during tracking	3	0	0	0	2	2	3	0	0
C) Total unmarked brown bears (≧2.0) verified as present (A+B)	7	5	16	16	14	10	20	9	11
D) No. of cubs w/bears in C (# litters)	0	2(1)	7(4)	6(3)	4(3)	2(2)	2(1)	0	3(2)
E) No. of ylgs. w/bears in C (# litters)	2	2(2)	3(1)	4(3)	2(1)	0	4(2)	3(2)	1(1)
F) Total unmarked bears verified as percent (C+D+E)	9	9	26	26	20	12	26	12	15
G) IDs of marked bears spotted (No. = "M_2")	282 =1	0	420,398 =2	398,420, 396 =3	420 =1	420 =1	0	398 =1	407, 423 (w/3@1)=5
H) Total no. of bears spotted (F+G = "N_2")	10	9	28	29	21	13	26	13	20
I) IDs of marked bears that were present in the search area that were not spotted during the search	420,398, 396=3	420,398, 396,282 =4	396,282 =2	282 =1	398,396, 282 =3	398,396, 282 =3	398,420 282 =3	420,396, 282 =3	382,398,397, 427,282,420, 396,and 283 (w/2c)=10
J) Total no. of marked bears present in search area (none of these had cubs or ylgs.) (G+I = N_1)	4	4	4	4	4	4	3	4	15(5@c)
K) IDs of marked bears present in general area but not in search area	397	382,397	382,397	397	397	397,382?	396,397, 382	382	
$N_1=(N_2+1)(C+1)/(M_2+1)$	28	-	48	38	55	35	-	35	56

* Flight on 8/6/85 was in a 180 w/3 observers and area was incompletely covered.

Table 14. Estimated average number of brown bears using Prairie Creek during the salmon run in 1985 based on bear-days estimator.

Date	n_1	m_2	n_2	Cum. n_1	Cum. m_2	Cum. n_2	N*= No.	Est. bears	95% CI = +/- bears
7/23pm	4	1	10	4	1	10		26.50	21.80
7/24am	4	0	9	8	1	19		44.50	42.60
7/24pm	4	2	28	12	3	47		51.67	36.31
7/25am	4	3	29	16	6	76		46.50	23.69
7/25pm	4	1	21	20	7	97		51.25	25.34
7/26am	4	1	13	24	8	110		51.22	24.43
7/26pm	3	0	26	27	8	136		60.75	30.05
7/27am	4	1	13	31	9	149		59.88	28.40
8/06am	15	5	20	46	14	169		59.07	22.85

Table 15. Summary of Nelchina Basin brown bear litter size data for cubs-of-the-year (based on spring observations of radio-collared bears).

BEAR ID (year-age)	LITTER SIZE (COY) (year)	COMMENTS	USABLE SUMMARY
207 (1978, 11)	3 (1978)	When last seen on 10/7/78 had all 3 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
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
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
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
283 (1981, 13)	2 (1981)	Weaned 2@2 in 1980, lost 1 cub by 9/1 other lost as ylg	1 of 2 lost

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Table 15. (cont'd)

BEAR ID (year-age)	LITTER SIZE (COY) (year)	COMMENTS	USABLE SUMMARY
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
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
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
341 (1981, 6)	2 (1982)	Survived until 7/15/82 when bear was lost	none
341 (1986, 11)	1 (1986)	Survived to August at least	--
299 (1980, 13)	1 (1982)	Bear weaned 2@2 in 1981, cub lost by 6/9/62	1 of 1 lost
299 (1983, 16)	3 (1983)	All cubs collared, alive to den exit	0 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

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Table 15. (cont'd)

BEAR ID (year-age)	LITTER SIZE (COY) (year)	COMMENTS	USABLE SUMMARY
281 (1985, 8)	2 (1985)	Lost 1 in June, other survived	1 of 2 lost
394 (1983, 6)	1 (1983)	Lost (capture related?) by 5/16, bred	1 of 1 lost (capture related?)
403 (1983, 6)	2 (1983)	Lost 1 in Sept., other ok to den exit	1 of 2 lost
403 (1986, 9)	2 (1986)	--	--
384 (1984, 13)	2 (1984)	Survived to September at least	0 of 2 lost
396 (1984, 14)	1 (1984)	Lost in May	1 of 1 lost
335 (1984, 6)	2 (1984)	Both survived to den exit	0 of 2 lost
340 (1984, 6)	2 (1984)	Both survived to den exit, collared cubs	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
423 (1984, 21)	4 (1984)	One died in July (collared), others ok to den exit	1 of 4 lost
381 (1985, 6)	2 (1985)	Survived to exit	0 of 2 lost
396 (1985, 16)	2 (1985)	Lost in June	2 of 2 lost
425 (1985, A)	2 (1985)	Survived	0 of 2 lost
447 (1986, 8)	2 (1986)	--	--
420 (1986, A)	2 (1986)	--	--

Summary

No. of cubs	No. of litters	mean litter size (range)	
78	38	2.1 (1-4)	22 of 59 cubs lost in first year of life = 37.3% (2 of these possibly capture-related)

Table 16. Summary of Nelchina Basin brown bear litter size data for litters of yearlings (based on spring observation of radio-collared bears).

BEAR ID (year-age)	LITTER SIZE (ylgs.) (year)	COMMENTS	SUMMARY
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
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
274 (1979, 11)	1 (1979)	Transplanted, no radio	none
207 (1978, 11)	1 (1979)	Survived until 9/12/79	0 of 1 lost
231 (1978,12)	1 (1979)	Survived until 8/79	none

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Table 16. (cont'd)

BEAR ID (year-age)	LITTER SIZE (ylgs.) (year)	COMMENTS	SUMMARY
213 (1978, 10)	1 (1978)	Apparent ylg. was not captured, had cubs following year	1 of 1 lost (capture related?)
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
299 (1980, 13)	2 (1980)	Both survived, weaned next year	0 of 2 lost
299 (1984, 17)	3 (1984)	Survived with internals to exit from den	0 of 3 lost
312 (1982, 12)	1 (1982)	Survived, weaned next year	0 of 1 lost
281 (1986, 9)	1 (1986)	--	--
283 (1982, 14)	1 (1982)	Lost by 5/18/82	1 of 1 lost
283 (1986, 18)	2 (1986)	--	--
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
380 (1982, 15)	2 (1982)	Both survived to den entrance, at least 1 exited den and was weaned	0 of 2 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
313 (1983, 12)	2 (1983)	Lost 1 (surgery related?) by 6/2/83, other survived thru October	0 of 1 lost
379 (1983, 6)	2 (1983)	Lost 1 in June-September period	1 of 2 lost
420 (1984, 19)	2 (1984)	Survived to den exit	0 of 2 lost

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Table 16. (cont'd)

BEAR ID (year-age)	LITTER SIZE (ylgs.) (year)	COMMENTS	SUMMARY
314 (1985, 7)	1 (1985)	Survived to den exit	0 of 1 lost
335 (1985, 7)	2 (1985)	1 lost in June, other survived to exit	1 of 2 lost
340 (1985, 7)	2 (1985)	Survived to October at least	0 of 2 lost (?)
381 (1986, 7)	2 (1986)	--	--
388 (1986, 17)	2 (1986)	--	--
403 (1984, 7)	1 (1984)	Survived thru November at least	0 of 1 lost
423 (1985, 22)	3 (1985)	All survived to den exit	0 of 3 lost
425 (1986, A)	2 (1986)	--	--

Summary

No. of yearlings	No. litters	mean litter size (range)	
62	36	1.7 (1-3)	8 of 37 lost = 21.6% (1 loss possibly capture-related)

Table 17. Summary of Nelchina Basin brown 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
283 (1980, 12)	2 (1980)	weaned in mid-June, bred, new litter next year
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
220 (1978, 5)	1 (1979)	weaned by 6/17, bred
221 (1978, 8)	2 (1979)	--
269 (1979, 16)	2? (1980)	--
299 (1980, 13)	2 (1981)	weaned in 5/81, new litter in 1982
337 (1983, 15)	1 (1983)	weaned by 5/15, bred
337 (1986, 18)	2 (1986)	still with mother on 9/24/86
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
396 (1983, 13)	2 (1983)	weaned by 6/1, bred
331 (1981, 6)	2 (1981)	weaned by 6/15, bred, no cubs in 1982, died in 1982 (reason?)
379 (1984, 7)	1 (1984)	apparently weaned cub (time?), bred
314 (1986, 8)	1 (1986)	bear lost in May '86
420 (1985, 20)	2 (1985)	weaned in May
423 (1985, 23)	3 (1986)	3 @ 2 in June 1986

Summary

No. of 2-year-olds	No. of litters	Mean litter size (range)
34	20	1.7 (1-3)

Table 18. Brown bear offspring survivorship and weaning, GMU 13 studies, (excludes bears transplanted in 1979).

	MOTHER'S ID (age in year when first captured)				
Year	G207 (11 in 1978)	G220 (5 in 1978)	G221 (8 in 1978)	G204 (7 in 1978)	G321 (12 in 1978)
1978	3 cubs, April-Oct.	1 ylg., May-Oct. in June and bred	2 ylgs., May-Oct.	2 @ 2 in May, weaned	bred
1979	1 ylg., May-Sept. 2 ylgs., lost in 78/79 den?	1 @ 2, weaned in June	2 @ 2 weaned	no data in May, radio failure	2 of 3 cubs lost in June, 1 survived April-Sept.
1980	no data	no data	no data	no data	no data

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Table 18. (cont'd)

Year	MOTHER'S ID (age in year when first captured) G277 (10 in 1980)	G312 (10 in 1980)	G299 (13 in 1980)	G313 (9 in 1980)	G283 (13 in 1980)	G281 (3 in 1980)
1980	2 @ 1 survived April thru August, collar shed in den	weaned 1 @ 2 in May, breeding not observed	2 of 2 ylgs. survived May-Oct.	weaned 1 @ 2 in May, bred	weaned 2 @ 2 in June, bred	not estrous
1981	no data	1 of 2 cubs lost in June, other survived May-Oct.	weaned 2 @ 2 in May and bred	1 @ 0 lost in May (capture related?)	1 of 2 cubs lost in Aug., other survived	estrous, bred
1982	no data	yearling survived	lost 1 of 1 @ 0 in June	2 @ 0 survived	lost 1 @ 1 in May, bred	alone, bred
1983	no data	weaned 1 @ 2 in June, bred, off-spring = G385, transmitted	3 @ 0 survived (w/collars)	1 @ 1 lost in June (trans-mitted inter-nally), sibling survived	lost 1 @ 0 in May, bred, lost cub had transmitter	2 @ 0 lost in May (bear predation), not seen breeding
1984	no data	w/2 @ 0-bear killed in May	3 @ 1 survived (w/internals)	1 @ 2 weaned in May, shot	alone, bred	2 @ 0 lost in May, bred
1985	no data ±	--	weaned 2-yr-olds collar failed?	--	2 @ 0, survived	2 @ 0, 1 lost in June, other survived
1986 (to Sept.)	no data	--	--	--	2 @ 1, survived	1 @ 1, survived

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Table 18. (cont'd)

	MOTHER'S ID (age in year when first captured)						
Year	G331 (6 in 1981)	G334 (10 in 1981)	G341 (6 in 1981)	G337 (13 in 1981)	G344 (5 in 1981)	G335 (3 in 1981)	G340 (3 in 1981)
1981	2 @ 2 weaned in May, bred	weaned 1 @ 2 in May, bred, bear missing since Sept.	alone, bred in May	lost 1 @ 0 in winter den, 2 survived	2 @ 0 survived	weaned from mother	alone
1982	no cubs, bred, died in July (reason?)	no data	had 2 @ 0 thru July, bear missing subsequently	lost 1 @ 1 in June, other survived	lost 1 @ 1 in May, lost other in early July	alone, bred	alone
1983	--	no data	no data	weaned 1 @ 2 in May, bred	2 @ 0, lost 1 by late June, other survived	alone, bred	alone,
1984	--	no data	no data	w/2 @ 0, collared, both survived	1 @ 1 lost in May, bear lost in July	w/2 @ 0 thru Oct.	w/2 @ 0, survived
1985	--	no data	alone	w/2 @ 1, survived	--	2 @ 1, lost in June	2 @ 1 survived to den entrance
1986 (to Sept.)	--	no data	w/1 @ 0	w/2 @ 2 thru Sept.	--	1 @ 2 weaned	alone, assume weaned young

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Table 18. (cont'd)

	MOTHER'S ID (age in year when first captured)					
Year	G380 (15 in 1982)	G394 (6 in 1983)	G384 (12 in 1983)	G379 (5 in 1982)	G388(14 in 1983)	G381 (3 in 1982)
1982	2 @ 1 survived until denning, one may have died in den	no data	no data	2 @ 0 survived	no data	alone
1983	at least 1 @ 2 weaned in May, possibly both shot in Sept.	lost 1 @ 0 in May (?capture-related possible?), bred	weaned 2 or 3 @ 2 in June, bred	1 of 2 survived, lost 2 (June - Sept.)	weaned 2 @ 2,	alone, bred
1984	--	alone, shot	w/2 @ 0 thru Sept., missing	probably weaned 1 @ 2 after May 23	w/2 @ 0, capture-related cub loss, bred	alone, bred
1985	--	--	--	alone, shot	w/2 @ 0, survived	w/2 c, survived
1986 (to Sept.)	--	--	--	--	w/2 @ 1, survived	w/2 @ 1, survived

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Table 18. (cont'd)

	MOTHER'S ID (age in year when first captured)							
Year	G396 (13 in 1983)	G403 (6 in 1983)	G407 (4 in 1983)	G420 (19 in 1984)	G423 (20 in 1984)	G425 (A in 1984)	273 (3 in 1979)	314 (7 in 1985
1983	weaned 2 @ 2 in May, bred	2 @ 0 thru Aug. lost 1 in Sept.	alone	no data	no data	no data	--	--
1984	lost litter of 1 @ 0 in May, breeding?	w/1 @1, lost after April	alone	w/2 @ 1, survived	4 @ 0, one lost in July, others survived to Oct.	alone, bred	--	--
1985	2 @ 0 lost in June	w/3 @ 0	alone	weaned 2 in May	3 @ 1 survived	w/2 cubs, survived	alone	1 @ 1 survived
1986 (to Sept.)	alone, bred	--	alone	w/2 @ 0, both lost in June	3 @ 2 weaned in May	w/2 @ 1, lost in June-July	alone	1 @ 2 weaned in May-June

Table 19. Summary of known losses from brown bear litters of cubs and yearlings. Losses dated from emergence in year indicated to emergence the following year. IDs of females included are indicated in parentheses.

Year of emergence	Losses of cubs	Losses of yearlings
1978	2 of 3 lost (G207)	0 of 3 lost (G221, G220)
1979	2 of 3 lost (231#)	0 of 1 lost (G207##)
1980	no data	0 of 4 lost (G299, G277*)
1981	4** of 10 lost (G312, G313, G283, G337, G344)	no data
1982	1*** of 5 lost (G299, G313, G379)	4 of 8 lost (G312, G283, G337, G344, G380****)
1983	6' of 11 lost (G283, G344, G299, G281, G394, G403)	2 of 4 lost (G379, G313")
1984	4 of 15 lost (281, 337, 335, 340, 384###, 396, 423)	1 of 7 lost (299, 344, 403,''', and 420)
1985	3 of 12 lost (283, 281, 381, 396 425, 388)	1 of 10 lost (314, 335, 340,''', 423, 337)
1986 (incomplete data, to 5 Sept.)	2 of 8 lost (341, 447, 420, 403 (upper Susinta study not included)	2 of 9 lost (281, 381, 388, 283, 425)
TOTALS:	24 of 67 lost = 36%	10 of 46 lost = 22%
Excluding possible capture-related deaths and incomplete data:	18 of 50 lost = 36%	7 of 29 lost = 24%

Last observation on 8/3/79.

Last observation on 9/12/79.

Last observation on 9/6/84.

* G277 shed collar in den so family status in spring 1981 was not determined, assumed 2 offspring were alive at emergence in 1981.

** One lost cub may have been capture-related (from litter of 1 with G313).

*** From litter of one with G299 (bears not handled).

**** G380 had 2 yearlings thru den entrance in 1982, only one was verified with her in spring 1983, but both were counted as surviving.

' One lost cub may have been capture-related (from litter of 1 with G394).

'' One of G313's yearlings died within 1 month of surgery to install internal transmitter (other survived), assumed this death was not surgery-related.

''' Last observation in October.

Table 20. Morphometrics of brown bear cubs-of-the-year handled in GMU 13, 1978-1986.

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	G394	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	over 10.0	neck=225mm, collared
419	G299	18 May 1983 (den)	M	over 10.0	neck=245mm, collared
417	G299	18 May 1983 (den)	M	over 10.0	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 = 220
009	G337	17 May 1984	F	11.5	collared, neck = 230
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

Totals: 17 males and 14 females

Table 21. Morphometrics of brown bear yearlings handled in GMU 13, 1978-1986.

YLG 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
G239	G240	23 May 1979	F	65	Ballard 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 Sep. 86
G463	G462	5 June 1986	M	90(est.)	ear tagged

Totals: 16 males and 8 females

Table 22. Summary of reproductive intervals for brown bears by bear ID. Based on data in Table 18, this report. Year of litter and reason for intervals >2 years are indicated in parentheses- "lost" means lost complete litter.

IDS OF BEARS WITH COMPLETE INTERVALS OF:

3 YEARS		4 YEARS	5 YEARS	6 YEARS
220(77)**	335(84)	313(82, 1 lost)	281(85, 2 lost)	283* (85, 1 lost @ age 1)
221(77)**	340(84)			
314(84)**	312(81)			
380(81)**	337a(81)			
420(83)**	337b(84)			
379(82)	388*(85)			
423(84)	381*(85)			

INCOMPLETE INTERVALS THAT WILL BE AT LEAST THE INDICATED LENGTH:

4 YEARS	5 YEARS	6 YEARS	7 YEARS
420 (87,lost 1)	403 (1 lost @ age 1) 425(87, skipped 1, and lost 1 @ age 1)	396 (87, lost 2 and skipped 1)	344 (85,lost 2 @ age 1)

* Will be a complete interval when 2-year-olds are weaned in 1987
** Litter was first observed when composed of 1-year-olds

SUMMARY:

AVERAGE REPRODUCTIVE INTERVAL	
COMPLETE INTERVALS ONLY (N = 17)	3.35
INCOMPLETE INTERVALS ONLY (N = 5)	5.4
COMPLETE AND INCOMPLETE (N = 22)	3.82

Table 23. Summary of age at first reproduction for Su-Hydro area brown bears by bear ID. Based on first observed litter, status in previous year is given in parentheses.

FIRST REPRODUCTION AT AGE:

4 YEARS	5 YEARS	6 YEARS		7 YEARS	8 YEARS
220**	379*	394*	281#	341**	407 (alone prev. 4 litter expt. in '87)
234**	344*	403*	335#		
240**	244**	261**	381#		
331***	204***	314**	340#		

Mean age based on long history (N = 5) =	6.4
Mean age based on backdated litters (N = 13) =	5.2
Combined data (N = 18) =	5.5

* Backdated based on 1st observation with newborn litter.
** Backdated based on 1st observation with litter of ylgs.
*** Backdated based on 1st observation with litter of 2-year-olds.
# Accurate value as no litter was observed in preceding 3 years.

Table 24. Brown bear harvest data in 3 GMU 13 study areas, 1962-85.

	Core 1979 Area *			Greater 1979 Area **			Su-Hydro Area ***		
Year	No. MM	No. FF	No. Sex Unkwn.	No. MM	No. FF	No. Sex Unkwn.	No. MM	No. FF	No. Sex Unkwn.
62	1	0	0	4	1	0	5	3	0
63	2	2	0	2	5	0	8	8	0
64	-	2	0	1	2	0	6	7	0
65	3	3	0	3	3	0	8	9	0
66	2	1	1	5	3	1	6	7	0
67	1	3	0	2	4	0	6	5	0
68	0	4	0	3	5	0	6	4	0
69	1	1	0	5	1	0	5	0	0
70	1	0	0	3	1	1	3	3	0
71	4	0	0	5	2	0	5	11	0
72	3	1	0	4	3	0	8	1	0
73	1	0	0	5	1	0	6	2	0
74	4	2	0	5	7	0	5	6	0
75	7	5	1	12	10	1	3	8	2
76	1	4	1	4	6	2	8	12	1
77	4	0	0	6	1	0	5	1	0
78	7	2	0	8	5	0	10	4	1
79	7	3	0	10	3	0	7	6	0
80	4	3	1	8	7	2	9	4	2
81	7	1	0	7	3	0	13	9	0
82	2	7	0	8	12	0	15	6	0
83	3	3	0	11	5	0	12	13	1
84	6	5	0	14	11	2	15	14	1
85	7	3	0	14	6	0	19	19	1
Total	78	55	4	149	107	9	193	162	9

* Includes Uniform Coding Areas 2500-2900 and 3100-3200 in 13E, 0500-0800 in 13B, plus dump codes for: Susitna R. 13B unknown, Susitna R. (N. of Forks 13B), Nenana R. 13E unknown, Denali Hwy. unknown 13E, Susitna R. (Butte Ck. to the Forks 13), Susitna R. (N. of Forks 13).

** Includes Uniform Coding Areas 2500-2900 and 3100-3200 in 13E, 0300-1300 and 1600 in 13B, plus above-listed dump codes and: Denali Hwy. unknown 13B, Denali Hwy. unknown 13.

*** Includes Uniform Coding Areas 1300-1400 and 1600-2500 in 13E, 1500-1800 and 2100 in 13A, 0100-0200 in 13B, and 0200-0300 in 14B, plus dump codes for: Susitna R. 13A unknown, Susitna R. Jay Ck-Butte Ck. 13A, Tyone R./Ck. 13A unknown, Susitna R. 13E unknown, Talkeetna R. 13E unknown, Kosina Ck. 13E unknown, Kosina Ck. 13 unknown, Susitna R. (Jay Ck.-Butte Ck., 13), Talkeetna R. 13 unknown, Talkeetna R. Unit 14B unknown.

Table 25. Status of brown bears first marked in 1978. (A=alive, T=transplanted in 1979, NR=no return, R=returned, ND=no data available, F=shot in fall season, Sp=shot in spring season).

Bear#	Sex/age	1978	1979	1980	1981	1982	1983	1984	1985	1986
Upper Susitna Expt. Area										
209	M/5 in '78	A	T,NR	A	Shot-F	-	-	-	-	-
212	F/10 in '78	A	A	A	A	Shot-F	-	-	-	-
217	M/3 in '78	A	A	Shot-F	-	-	-	-	-	-
219	F/4 in '78	A	A	A	A	Shot-F	-	-	-	-
218	M/4 in '78	A	T,R	Shot-F	-	-	-	-	-	-
214**	M/2 in '78	A	A	A	A	A	A	A	A	A
230	M/9 in '78	A	T,Shot-Sp	-	-	-	-	-	-	-
211	M/4 in '78	A	T,NR	ND	ND	ND	ND	ND	ND	ND
216	M/11 in '78	A	T,NR	ND	ND	ND	ND	ND	ND	ND
210/242	M/2 in '78	A	T,ND	ND	ND	ND	ND	ND	ND	ND
215	F/2 in '78	A	T,NR	ND	ND	ND	ND	ND	ND	ND
213	F/10 in '78	A	T*	-	-	-	-	-	-	-
Not Upper Susitna Expt. Area										
205	M/4 in '78	A	A	A	A	A	Shot-Sp	-	-	-
206	F/13 in '78	A	A	A	Shot-F	-	-	-	-	-
201	M/10 in '78	A	A	A	A	A	Shot-Sp	-	-	-
202	F/8 in '78	Shot-F	-	-	-	-	-	-	-	-
221	F/8 in '78	A	A	A	A	Shot-Sp	-	-	-	-
228	M/7 in '78	A	A	A	A	A	Shot-Sp	-	-	-
227	M/9 in '78	A	A	A	A	A	A	Shot-F	-	-
224	M/2 in '78	A	A	A	A	A	A	Shot-Sp	-	-
222	M/11 in '78	A	ND	ND	ND	ND	ND	ND	ND	Shot-sp
225	M/4 in '78	A	A	ND	ND	ND	ND	ND	ND	Shot-sp
207	F/11 in '78	A	A	ND	ND	ND	ND	ND	ND	ND
208	F/12 in '78	A	A	ND	ND	ND	ND	ND	ND	ND
220	F/5 in '78	A	A	ND	ND	ND	ND	ND	ND	ND
234	F/5 in '78	A	ND	ND	ND	ND	ND	ND	ND	ND
200	M/7 in '78	A	ND	ND	ND	ND	ND	ND	ND	ND
204	F/7 in '78	A	A	ND	ND	ND	ND	ND	ND	ND
231	F/12 in '78	A	A	ND	ND	ND	ND	ND	ND	ND
Max. no. Bears potentially alive in year includes ND (M:F)		29(16:13)	27*(16:11)	26(15:11)	24(13:11)	22(12:10)	19(11:8)	16(8:8)	14(6:8)	14(6:8)
No. marked bears known shot in year (M:F)		1(0:1)	1(1:0)	2(2:0)	2(1:1)	3(1:2)	3(3:0	2(2:0)	0	2(2:0)
% of potentially alive bears known shot in year		3%	4%	8%	8%	14%	16%	13%	0	14%
Cumulative % (min.) of marked bears shot (N=28)		3%	7%	14%	21%	32%	43%	50%	50%	57%

Not included:
Subadults @2 in 1978, = 203, 223 (all ND).
Subadults @1 in 1978 = 232 (ND).
* suspected mortality of 213 in 1979, not included as alive in 1979 or subsequently.
** recaptured 4/80 and 6/85 in Su-Hydro area.

Table 26. Status of brown bears first captured in 1979 (all were transplanted from upper Susitna drainage). (A-alive, NR=no return, R=returned, ND=no data available, F=shot in fall season, SP=shot in spring season). Does not include transplanted bears first captured in 1978 (see Table 13). ND in year of capture indicated bear was not collared or soon shed its collar and no subsequent data were collected.

Bear ID	Sex/age	1979	1980	1981	1982	1983	1984	1985	1986
246	M/3 in '79	Shot-F	-	-	-	-	-	-	-
247	M/8 in '79	A	A	A	A	Shot-F	-	-	-
243	M/2 in /79	A	A	Shot-F	-	-	-	-	-
265	M/4 in '79	A	Shot-Sp	-	-	-	-	-	-
268	M/4 in '79	A	Shot-Sp	-	-	-	-	-	-
269	F/18 in '79	A	A	Shot-F	-	-	-	-	-
270	F/1 in '79	A	Shot-F	-	-	-	-	-	-
272	M/9 in '79	A	A	A	Shot-F	-	-	-	-
260	M/4 in '79	A	A	A	A	Shot-F	-	-	-
240	F/5 in '79	A,R	A	A	A	A	Shot-Sp	-	-
273**	F/3 in '79	A,R	A	A	A	A	A	A	A
241	M/3 in '79	A,ND	ND	ND	ND	ND	ND	ND	ND
249	M/5 in '79	A,ND	ND	ND	ND	ND	ND	ND	ND
258	M/21 in '79	A,ND	ND	ND	ND	ND	ND	ND	ND
264	F/4 in '79	A,ND	ND	ND	ND	ND	ND	ND	ND
267	F/4 in '79	A,ND	ND	ND	ND	ND	ND	ND	ND
274	F/11 in '79	A,ND	ND	ND	ND	ND	ND	ND	ND
276	M/4 in '79	A,ND	ND	ND	ND	ND	ND	ND	ND
236	F/5 in '79	A,R	ND	ND	ND	ND	ND	ND	ND
237	M/10 in '79	A,R	ND	ND	ND	ND	ND	ND	ND
244	F/6 in '79	A,R	A	ND	ND	ND	ND	ND	ND
251	F/10 in '79	A,R	A	ND	ND	ND	ND	ND	ND
248	F/4 in '79	A,NR	ND	ND	ND	ND	ND	ND	ND
261	F/7 in '79	A,NR	ND	ND	ND	ND	ND	ND	ND
Max. no. Bears potentially alive in year includes ND (M:F)		24 (12:12)	23(11:12)	20(9:11)	18(8:10)	17(7:10)	14(4:10)	13(4:9)	13(4:9)
No. marked bears known shot in year (M:F)		1(1:0)	3(2:1)	2(1:1)	1(1:0)	2(2:0)	1(0:1)	0	0
Known % of potentially alive bears shot in year		4%	13%	10%	6%	12%	7%	0	0
Cumulative % (min.) of marked bears shot (N=24)		4%	17%	25%	29%	38%	42%	42%	42%

Not Included:
Subadults @2 in 1979 = 259.
Subadults @1 in 1979 = 275, 262 or 263, 256, 257, 252, 253, 245, 271, 239, 238.
** Recaptured in Su-Hydro area (6/85).

Table 27. Status of brown bears first marked during Su-Hydro studies, 1980-1983. (A=alive, ND=no data available, F=shot in fall season, SP=shot in spring season). ND in year of capture indicates 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
1980 captures								
277	F/10 in '80	A	ND	ND	ND	ND	ND	ND
279	M/9 in '80	A	A	A	A	Shot-F	-	-
280	M/5 in '80	A	A	A	A	A	A	A
281	F/3 in '80	A	A	A	A	A	A	A
282	M/4 in '80	A	A	A	A	A	A	A
283	F/12 in '80	A	A	A	A	A	A	A
284	M/2 in '80	A	Shot-Sp	-	-	-	-	-
286	M/3 in '80	A	A	A	A	Shot-F	-	-
292	F/3 in '80	ND	ND	ND	ND	ND	ND	ND
293	M/3 in '80	A	A	A	A	ND	Shot-Sp	-
294	M/10 in '80	A	Died in Aug.	-	-	-	-	-
295	M/12 in '80	ND	ND	ND	ND	ND	ND	ND
299	F/13 in '80	A	A	A	A	A	ND	ND
297	M/1 in '80	A	Shot-F	-	-	-	-	-
306	F/3 in '80	ND	ND	ND	ND	ND	ND	ND
308a	M/6 in '80	A	A	A	Shot-F	-	-	-
308b	F/5 in '80	A	Died in Aug.	-	-	-	-	-
309	M/12 in '80	A	A	A	A	A	A	ND
311	M/2 in '80	Shot-F	-	-	-	-	-	-
312	F/10 in '80	A	A	A	A	Died-NS	-	-
313	F/9 in '80	A	A	A	A	A	Shot-F	-
314	F/2 in '80	A	A	A	A	A	A	A
315	F/2 in '80	A	A	A	A	A	A	Shot-Sp
1981 captures								
331	F/6 in '81	-	A	Died in Aug.	-	-	-	-
332	M/2 in '81	-	A	Shot-F	-	-	-	-
333	M/2 in '81	-	Shot-F	-	-	-	-	-
334	F/10 in '81	-	Lost in Sept.-shot?	-	-	-	-	-
335	F/2 in '81	-	A	A	A	A	A	A
337	F/13 in '81	-	A	A	A	A	A	A
339	M/0 in '81	-	Cub	Ylg	A	A	Shot-F	-
340	F/3 in '81	-	A	A	A	A	A	A
341	F/6 in '81	-	A	A	A	A	A	A
342a	M/2 in '81	-	A	A	A	Died-NS	-	-
344	F/5 in '81	-	A	A	A	Lost Sept.-shot?	-	-
347	M/14 in '81	-	A	A	A	A	A	ND
214***	M/2 in '78	A	A	A	A	A	A	A
273***	F/3 in '79	A	A	A	A	A	A	A

(continued)

Table 27. (cont'd)

Bear ID	Sex/age	1982	1983	1984	1985	1986
1982 captures						
379**	F/5 in '82	A	A	A	Shot-F	-
380	F/15 in '82	A	Shot-F	-	-	-
381	F/3 in '82	A	A	A	A	A
1983 captures						
385	F/2 in '83	-	A	A	A	ND
386	M/2 in '83	-	A	Shot-Sp	-	-
388	F/14 in '83	-	A	A	A	A
389	M/2 in '83	-	A, died Oct.	-	-	-
390	M/2 in '83	-	A	ND	ND	ND
384	F/12 in '83	-	A	Lost in Sept.- shot?	-	-
391	M/2 in '83	-	A	Shot-F	-	-
392	M/2 in '83	-	A	Shot-Sp	-	-
393	F/2 in '83	-	A	ND	ND	ND
394	F/6 in '83	-	A	Shot-F	-	-
395	F/3 in '83	-	Shot-F	-	-	-
396	F/13 in '83	-	A	A	A	A
397	F/2 in '83	-	A	A	Shot-F	-
398	F/2 in '83	-	A	A	A	Shot-Sp
399	M/9 in '83	-	A	A	A	ND
400	M/20 in '83	-	A	A	A	ND
403**	F/6 in '83	-	A	A	A	A
407**	F/4 in '83	-	A	A	A	A
1984 captures						
420	F/19 in '84	-	-	A	A	A
422	M/4 in '84	-	-	A	Died-Sp	-
423	F/21 in '84	-	-	A	A	A
425	F/A in '84	-	-	A	A	A
382	F/2 in '84	-	-	A	A	ND
417	M/1 in '84	-	-	-	A	Shot-Sp
1985 captures						
427	M/3 in '85	-	-	-	A	Shot-Sp
429	F/1 in '85	-	-	-	A	Shot-Sp
437	F/2 in '85	-	-	-	A	A
442	M/13 in '85	-	-	-	A	Shot-Sp
443	M/A in '85	-	-	-	A	ND
447	F/7 in '85	-	-	-	A	Shed collar

(continued)

Table 27. (cont'd)

Bear ID Sex/age	1980	1981	1982	1983	1984	1985	1986 (prelim.)
A. Max. no. marked bears potentially alive in year, includes ND. Excludes tagging and natural mortalities and coy ab=nd ylgs. (M:F)	25(14:11)	32(15:18)	30(11:19)	46(19:27)	48(17:31)	46(18:28)	41(13:28)
B. No. 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)
Min. % known shot (B/A)	4%	9%	3%	7%	13%	11%	15%
C. No. 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)
Probable min. % shot (C/A)	4%	13%	3%	7%	17%	11%	12%
D. No. bears known alive (excludes ND, died, lost, cubs or ylgs)	22	28	27	42	38	39	27
Probable % shot (C/D)	5%	14%	4%	7%	21%	13%	22%
Cumulative % shot (based on bear-years available, from row A and row C).	4%	9%	6%	7%	8%	12%	-

Not Included:

Subadults @2 in1980: 285;
1983: 397 & 398 both recaptured in 1985

Subadults @1 in 1980: 298;
1983: 383;
1984: 421, 418, 419

* G373 (M@9 in 1982) not included as it shed collar and had no ear tags or tattoo, so was not recognizable as a marked bear subsequently.

** Downstream study area.

*** Captured earlier as part of studies outside of Su-Hydro area.

Table 28. Summary of Tables 25-27, marked hunter-killed brown bears in GMU 13.

	1978	1979	1980	1981	1982	1983	1984	1985	1986 (prelim.)
Maximum no. of marked bears potentially alive in year (includes N.D.) (M:F)	28(15:13)	51(28:33)	74(40:34)	77(37:39)	70(31:39)	82(37:45)	78(29:49)	73(28:45)	68(23:45)
No. marked bears shot in year* (M:F)	1(0:1)	2(2:0)	6(5:1)	7(5:2)	5(3:2)	8(6:2)	11(7:4)	5(2:3)	6(3:3)
Min. % of marked bears shot in year	4%	4%	8%	9%	7%	10%	14%	7%	9%
% males in population of marked bears	54%	55%	54%	48%	44%	45%	37%	38%	34%
% males in harvest of marked bears	0	100%	83%	71%	60%	75%	64%	1978-1984: 70%	1978-1986: 65%

* Includes row C in preceding table.

Table 29. Summary of apparent natural mortalities of radio-collared adult bears. Susitna Hydro project. Includes black bears ≥1 year of age and brown bears ≥2 year of age.

Bear ID	Sex/age (at death), reprod. status	Comments
Black bears		
B291	M/3	Died 2-28 July 1980, 2 months after capture, cause of death unknown.
B300	M/7	Died 6-14 May 1980, 2-10 days after capture, cause of death unknown but capture myopathy possible (M99/Rompun used, immobilization, and recovery were apparently normal).
B288	F/10 with 3c	Not sure bear died but suspect that it did and collar was moved away from carcass by predator. Probably died 22-27 August 1980, 6 months after capture.
B319	M/4	Died 29 July-4 August 1981, 11 months after capture, cause unknown.
B330	M/1	Died 17-24 August 1981, 5 months after capture in den with mother and sibling, apparently killed and eaten by predator. Radio-collared female sibling survived (B329).
B357	M/4	Died winter of 1981, 6 months after capture, apparently killed by another bear (species?) at or near its den and eaten.
B322	M/6	Died 24-29 June 1982, 4 weeks after recapture (was very skinny and weighed an est. 90 lbs.), cause unknown.
B327	F/8 with 2c	Died 20 June-1 July 1983, 4 months after recapture in den, killed by predator (probably bear), but not eaten (cub defense?).
B379	F/9 with 3c	Died early July 1983 (?), 3 months after recapture in den, canine punctures in scapula, in brown bear habitat, lost cubs earlier. Suspect was killed by brown bear.
B365	M/6	Died October 1983 9 months after recapture in den. Scavenged (killed?) by wolves. Guess may have been wounded by hunter (no evidence). Good condition.
B346	M/12	Died in May 1984, eaten by unknown predator-suspect a brown bear.
B343	M/8	Died in fall '84. Suspect may have been wounded by hunter, but have no evidence.
B358	M/4	Died summer '84, cause unknown, not disturbed.
Brown bear		
G331	F/7	Died 1-31 July 1982, 14 months after capture, cause of death unknown, had no cubs in 1982, but should have (weaned 2@2 in 1981). Bones not scattered. Weighed 284 lbs. on 5/81 (large).
G389	M/2	Died early October 1983. Cause undetermined.
G422	M/7	Died June 1985. Cause undetermined, but suspect injury from moose or another bear. Bear moved suddenly miles from home range and was found dead 2 weeks later.

Table 30. Brown bear home range sizes. Code 99 in year or age column indicates lumping of all years. Area 1 = upstream, area 2 = downstream, sex 1 = male, sex 2 = female, code 1 for COY indicates bear had litter of newborn cubs.

ID No.	Area	Sex	Year	Age	No. Pts.	Size Sq. Km.	Period	Comments	COY
214	1	1	80	4	11	974.8	Apr-Sept	Shed 10/80, recpt '85	0
214	1	1	99	99	18	976.2	1980, 85	No dens	0
279	1	1	83	12	20	1431.2	May-Oct	Shed 6/80	0
279	1	1	84	13	40	1479.0	May-Sept	Shot 9/84	0
279	1	1	99	99	62	2075.6	80, 83 & 84		0
280	1	1	80	5	10	498.6	Apr-Sept		0
280	1	1	81	6	25	570.2	Apr-Oct		0
280	1	1	82	7	17	376.1	May-Oct		0
280	1	1	83	8	17	687.3	Apr-Oct		0
280	1	1	84	9	43	1177.0	Apr-Oct	No den	0
280	1	1	99	99	115	2269.3	1980-85		0
282	1	1	82	6	17	1534.5	Apr-Oct		0
282	1	1	83	7	21	2134.9	Apr-Oct		0
282	1	1	84	8	48	1761.9	Apr-Oct	No den	0
282	1	1	99	99	103	2794.4	1982-85		0
293	1	1	80	3	8	1408.5	May-Oct	No den	0
293	1	1	81	4	11	2727.0	May-Sept	No dens	0
293	1	1	82	5	12	2577.8	Jun-Aug	No dens	0
293	1	1	83	6	10	2222.2	May-Sept	No dens, shot 5/85	0
293	1	1	99	99	41	5923.5	1980-85	1980-1985, failed ±84	0
294	1	1	80	10	14	494.6	May-Oct		0
294	1	1	81	11	9	143.3	May-Aug	Died 8/81, CM	0
294	1	1	99	99	23	611.9	1980-81		0
373	1	1	82	9	11	605.9	Jun-Oct	Shed 6/83	0
373	1	1	99	99	13	853.5	1982-83		0
382	1	1	84	2	60	611.6	May-Oct	with g313	0
382	1	1	99	2	70	406.6	1984-85	shed 8/85	0
386	1	1	83	2	13	938.8	May-Oct	Shot 5/84	0
386	1	1	99	2	13	938.8	1983 only	w/g312	0
389	1	1	83	2	16	1953.6	May-Oct	Died 10/83, ??	0
389	1	1	99	2	16	1953.6	1983 only	w/g388	0
390	1	1	83	2	14	87.5	May-Oct		0

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Table 30. (cont'd)

ID No.	Area	Sex	Year	Age	No. Pts.	Size Sq. Km.	Period	Comments	COY
390	1	1	99	2	14	87.5	1983 only	w/g388	0
391	1	1	83	2	15	1169.0	May-Oct		0
391	1	1	99	2	15	1169.0	1983 only	w/g384	0
392	1	1	83	2	15	1252.3	May-Oct		0
392	1	1	99	2	15	1252.3	1983 only	w/g384	0
399	1	1	83	9	19	1183.4	May-Oct		0
399	1	1	84	10	54	1633.3	Apr-Oct	Failed 6/85	0
399	1	1	99	99	83	1772.2	1983-85		0
400	1	1	83	20	14	1733.1	May-Oct	Distant den incl.	0
400	1	1	84	21	43	3129.5	Apr-Oct	Distant den incl.	0
400	1	1	99	99	64	3156.6	1982-85		0
422	1	1	84	4	84	760.2	May-Oct	died 6/85	0
422	1	1	99	99	99	832.4	1984-85	deathbed deleted	0
342a	1	1	81	2	8	1775.8	May-Oct.	alone	0
342a	1	1	82	3	17	729.5	May-Oct		0
342a	1	1	83	4	15	931.7	Apr-Oct	Died 7/84, CM	0
342a	1	1	99	99	40	4923.3	1981-84		0
277	1	2	80	10	6	147.3	Apr-Oct	w/ylgs, shed in den	0
277	1	2	99	10	6	147.3	1980 only		0
281	1	2	80	3	13	189.1	Apr-Oct		0
281	1	2	81	4	41	368.1	Apr-Oct	alone	0
281	1	2	82	5	22	233.1	Apr-Oct	alone	0
281	1	2	83	6	19	302.2	Apr-Oct	w/2@0 (lost by 6/83)	0
281	1	2	84	7	57	435.2	Apr-Oct	w/2@0 (lost by 5/84)	0
281	1	2	99	99	162	673.7	1980-85	1@0 survived to '86	1
283	1	2	80	12	12	232.8	Apr-Oct	w/@2	0
283	1	2	81	13	20	94.3	Apr-Oct	w/coy, survived	1
283	1	2	82	14	20	206.1	Apr-Oct	w/ylg (lost 5/82)	0
283	1	2	83	15	20	416.0	Apr-Oct	w/coy (lost 5/83)	0
283	1	2	84	16	61	402.0	Apr-Oct	alone	0
283	1	2	99	99	144	708.4	1980-85	had coy in '85, surv	0
299	1	2	80	13	10	188.2	May-Oct	w/ylgs	0
299	1	2	81	14	24	358.0	Apr-Oct	w@2	0

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Table 30. (cont'd)

ID No.	Area	Sex	Year	Age	No. Pts.	Size Sq. Km.	Period	Comments	COY
299	1	2	82	15	21	191.3	Apr-Oct	w/coy (lost 6/82)	0
299	1	2	83	16	24	223.9	Apr-Oct	w/coy, survived	1
299	1	2	84	17	60	466.7	Apr-Oct	w/ylgs,failed 4/85	0
299	1	2	99	99	141	949.4	1980-1985		0
312	1	2	80	10	13	157.0	May-Oct	w/@2	0
312	1	2	81	11	24	181.7	Apr-Oct	w/coy, survived	1
312	1	2	82	12	20	251.6	Apr-Oct	w/ylgs	0
312	1	2	83	13	15	191.0	Apr-Sept	w/@2, no den	0
312	1	2	99	99	74	457.9	1980-85	died 5/84 CM	0
313	1	2	80	9	14	81.5	May-Oct	w/1@2 (g314)	0
313	1	2	81	10	25	210.9	Apr-Oct	w/coy(lost 5/81)	0
313	1	2	82	11	22	128.3	Apr-Oct	w/coy, survived	1
313	1	2	83	12	20	271.5	Apr-Oct	w/ylg, survived	0
313	1	2	84	13	60	187.7	Apr-Sept	shot 9/84	0
313	1	2	99	99	141	455.0	1980-84		0
315	1	2	83	5	18	280.4	May-Oct	1st @ 2 in 80	0
315	1	2	84	6	24	222.7	May-Oct	No den, no cubs	0
315	1	2	99	99	43	351.2	1983-84	failed 10/84	0
331	1	2	81	6	24	1281.7	May-Oct	w/@2, died 7/82	0
331	1	2	99	99	34	1280.7	1981-82	Natural mort. 7/82	0
334	1	2	81	10	31	110.9	May-Sept	w/@2, failed 9/81	0
334	1	2	99	10	31	110.9	1981		0
335	1	2	81	3	34	179.8	May-Oct	alone	0
335	1	2	82	4	20	131.2	Apr-Oct		0
335	1	2	83	5	19	183.3	Apr-Oct		0
335	1	2	84	6	36	123.8	Apr-Oct	w/2@0	1
335	1	2	99	99	118	431.3	1982-85	w/ylgs. in '85	0
337	1	2	81	13	19	269.6	May-Oct	w/coy, survived	1
337	1	2	82	14	20	356.3	Apr-Oct	w/ylg, survived	0
337	1	2	83	15	20	245.9	Apr-Oct	w/@2	0
337	1	2	84	16	26	195.7	Apr-Oct	w/coy, survived	1
337	1	2	99	99	94	545.4	1981-85		0
340	1	2	81	3	39	613.3	May-Oct	alone	0
340	1	2	82	4	23	712.0	Apr-Oct	alone	0
340	1	2	83	5	18	538.7	Apr-Oct	alone	0

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Table 30. (cont'd)

ID No.	Area	Sex	Year	Age	No. Pts.	Size Sq. Km.	Period	Comments	COY
340	1	2	84	6	60	168.9	Apr-Oct	w/2@0, survived	1
340	1	2	99	99	152	1040.0	1981-85	w/2@1 thru 85	0
341	1	2	81	6	28	888.7	May-Oct	alone	0
341	1	2	99	99	44	903.9	1981-82,85	recaptured in '85	0
344	1	2	81	5	21	270.4	May-Oct	w/coy, survived	1
344	1	2	82	6	22	400.9	Apr-Oct	w/ylg(lost 7/82)	0
344	1	2	83	7	18	287.0	Apr-Oct	w/coy, survived	1
344	1	2	84	8	13	246.9	Apr-Sept	w/ylg(lost 5/84)	0
344	1	2	99	99	74	615.4	1981-1984	missing 9/84	0
380	1	2	82	15	9	493.1	Jun-Oct	w/ylg	0
380	1	2	83	16	12	450.0	Apr-Sept	Shot 9/83	0
380	1	2	99	99	21	548.6	1982-83	shot 9/83	0
381	1	2	82	3	17	264.9	Jun-Oct	alone	0
381	1	2	83	4	18	250.6	Apr-Oct	alone	0
381	1	2	84	5	43	325.8	Apr-Oct	alone	0
381	1	2	99	99	84	489.5	1982-85	coy survived '85	1
384	1	2	83	12	16	198.9	May-Oct	w/@2	0
384	1	2	99	99	25	350.6	1983-84	failed 6/84 w/coy	0
385	1	2	83	2	16	253.3	May-Oct	w/g337	0
385	1	2	84	3	19	196.8	Apr-Oct	no den, failed 10/84	0
385	1	2	99	99	37	464.9	1983-85	spotted in 85	0
388	1	2	83	14	16	146.1	May-Oct	w/@2	0
388	1	2	84	15	47	329.6	Apr-Oct	w/coy (lost 5/84)	0
388	1	2	99	99	73	403.6	1983-85	coy in '85, survived	0
393	1	2	83	2	14	155.7	May-Sept	no den, lost 9/83	0
393	1	2	99	2	14	155.7	1983 only	w/g384 & sibs	0
394	1	2	83	6	20	201.0	May-Oct	w/coy (lost 5/83)	0
394	1	2	84	7	25	151.2	Apr-Sept	shot 9/84	0
394	1	2	99	99	45	249.3	1983-84	shot 9/84	0
395	1	2	83	3	11	457.6	May-Aug	no den, shot 8/83	0
395	1	2	99	99	11	457.6	1983 only	no den, shot 8/83	0
396	1	2	83	13	16	253.6	May-Oct	w/@2	0
396	1	2	84	14	23	252.9	Apr-Oct	coy (lost 5/84)	0
396	1	2	99	99	59	377.4	1983-84		
420	1	2	84	19	61	737.9	May-Oct	w/ylgs, survived	0

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Table 30. (cont'd)

ID No.	Area	Sex	Year	Age	No. Pts.	Size Sq. Km.	Period	Comments	COY
420	1	2	99	99	79	772.4	1984-85	coy in '86	0
423	1	2	84	99	27	151.8	May-Oct	coy, unaged adult	1
423	1	2	99	99	43	288.3	1984-85	had @2 in '86	0
425	1	2	84	8	39	234.0	May-Oct	alone	0
425	1	2	99	99	48	318.9	1984-85	coy in '85 (survived)	1
308b	1	2	80	5	15	142.0	May-Oct	alone	0
308b	1	2	81	6	14	110.1	Apr-Aug	died 8/81	0
308b	1	2	99	99	29	190.9	1980-81	Died 8/81, CM	0
379	2	2	82	5	19	226.7	Jun-Oct	w/coy, survived	1
379	2	2	83	6	20	72.7	Apr-Oct	w/ylg., survived	0
379	2	2	84	7	13	104.3	Apr-Oct	alone, shot 9/85	0
379	2	2	99	99	59	520.6	1982-85		0
403	2	2	83	6	19	135.4	May-Oct	w/coy(survived)	1
403	2	2	84	7	18	338.2	Apr-Oct	w/ylg(survived)	0
403	2	2	99	99	43	507.5	1983-85	w/coy in'86	0
407	2	2	83	4	17	185.7	May-Oct	alone, downstream	0
407	2	2	84	5	19	195.3	Apr-Oct	alone	0
407	2	2	99	99	45	250.8	1983-85	alone in '85 too	0

Table 31. Mean brown bear home range size in the Su-Hydro study area by sex and reproductive status categories, 1980-1984.

Category	No. Individuals	Number of Points			Home Range Size (km^2)			
		Mean	Max.	Min.	Mean	S.D.	Max.	Min.
TOTAL HOME RANGE (Summation all years)								
All bears	47	59.1	162	6	1021.6	1167.9	5923.5	87.5
All males	17	47.3	115	13	1941.0	1541.5	5923.5	87.5
All females	30	65.8	162	6	500.6	275.8	1280.7	110.9
ANNUAL HOME RANGES (all points in calendar year)								
All bears	106	23.7	84	6	580.5	635.0	3129.5	72.7
All males	32	22.8	84	8	1271.7	755.0	3129.5	87.5
All females	74	24.0	61	6	281.6	194.5	1281.7	72.7
Females 5.0+, without coy	48	24.2	61	6	300.5	215.2	1281.7	72.7
Females 5.0+, with coy	13	25.8	60	18	189.0	62.6	94.3	287.0

* Standard minimum grid method (Mohr 1947).

Table 32. Brown bear predation rates, by bear ID based on intensive monitoring in spring in the Su-Hydro study area. Only kills made on a consecutive observation day are listed. Area 1 = upstream, 2 = downsteam, 3 = '78 studies (Ballard et al. in prep). Sex 1 = male, 2 = female, Status 1 = alone or w/@2, 2= w /coy, 3 = w/@1, based on status on 15 June. If another bear or wolves also on kill, each credited with 0.5 kills. Observation day = a day in which at least 1 visual observation was made. Consecutive observation day sums all days, for periods of >2 consecutive days. Misc. kills include suspected and probable kills.

Bear ID	Area	Sex	Age	Year	Repro. status	No. consec. obsv.-days	Period	Missing period	No. moose calves	No. adult moose	Unident. moose	No. adult caribou	Ungulate age/ species unk.	Misc. kills	Total kills	No. Kills/ 100 con_ ob_day	No. con_ ob_days per kill
207	3	2	11	78	2	7	5/28-6/22						1		1	14.29	7.00
220	3	2	5	78	3	16	5/28-6/22		1		1				2	12.50	8.00
221	3	2	8	78	3	15	5/28-6/22		5	1					6	40.00	2.50
204	3	2	7	78	1	13	5/28-6/22		2	1					3	23.08	4.33
202	3	2	8	78	1	18	5/28-6/22		5	1					6	33.33	3.00
206	3	2	13	78	1	18	5/28-6/22		1.5	0.5					2	11.11	9.00
208	3	2	12	78	1	21	5/28-6/22		8	2			1		11	52.38	1.91
209	3	2	4	78	1	14	5/28-6/22				1				1	7.14	14.00
212	3	2	10	78	1	6	5/28-6/22								0	0.00	-
213	3	2	10	78	1	8	5/28-6/22		1						1	12.50	8.00
219	3	2	4	78	1	5	5/28-6/22								0	0.00	-
231	3	2	12	78	1	11	5/28-6/22								0	0.00	-
201	3	1	10	78	1	11	5/28-6/22								0	0.00	-
205	3	1	4	78	1	22	5/28-6/22		2.5	2.5			0.5		5.5	25.00	4.00
211	3	1	4	78	1	6	5/28-6/22			0.5					0.5	8.33	12.00
217	3	1	3	78	1	11	5/28-6/22		1	1			1		3	27.27	3.67
222	3	1	11	78	1	9	5/28-6/22		0.5	0.5			0.5		1.5	16.67	6.00
225	3	1	4	78	1	16	5/28-6/22			2			1		3	18.75	5.33
227	3	1	9	78	1	5	5/28-6/22					1			1	20.00	5.00
281	1	2	8	81	1	8	5/21-6/22								0	0.00	-
340	1	2	3	81	1	15	5/21-6/22		3					1	4	26.67	3.75
334	1	2	18	81	1	18	5/22-6/22								0	0.00	-
341	1	2	5	81	1	5	5/21-6/22								0	0.00	-
355	1	2	10	81	1	10	5/22-6/22						1		1	10.00	10.00
340	1	2	6	84	2	28	5/28-7/1		0.5	2					2.5	8.93	11.20
299	1	2	17	84	3	22	5/28-7/1		2						2	9.09	11.00
420	1	2	19	84	3	18	5/31-7/1		4					1	5	27.78	3.60
281	1	2	7	84	1	17	5/28-7/1		1					1	2	11.76	8.50
283	1	2	16	84	1	19	5/28-7/1			1					1	5.26	19.00
313	1	2	13	84	1	23	5/28-7/1		6.5						6.5	28.26	3.54
381	1	2	5	84	1	11	5/28-7/1	6/11-6/23	1						1	9.09	11.00
388	1	2	15	84	1	13	5/28-7/1								0	0.00	ERR
425	1	2	8	84	1	6	6/1-7/1	6/9-6/15		0.5					0.5	8.33	12.00
279	1	1	13	84	1	12	5/28-6/12		0.5						0.5	4.17	24.00
280	1	1	9	84	1	11	5/28-7/1	6/11-6/22						2	2	18.18	5.50
282	1	1	8	84	1	11	6/1-7/1	6/9-6/14	1	0.5				2	3.5	31.82	3.14
382	1	1	2	84	1	16	5/28-7/1						2		2	12.50	8.00
399	1	1	10	84	1	15	5/28-6/25		2						2	13.33	7.50
400	1	1	21	84	1	9	5/30-7/1	6/19-6/22	1						1	11.11	9.00
422	1	1	4	84	1	15	5/28-7/1	6/20-6/24	3					1	4	26.67	3.75

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Table 32. (cont'd)

SUMMARY	No. consec. obsv.-days	No. moose calves	No. adult moose	Unident. moose	No. adult caribou	Ungulate age/ species unk.	Misc. kills	Total kills	No. Kills/ 100 con_ ob_day	No. con_ ob_days per kill
TOTALS, all bears =	534	53	16	2	1	8	8	88	16.48	6.07
No. of bear-years =	40									
Totals, males only =	169	11.5	7	0	1	5	5	29.5	17.46	5.73
No. of bear-years =	14									
Totals, females only =	365	41.5	9	2	0	3	3	58.5	16.03	6.24
No. of bear-years =	26									
Totals, females status 1 =	259	29	6	1	0	2	2	40	15.44	6.48
No. bear-years =	20									
Totals, females status 2 =	35	0.5	2	0	0	1	0	3.5	10.00	10.00
No. of bear-years =	2									
Totals, females status 3 =	71	12	1	1	0	0	1	15	21.13	4.73
No. of bear-years =	4									
Totals, all bears area 1 =	302	25.5	4	0	0	3	8	40.8	14.41	7.46
No. of bear-years =	21									
Totals, males area 1 =	89	7.5	0.5	0	0	2	5	15	16.85	5.93
No. bear-years =	7									
Totals, females area 1 =	213	18	3.5	0	0	1	3	25.5	11.97	8.35
No. bear-years =	14									
Totals, females area 1 & status 1 =	145	11.5	1.5	0	0	1	2	16	11.03	9.06
No. bear-years =	11									
Totals, females area 1 & status 2 =	28	0.5	2	0	0	0	0	2.5	8.93	11.20
No. of bear-years =	1									
Totals, females area 1 & status 3 =	40	6	0	0	0	0	1	7	17.50	5.71
No. of bear-years =	2									

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Table 32. (cont'd)

SUMMARY	No. consec. obsv.-days	No. moose calves	No. adult moose	Unident. moose	No. adult caribou	Ungulate age/ species unk.	Misc. kills	Total kills	No. Kills/ 100 con_ob_day	No. con_ob_days per kill
Totals, all bears area 3 =	232	27.5	12	2	1	5	0	47.5	20.47	4.88
No. of bear-years =	40									
Totals, males area 3 =	80	4	6.5	0	1	3	0	14.5	18.13	5.52
No. bear-years =	7									
Totals, females area 3 =	152	23.5	5.5	2	0	2	0	33	21.71	4.61
No. bear-years =	12									
Totals, females area 3 & status 1 =	114	17.5	4.5	1	0	1	0	24	21.05	4.75
No. bear-years =	9									
Totals, females area 3 & status 2 =	7	0	0	0	0	1	0	1	14.29	7.00
No. of bear-years =										
Totals, females area 3 & status 3 =	31	6	1	1	0	0	0	8	20.00	5.00
No. of bear-years =	2									

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Table 32. (cont'd)

SUMMARY	No. consec. obsv.-days	No. moose calves	No. adult moose	Unident. moose	No. adult caribou	Ungulate age/ species unk.	Misc. kills	Total kills	No. Kills/ 100 con_ ob_day	No. con_ ob_days per kill
Totals, in 1981 = No. of bear-years =	56 5	3	0	0	0	1	1	5	8.93	11.20
Totals, males in 1981 = No. bear-years =	0 0	0	0	0	0	0	0	0	-	-
Totals, females in 1981 = No. bear-years =	56 5	3	0	0	0	1	1	5	8.93	11.20
Totals, FF in '81 w/status 1 No. bear-years =	56 5	3	0	0	0	1	1	5	8.93	11.20
Totals, FF in '81 w/status 2 No. of bear-years =	0 0	0	0	0	0	0	0	0	-	-
Totals, FF in '81 w/status 3 No. of bear-years =	0 0	0	0	0	0	0	0	0	-	-
Totals, all bears in 1984 = No. of bear-years =	246 16	22.5	4	0	0	2	7	35.5	14.43	6.93
Totals, males in 1984 = No. bear-years =	89 7	7.5	0.5	0	0	2	5	15	16.85	5.93
Totals, females in 1984 = No. bear-years =	157 9	15	3.5	0	0	0	2	20.5	13.06	7.66
Totals, FF in '84 w/status 1 No. bear-years =	28 6	8.5	1.5	0	0	0	1	11	39.29	2.55
Totals, FF in '84 w/status 2 No. of bear-years =	28 1	0.5	2	0	0	0	0	2.5	8.93	11.20
Totals, FF in '84 w/status 3 No. of bear-years =	40 2	6	0	0	0	0	1	7	17.50	5.71

Table 33. Results of intensive monitoring of brown bear predation rates during summer 1984. Bears were located once/day from 23 July through 1 August, conditions permitting.

Bear ID	Sex	Age	Repro. status	No. of locations	No of visuals (%)	No. of locations at salmon streams	No. of visuals at salmon streams (%)	Total known or suspected kills of ungulates
MALES								
282	M	8	--	9	4	9	4	0
382	M	2	--	5	1	0	0	0
280	M	9	--	4	1	0	0	0
399	M	10	--	9	5	9	5	0
279	M	13	--	6	3	6	3	0
400	M	21	--	6	0	0	0	0
422	M	A	--	6	5	0	0	1
342	M	5	--	5	1	5	1	0
	Subtotals for males			50	20(40.0%)	29	13(44.8%)	1
FEMALES								
381	F	5	alone	4	0	0	0	0
281	F	7	alone	6	0	0	0	0
313	F	13	alone	6	2	0	0	0
388	F	15	alone	4	1	0	0	0
283	F	16	alone	8	2	1	1	0
425	F	A	alone	6	2	0	0	0
315	F	6	alone	8	5	8	5	0
394	F	7	alone	8	1	8	1	0
396	F	15	alone	6	2	5	1	0

(continued)

Table 33. (cont'd)

Bear ID	Sex	Age	Repro. status	No. of locations (%)	No of visuals (%)	No. of locations at salmon streams	No. of locations at salmon streams (%)	Total known or suspected kills of ungulates
407	F	6	alone	6	5	6	5	0
344 & 385	F	--	alone	2	2	0	0	0
340	F	6	w/2@0	6	6	0	0	0
423	F	A	2/3@0	9	7	7	5	0
335	F	6	w/2@0	5	3	0	0	0
337	F	10	w/2@0	2	2	0	0	0
299	F	18	w/3@1	6	6	0	0	0
420	F	A	w/2@1	9	5	9	5	0
	Subtotals for females			101	51(50.5%)	44	23(52.3%)	0
TOTALS FOR ALL BEARS				161	71(44.1%)	73	36(49.3%)	1

* Note that if the same ratio of kills to visuals observed in the spring (48:475) were present in the summer, then 7.2 kills would have been observed during the 71 visual observations made. Excluding the observations at salmon streams leaves only 35 visual observations and 3.5 kills would have been expected with this number of observations using the ratio of kills:visual observations observed in the spring.

Table 34. Brown bear predation rates by different sex and age categories. All data, 1978-1984, are included. Status 1 = alone or with 2 year-olds status 2 = with cubs, and status 3 = with yearlings. Area 1 = Su-hydro studies and Area 3 = work in 1978 based on Spraker et al. (1981). Den site observations are not included.

ALL BEARS	No. Visuals	No. w/o Visuals	% Visuals	No. moose calves	No. adult moose	No. adlt. caribou	Age/ spec. Unknown	Probable kill	Suspected kill	Total Kills	Kills/100 visuals
TOTALS, all bears =	2188	852	72.0	68	42	9	26.5	10.5	12.5	168.5	7.70
No. of bear-years =	156										
Totals, males only =	582	269	68.4	17.5	15	0	8	5	5	50.5	8.68
No. of bear-years =	46										
Totals, females only =	1606	583	73.4	50.5	27	9	18.5	5.5	7.5	118	7.35
No. of bear years =	110										
Totals, females status 1 =	978	424	69.8	32	18	7	9.5	2.5	6.5	75.5	7.72
No. bear-years =	68										
Totals, females status 2 =	334	90	78.8	2.5	4	1	2	3	0	12.5	3.74
No. of bear-years =	23										
Totals, females status 3 =	294	69	81.0	16	5	1	7	0	1	30	10.20
No. of bear-years =	19										

(continued on next page)

Table 34. (cont'd)

SU HYDRO ONLY	No. Visuals	No. w/o Visuals	% Visuals	No. moose calves	No. adult moose	No. adlt. caribou	Age/ spec. Unknown	Probable kill	Suspected kill	Total Kills	Kills/100 visuals
Totals, all bears area 1 =	1632	691	70.3	40	18.5	6	17.5	6	8.5	96.5	5.91
No. of bear-years =	118										
Totals, males area 1 =	404	218	65.0	11	3	0	5	3	3	25	6.19
No. bear-years =	32										
Totals, females area 1 =	1228	473	72.2	29	15.5	6	12.5	3	5.5	71.5	5.82
No. bear-years =	86										
Totals, females area 1 & status 1 =	716	383	65.2	17.5	9.5	5	6.5	0	4.5	43	6.01
No. bear-years =	53										
Totals, females area 1 & status 2 =	289	51	85.0	1.5	3	1	1	3	0	9.5	3.29
No. of bear-years =	19										
Totals, females area 1 & status 3 =	223	39	85.1	10	3	0	5	0	1	19	8.52
No. of bear-years =	14										

(continued on next page)

Table 34. (cont'd)

1978 ONLY	No. Visuals	No. w/o Visuals	% Visuals	No. moose calves	No. adult moose	No. adlt. caribou	Age/ spec. Unknown	Probable kill	Suspected kill	Total Kills	Kills/100 visuals
Totals, all bears area 3 =	483	67	87.8	28	23.5	3	9	4.5	4	72	14.91
No. of bear-years =	26										
Totals, males area 3 =	160	23	87.4	6.5	12	0	3	2	2	25.5	15.94
No. bear-years =	10										
Totals, females area 3 =	323	44	88.0	21.5	11.5	3	6	2.5	2	46.5	14.40
No. bear-years =	16										
Totals, females area 3 & status 1 =	226	25	90.0	14.5	8.5	2	3	2.5	2	32.5	14.38
No. bear-years =	11										
Totals, females area 3 & status 2 =	32	16	66.7	1	1	0	1	0	0	3	9.38
No. of bear-years =	2										
Totals, females area 3 & status 3 =	65	3	95.6	6	2	1	2	0	0	11	16.92
No. of bear-years =	3										

Table 35. Den entrance and emergence dates of radio-collared brown bears for the winter of 1980-81 ("S" is the standard deviation, but it includes variability from the fluctuating time between observations, as well as variability in denning times).

			1980 Entrance			1981 Emergence			Days In Den		
Bear ID	Sex	Repro-ductive status at exit	Min.	Max.	Mid.	Min.	Max.	Mid.	Min.	Max.	Mid.
280	M		13 Oct	27 Oct	20 Oct	7 Apr	21 Apr	14 Apr	162	190	176
281	F	w/o	13 Oct	27 Oct	20 Oct	7 Apr	21 Apr	14 Apr	162	190	176
283	F	2@0	9 Oct	27 Oct	18 Oct	30 Apr	5 May	2 May	185	208	197
294	M		-	27 Oct	-	21 Apr	30 Apr	26 Apr	176	-	-
299	F	2@2	13 Oct	27 Oct	20 Oct	7 Apr	21 Apr	14 Apr	162	190	176
308	F	w/o	13 Oct	27 Oct	20 Oct	30 Apr	5 May	2 May	185	204	195
312	F	2@0	29 Sep	-	-	30 Apr	6 May	3 May	-	-	-
313	F	1@0	9 Sep	9 Oct	24 Sep	21 Apr	24 Apr	22 Apr	194	207	200
277	F	?	-	27 Oct	-	ND	ND	ND	-	-	-
	MEAN		6 Oct	25 Oct	15 Oct	19 Apr	28 Apr	23 Apr	175	198	187
	"S"		13	6	11	11	7	9	13	9	12
	n		7	8	6	8	8	8	7	6	6

Table 36. Den entrance and emergence dates of radio-collared brown bears for the winter of 1981-82 ("S" is the standard deviation, but it includes variability from the fluctuating time between observations, as well as variability in denning times)

Bear ID	Sex	Reproductive status at exist	1981 Entrance			1982 Emergence			Days In Den		
			Min.	Max.	Mid.	Min.	Max.	Mid.	Min.	Max.	Mid.
280	M		22 Sep	1 Oct	27 Sep	19 Apr	6 May	28 Apr	200	226	213
281	F	w/o	1 Oct	7 Oct	4 Oct	6 May	12 May	9 May	211	223	217
283	F	1@1	1 Oct	7 Oct	4 Oct	12 May	18 May	15 May	217	229	223
293	M		22 Sep				1 Jun				
299	F	1@0	1 Oct	7 Oct	4 Oct	19 Apr	6 May	28 Apr	194	217	206
312	F	1@1	1 Oct	16 Oct	8 Oct	12 May	18 May	15 May	208	229	218
313	F	2@0	7 Oct	16 Oct	12 Oct	18 May	26 May	22 May	214	231	222
331	F	w/o	7 Oct	16 Oct	12 Oct	6 May	12 May	9 May	202	217	210
335	F	w/o	1 Oct	7 Oct	4 Oct	19 Apr	6 May	28 Apr	194	217	206
337	F	2@1	1 Oct	7 Oct	4 Oct	18 May	26 May	22 May	223	237	230
340	F	w/o	7 Oct	16 Oct	12 Oct	19 Apr	6 May	28 Apr	185	211	198
341	F	2@0	1 Oct	7 Oct	4 Oct	12 May	18 May	15 May	217	229	223
342	M		30 Oct		19 Apr	4 May	26 Apr				
344	F	2@1	7 Oct	16 Oct	12 Oct	19 Apr	6 May	28 Apr	185	211	198
	MEAN		1 Oct	12 Oct	6 Oct	1 May	14 May	7 May	204	223	214
	"S"		5	7	5	12	9	10	13	8	10
	n		13	13	11	13	14	13	12	12	12

Table 37. Den entrance and emergence dates of radio-collared brown bears for the winter of 1982-83 ("S" is the standard deviation, but it included variability from the fluctuating time between observations, as well as variability in denning times).

		Reproductive status	1982 Entrance			1983 Emergence			Days in Den		
Bear ID	Sex	at exit	Min.	Max.	Mid.	Min.	Max.	Mid.	Min.	Max.	Mid.
280	M		6 Oct	15 Oct	10 Oct	17 Apr	25 Apr	21 Apr	184	201	193
281	F	2@0	6 Oct	20 Oct	13 Oct	14 May	16 May	15 May	206	222	214
283	F	1@0	6 Oct	15 Oct	10 Oct	14 May	15 May	15 May	211	221	217
299	F	3@0	6 Oct	15 Oct	10 Oct	23 May	1 Jun	28 May	220	238	230
312	F	1@2	6 Oct	20 Oct	13 Oct	25 Apr	4 May	30 Apr	187	210	199
313	F	2@1	15 Oct	20 Oct	18 Oct	14 May	15 May	15 May	206	212	209
335	F	w/o	20 Sep	6 Oct	28 Sep	17 Apr	25 Apr	21 Apr	193	217	205
337	F	1@2	20 Oct	15 Nov	2 Nov	10 May	14 May	12 May	176	206	191
340	F	w/o	6 Oct	15 Nov	26 Oct	25 Apr	4 May	30 Apr	161	210	186
344	F	2@0	20 Oct	15 Nov	2 Nov	14 May	15 May	15 May	180	207	194
282	M		20 Oct	15 nov	2 Nov	17 Apr	25 Apr	21 Apr	153	187	170
379	F	2@1	20 Oct	17 Nov	4 Nov	25 Apr	4 May	30 Apr	159	196	177
381	F	w/o	6 Oct	15 Oct	10 Oct	17 Apr	25 Apr	21 Apr	184	201	193
380	F	w/o	N. D.	N. D.	N. D.	10 May	19 May	15 May	-	-	-
342	M		N. D.	N. D.	N. D.	17 Apr	25 Apr	21 Apr	-	-	-
	MEAN		12 Oct	28 Oct	19 Oct	1 May	8 May	5 May	186	210	198
	"S"		7	16	12	13	11	12	21	13	17
	n		13	13	13	15	15	15	13	13	13

Table 38. Brown bear den entrance and emergence dates, winter of 1983/84.

		Repro-ductive status	1983 Entrance			1984 Emergence			Days in Den		
Bear ID	Sex	at exit	earliest	latest	mid.	earliest	latest	mid.	Min.	Max.	Mid.
G279	M		26 Sep	24 Oct	10 Oct	3 Apr	18 Apr	11 Apr	162	205	184
G280	M		5 Oct	25 Oct	15 Oct	18 Apr	30 Apr	24 Apr	176	208	192
G281	F	2@0	26 Sep	24 Oct	10 Oct	30 Apr	10 May	5 May	189	227	208
G282	M		5 Oct	24 Oct	15 Oct	3 Apr	7 Apr	5 Apr	162	215	189
G283	F	w/o	26 Sep	5 Oct	1 Oct	18 Apr	10 May	29 Apr	196	227	212
G293	M		27 Sep*	-	-	-	-	-	-	-	-
G299	F	3@1	27 Sep*	24 Oct*	11 Oct*	8 Apr	18 Apr	13 Apr	167	204	186
G313	F	1@2	5 Oct	24 Oct	15 Oct	30 Apr	10 May	5 May	189	218	204
G315	F	w/o	26 Sep	24 Oct	10 Oct	18 Apr	30 Apr	24 Apr	177	217	197
G335	F	2@0	15 Sep	26 Sep	6 Oct	30 Apr	10 May	5 May	217	238	228
G337	F	2@0	5 Oct	24 Oct	15 Oct	30 Apr	10 May	5 May	189	218	204
G340	F	2@0	5 Oct	24 Oct	15 Oct	10 May	17 May	14 May	199	225	212
G342	M		26 Sep*	14 Nov*	21 Oct*	30 Apr	10 May	5 May	168	227	197
G344	F	1@1	27 Sep*	14 Nov*	25 Oct*	30 Apr	10 May	5 May	168	226	196
G379	F	1@2	24 Oct	14 Nov	25 Oct	3 Apr	18 Apr	11 Apr	141	177	159
G381	F	w/o	25 Oct*	--	-	18 Apr	30 Apr	24 Apr	-	188	-
G384	F	2@0	5 Oct	25 Oct	15 Oct	10 May	28 May	19 May	198	236	217
G385	F	w/o	26 Sep*	24 Oct*	10 Oct*	30 Apr	10 May	5 May	189	227	208
G386	M		5 Oct	24 Oct	15 Oct	-	-	-	-	-	-
G388	F	2@0	26 Sep*	15 Nov*	21 Oct*	30 Apr	10 May	5 May	167	227	197
G390	M		5 Oct	24 Oct	15 Oct	30 Apr	3 May	1 May	189	211	200
G391	M		5 Oct	24 Oct	15 Oct	-	-	-	-	-	-
G393	F	?	27 Sep*	-	-	-	-	-	-	-	-
G394	F	w/o	5 Oct	24 Oct	15 Oct	30 Apr	10 May	5 May	189	218	204
G396	F	1@0	27 Sep*	25 Oct*	11 Oct*	18 Apr	30 Apr	24 Apr	176	216	196
G399	M		5 Oct	25 Oct	15 Oct	18 Apr	30 Apr	24 Apr	176	208	196
G400	M		27 Sep*	24 Oct	11 Oct*	18 Apr	10 May	24 Apr	177	226	202
G403	F	1@1	24 Oct	14 Nov	4 Nov	3 Apr	18 Apr	11 Apr	141	177	159
G407	F	w/o	-	-	-	18 Apr	30 Apr	24 Apr	--	-	-
G423	F	4@0	-	-	-	16 May	17 May	17 May	--	-	-
	Mean		3 Oct	23 Oct	15 Oct	23 Apr	4 May	29 Apr	178	215	198
	"S"		7.8	10.9	7.1	12.0	11.2	11.4	18.0	16.2	15.7
	n		18	18	18	26	26	26	23	24	23

* Not included in calculation of means

Table 39. Brown bear den entrance and emergence dates, winter of 1984/85.

Bear ID	Sex	Repro. status at exit	1984 Entrance earliest	latest	Mid.	1985 Emergence earliest	latest	Mid.	Days in Den Min.	Max.	Mid.
G280	M		11 Oct	(missing)		-	-	-			
G281	F	2@0	11 Oct	24 Oct	18 Oct	23 May	1 June	28 May	211	233	222
G282	M		7 Nov	13 Nov	10 Nov (unconfirmed)	11 April	18 April	14 April	149	162	156
G283	F	2@0	11 Oct	24 Oct	18 Oct	23 May	1 June	28 May	211	233	222
G299	F	3@2?	1 Oct	11 Oct	6 Oct	18 April	30 April	24 April	189	211	200
G315	F	?	11 Oct	24 Oct	18 Oct	is (missing)		-	-	-	-
G335	F	2@1	11 Oct	24 Oct	18 Oct	30 April	9 May	5 May	188	210	199
G337	F	2@1	11 Oct	24 Oct	18 Oct	16 May	23 May	20 May	204	224	214
G340	F	2@1	11 Oct	24 Oct	18 Oct	18 April	30 April	24 April	176	201	189
G379	F	alone?	1 Oct	11 Oct	6 Oct	9 May	16 May	13 May	210	227	219
G381	F	2@0	11 Oct	24 Oct	18 Oct	16 May	23 May	20 May	204	224	214
G388	F	2@0	11 Oct	24 Oct	18 Oct	23 May	1 June	28 May	211	233	222
G396	F	2@0	21 Sep	11 Oct	1 Oct (shed?)	16 May	23 May	20 May	217	244	231
G399	M		11 Oct	24 Oct	18 Oct	18 April	30 April	24 April	176	201	189
G400	M		11 Oct	24 Oct	18 Oct	30 April	9 May	5 May	188	210	199
G403	F	1@2?	7 Nov	13 Nov	10 Nov	9 May	16 May	13 May	177	190	199
G382	M		11 Oct	24 Oct	18 Oct	30 April	9 May	5 May	188	210	199
G407	F	alone	11 Oct	24 Oct	18 Oct	18 April	30 April	24 April	176	201	189
G420	F	2@2	11 Oct	24 Oct	18 Oct	30 April	9 May	5 May	188	210	199
G422	M		11 Oct	24 Oct	18 Oct	18 April	30 April	24 April	176	201	189
G423	F	3@1	11 Oct	24 Oct	18 Oct	30 April	9 May	5 May	188	210	199
G425	F	2@0	11 Oct	24 Oct	18 Oct	23 May	2 June	28 May	211	233	222
	Mean		11 Oct	24 Oct	18 Oct	4 May	13 May	10 May	192	213	204
	"S"		9.7	8.1	9.0	14.2	13.3	13.8	17.6	18.9	17.5
	n		24	21	21	20	20	20	20	20	20

Table 40. Characteristics of brown bear dens in the Susitna study area during winters of 1980/81, 1981/1982, 1982/1983, 1983/1984, and 1984/1985.

	Den No.	Bear ID No.	Age at Exit	Elevation (Feet)	Slope (Degrees)	Aspect (True N.)	Vegetation	ENTRANCE Ht. (cm.)	ENTRANCE Width (cm.)	CHAMBER Ln. (cm.)	CHAMBER Width (cm.)	CHAMBER Ht. (cm.)	Total Length (cm.)	Previously Used? (Yes/No)	Comments
DUG DENS															
FEMALES															
With offspring (@ exit)															
w/2 @0	14	G283(sp.)	13	3900	28	192	Tussock grass	-	83	-	138	-	196	No	Spring den/collapsed
w/2 @0	16	G283(wt.)	13	3725	26	210	Willows	76	64	239	203	92	291	No	Winter den
w/1 @0	22	G313	10	5150	35	166	Tussock/rock slide	-	-	-	104	-	410	No	Collapsed
w/3 @0	24	G337	13	4825	31	252	Tussock/lg. rocks	57	69	-	152	90	219	No	
w/2 @0	30	G344	5	4760	-	153	--	-	-	-	-	-	-	-	Collapsed/not visited
w/2 @0	31	G312	11	4900	-	145	Tundra/rock	-	-	-	-	-	-	-	Collapsed/not visited
w/2 @1*	25	G277	11	4925	45	93	Moss/rock slide	-	-	-	165	-	207	No	Collapsed
w/2 @2	28	G299	14	4660	25	138	Tundra/rock	-	-	-	-	-	-	No	Collapsed
w/2 @0	42	G331	7	3950	30	213	Willow, grass	67	52	117	127	84**	290	No	Collapsed
w/2 @0	44	G313	11	4575	34	182	Grass	102**	-	-	-	-	230	No	Collapsed
w/1 @1	47	G312	12	4925	27	201	--	-	-	-	-	-	-	-	Collapsed
w/2 @1	52	G344	6	4250	26	202	Grass	49	65	-	-	-	-	No	Collapsed
w/2 @0	54	G341	7	4575	45**	118**	--	-	-	-	-	-	-	-	Collapsed/not visited
w/1 @0	59	G299	15	3525	31	156	Willow, alder	58	69	151	136	101	350	No	
w/2 @1	37***	?	?	2075	36	346	Alder	53**	79	-	-	-	-	No	Partially collapsed
w/3 @0	76	G299	16	4150	17	189	Tundra	64	76	-	-	-	-	No	Spring den, collapsed
w/3 @0	78	G299	16	3975	27	220	Tundra	-	66	-	-	-	-	No	Collapsed
w/2 @1	87***	G379	6	1375	28	218	Alder	-	-	102	221	86	345	No	Collapsed
w/2 @1	89***	G379	6	1050	42	40	Alder, ferns	-	76**	-	-	-	-	No	Spring den, collapsed
w/2 @1	102	G313	12	4750**	35**	23**	Tundra	-	-	-	-	-	-	-	Collapsed
w/1 @0	103	G283	15	3725	39	176	Tundra, willows	61	69	103	101	-	177	No	
w/2 @0	104	G281	6	4575	33	198	Tundra	58	56	136	88	-	136	No	Collapsed
w/1 @2	105	G337	15	5150**	45**	336**	Tundra	-	-	-	-	-	-	-	Collapsed
w/1 @2	107	G337	15	4900**	35**	34**	Tundra	-	-	-	-	-	-	-	Spring den, collapsed

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Table 40. (continued)

	Den No.	Bear ID No.	Age at Exit	Elevation (Feet)	Slope (Degrees)	Aspect (True N.)	Vegetation	ENTRANCE Ht. (cm.)	ENTRANCE Width (cm.)	CHAMBER Ln. (cm.)	CHAMBER Width (cm.)	CHAMBER Ht. (cm.)	Total Length (cm.)	Previously Used? (Yes/No)	Comments
w/1 @2	108	G312	13	4540**	40**	51**	Tundra, grass	-	-	-	-	-	-	-	Collapsed
w/2 @0	109	G344	7	4750**	50**	101**	Tundra	-	-	-	-	-	-	-	Collapsed
w/2 @0	112	G384	13	4125	11	69	Tundra	72	78	212	135	-	275	No	Partially collapsed
w/1 @1	117	G344	8	4525	30**	98	Tundra	-	-	-	-	-	-	-	Collapsed
w/2 @0	118	G335	6	3500	30**	303	Alder/shrub	-	-	-	-	-	-	-	Collapsed
w/2 @0	119	G388	15	3700	33	73	Tundra	-	-	-	-	-	-	-	Collapsed
w/2 @0	120	G340	6	4450	30	283	Tundra/rocks	-	-	-	-	-	-	-	Collapsed
w/2 @0	121	G340	6	3275	34	249	Tundra	62	96	96	109	113	163	Yes	Spring den
w/3 @1	124	G299	17	3725	34	274	Grass/willow	-	-	-	-	-	-	-	Collapsed
w/1 @0	125	G396	14	4550	25	238	Tundra/grass/rock	-	-	-	-	-	-	-	Collapsed
w/1 @2	133	G313	13	4150	35	238	Tundra	-	-	-	-	-	-	-	Collapsed
w/2 @0	134	G281	7	4550	20	202	Tundra	-	-	-	-	-	-	-	Collapsed
w/2 @0	135	G337	16	5000	40	193	Tundra/rock	-	-	-	-	-	-	-	Collapsed
w/2 @2	153***	G379	7	2250	26	103	Alder/grass	-	-	-	-	-	-	-	Collapsed
w/2 @0	179	G283	17	4750**	30**	208**	Tundra	-	-	-	-	-	-	-	Collapsed/not visited
w/3 @2	194	G299	18	4100**	--	168**	--	-	-	-	-	-	-	-	Not visited
w/2 @1	161	G335	7	4700**	30**	180**	Scree/tundra	-	-	-	-	-	-	-	Collapsed/not visited
w/2 @1	164	G337	17	5240	36	134	Tundra	-	-	-	-	-	-	No	Collapsed
w/2 @1	193	G340	7	4300**	--	114**	--	-	-	-	-	-	-	-	Not visited
w/2 @0	162	G388	16	4000	21	76	Tundra	48	62	104**	100**	90**	298	No	Partially collapsed
w/2 @0	182	G396	15	2010	26	297	D. birch/spruce	-	-	-	-	-	-	No	Collapsed
w/1 @2	192***	G403	8	1400**	30**	208**	Birch/alder	-	-	-	-	-	-	-	Collapsed/Not visited
w/3 @1	195	G423	--	3350**	--	256**	--	-	-	-	-	-	-	-	Not visited

(continued on next page)

Table 40. (continued)

	Den No.	Bear ID No.	Age at Exit	Elevation (Feet)	Slope (Degrees)	Aspect (True N.)	Vegetation	ENTRANCE Ht. (cm.)	ENTRANCE Width (cm.)	CHAMBER Ln. (cm.)	CHAMBER Width (cm.)	CHAMBER Ht. (cm.)	Total Length (cm.)	Previously Used? (Yes/No)	Comments
w/2 @0	163	G425	--	5330	19	173	Tundra	-	76	-	-	-	-	-	Collapsed
w/o	23	G281	4	4700	39	142	Tussock/rock slide	-	61	-	-	-	-	No	Collapsed
w/o	5	G308b	6	2330	26	358	Alder	69	82	112	112	110	230	No	
w/o	46	G340	4	5150	-	-	--	-	-	-	-	-	-	-	Not visited
w/o	56	G335	3	3525	32	261	Willow, alder	47	39	-	-	-	224	No	Partially collapsed
w/o	79	G335	4	4350	60**	354**		-	-	-	-	-	-	No	Collapsed
w/o	106	G340	5	4950**	45**	306**	Tundra	-	-	-	-	-	-	-	Collapsed
w/o	111	G381	4	4500**	30**	62**	Tundra	-	-	-	-	-	-	-	Collapsed
w/o	122	G381	5	4300	28	205	Tundra	-	-	-	-	-	-	Yes	Collapsed
w/o	131	G283	16	3450	32	75	Tundra/alder	-	-	-	-	-	-	-	Collapsed
w/o	189	G407	7	2600**	40**	38**	Alders	-	-	-	-	-	-	-	Not visited
MALES	1	G280	6	3950	32	158	Tundra/grass/rock	48	86	-	231	-	269	No	Collapsed
	15	G284?	3	3990	23	216	Tundra/grass	56	83	135	154	77	239	No	ID uncertain
	29	G294	11	2650	30	146	Alder/grass	52	80	-	157	89	188	No	Partially collapsed
	36***	G342A	3	2375	31	288	Alder	38	71	81	86	94	124	No	Partially collapsed
	60	G280	7	4125	26	210	Grass, willow	-	-	-	-	-	-	No	Collapsed
	94***	G342	6	2525	26	299	Alder	66**	74	-	84	81	147	No	Collapsed
	86	G282	7	3200	33	46	Alder, willow	-	-	-	-	-	-	No	Collapsed
	110	G280	8	3950**	26	54	Grass, willow	-	-	-	-	-	-	-	Collapsed
	123	G280	9	2950	40	278	Willow/tundra	-	-	-	-	-	-	-	Collapsed
	132	G279	13	3625	40	258	Willow/tundra	-	-	-	-	-	-	-	Collapsed
	166	G382	3	4950**	50**	22**	Tundra	-	-	-	-	-	-	-	Not visited
	175	G422	7	3045	24	264	Alder	72	84	103	145	108	119	No	Partially collapsed

(continued on next page)

Table 40. (continued)

	Den No.	Bear ID No.	Age at Exit	Elevation (Feet)	Slope (Degrees)	Aspect (True N.)	Vegetation	ENTRANCE Ht. (cm.)	ENTRANCE Width (cm.)	CHAMBER Ln. (cm.)	CHAMBER Width (cm.)	CHAMBER Ht. (cm.)	Total Length (cm.)	Previously Used? (Yes/No)	Comments
DUG DENS UNKNOWN SEX/ID															
	17	-	-	3925	33	192	Willow	61	62	154	162	122	220	No	
	26	-	-	4090	29	162	Willow/grass	73	65	-	-	-	171	No	Partially collapsed
	27	-	-	4125	26	140	Willow/grass	-	58	-	-	68	-	No	Partially collapsed
	53	-	-	4350	31	195	Grass	-	-	-	-	-	-	No	Collapsed
	77	-	-	4050	29	169	Tundra	-	61	-	-	-	-	No	Collapsed
NATURAL CAVITY - FEMALES															
w/1 @2	101***	G380	16	3900	31	60	Tundra	54	112	132	143	109	290	-	Slightly excavated
	165	--	--	5215	36	170	Tundra	66**	133**	-	-	-	552	Yes	Rock cave
UNKNOWN CAVITY TYPE - FEMALES															
w/4 @0	149	G423		3500**	--	--	Tundra	-	-	-	-	-	-	-	Not located
w/1 @1	155***	G403	7	2450	--	343	--	-	-	-	-	-	-	-	Not located
w/o	137	G385	3	--	--	--	--	-	-	-	-	-	-	-	Not located
w/o	139	G315	6	--	--	--	--	-	-	-	-	-	-	-	Not located
w/o	148	G394	7	3000**	--	208**	--	-	-	-	-	-	-	-	Not located
w/o	150	G407	6	--	--	--	--	-	-	-	-	-	-	-	Not located
w/1 yrl	41	G283	14	4000	26	161	--	-	-	-	-	-	-	-	Not visited
w/2 @2	48	G337	14	5050	45**	253**	--	-	-	-	-	-	-	-	Not located
w/o	45	G281	5	4575**	25	176	Grass	-	-	-	-	-	-	-	Not located
w/2 @0	177	G281	8	4600**	--	184**	--	-	-	-	-	-	-	-	Not visited
unk.	196	G315	7	2700**	--	270**	--	-	-	-	-	-	-	-	Not visited
w/o	199	G379***	8	1600**	--	97**	--	-	-	-	-	-	-	-	Not visited
w/2 @0	170	G381	6	--	--	186**	Tundra	-	-	-	-	-	-	-	Not visited
w/o	178	G385	4	3000**	--	262**	Alder	-	-	-	-	-	-	-	Not visited
w/3 @1	183	G420	-	3600**	20**	238**	Tundra	-	-	-	-	-	-	-	Collapsed/not visited

(continued on next page)

Table 40. (continued)

	Den No.	Bear ID No.	Age at Exit	Elevation (Feet)	Slope (Degrees)	Aspect (True N.)	Vegetation	ENTRANCE Ht. (cm.)	ENTRANCE Width (cm.)	CHAMBER Ln. (cm.)	CHAMBER Width (cm.)	CHAMBER Ht. (cm.)	Total Length (cm.)	Previously Used? (Yes/No)	Comments
MALES															
	136	G399	10	--	--	--	--	-	-	-	-	-	-	-	Not located
	151	G342	7	--	--	--	--	-	-	-	-	-	-	-	Not located
	176	G282	9	3400**	30**	301**	Alders	-	-	-	-	-	-	-	Not visited
	197	G399	11	4250**	--	125**	Tundra	-	-	-	-	-	-	-	Not visited

* Entered den with 2 yearlings, shed collar in den so exit not observed.
** Approximate value
*** Downstream

Dens No. 14, 16, 22, 24, 30, 31, 25, 28, 23, 5, 1, 15, 29, 17, 26 27 are 1980/1981

Dens No. 42, 44, 47, 52, 54, 59, 37, 46, 56, 36, 60, 53, 41, 48, 45 are 1981/1982

Dens No. 76, 78, 87, 89, 101, 102, 102, 103, 105, 107, 108, 109, 79, 106, 111, 94, 86, 110, 77 are 1982/1983

Dens No. 112, 117, 118, 119, 120, 121, 124, 125, 133, 134, 135, 153, 122, 131, 123, 132, 149, 155, 137, 139, 148, 150, 136, 151 are 1983/84

Dens No. 179, 194, 161, 164, 193, 162, 182, 192, 195, 163, 189, 166, 175, 165, 177, 196, 199, 170, 178, 183, 176, 197 are 1984/1985

Table 41. Brown bear den elevations by sex and reproductive status. Includes some bears of unknown sex and reproductive status in totals for all bears.

	Mean Elevation (feet)	N	Maximum	Minimum	Std. Dev.
UPSTREAM STUDY AREA					
Females w/COY	4221	29	5330	2010	695.3
Females w/o COY	4181	33	5240	2330	805.8
Females w/COY or YLG	4261	41	5330	2010	662.4
Females w/YLG or @2	4465	19	5240	3350	541.1
Single females	3879	13	5150	2330	939.7
All females	4200	62	5330	2010	750.3
All males	3674	12	4950	2650	652.7
All bears	4128	80	5330	2010	738.6
DOWNSTREAM STUDY AREA					
All bears	2100	10	3900	1050	817.2

Table 42. Distances between den sites (miles) used in different years by radio-collared brown bears. Based on principal winter den, early spring dens not considered.

Bear ID	Age	80/81 to 81/82	80/81 to 82/83	80/81 to 83/84	81/82 to 82/83	81/82 to 83/84	82/83 to 83/84	80/81 to 84/85	81/82 to 84/85	82/83 to 84/85	83/84 to 84/85	$\bar{x}$	s
FEMALES													
G283	13 in'81	3.2	2.4	1.6	5.3	4.9	1.7	3.4	3.5	5.8	4.4	3.6	1.5
G313	10 in'81	4.1	4.4	3.4	6.7	1.0	5.7	-	-	-	-	4.2	2.0
G337	13 in'81	3.3	2.4	1.9	3.7	3.1	0.6	4.2	1.0	4.7	4.1	2.9	1.4
G344	5 in'81	3.1	1.5	3.8	1.6	1.2	2.5	-	-	-	-	2.3	1.0
G299	14 in'81	8.9	6.7	7.1	3.5	3.5	0.5	11.3	2.7	6.2	6.1	5.7	3.2
G281	4 in'81	1.9	1.7	1.7	0.2	0.2	0.1	2.7	1.5	1.6	1.5	1.3	0.9
G335	4 in'82	-	-	-	2.4	2.0	0.9	-	1.4	1.5	1.9	1.7	0.5
G340	4 in'82	-	-	-	0.3	17.7	17.6	-	18.1	18.0	0.6	12.0	9.0
G312	11 in'81	2.1	0.6	-	1.6	-	-	-	-	-	-	1.4	0.8
G379	6 in'83	-	-	-	-	-	5.3	-	-	5.3	0.5	3.7	2.8
G315	2 in'80							-	-	-	0.8	-	-
G381	3 in'82							-	-	2.8	2.5	2.7	-
G388	14 in'83							-	-	-	0.8	-	-
G396	9 in'83							-	-	-	9.0	-	-
G403	4 in'83							-	-	-	2.2	-	-
G407	4 in'83							-	-	-	5.1	-	-
(FEMALES)	$\bar{x}$ =	3.9	2.8	3.3	2.7	4.2	3.9	5.4	4.7	5.7	3.0	$\bar{x}$(n=77)= 3.8	
	s =	2.3	2.1	2.1	2.3	5.7	5.5	4.0	6.6	5.3	2.6	s = 4.0	
												Range = 0.1-18.1	

(continued)

Table 42. (cont'd)

Bear ID	Age	80/81 to 81/82	80/81 to 82/83	80/81 to 83/84	81/82 to 82/83	81/82 to 83/84	82/83 to 83/84	80/81 to 84/85	81/82 to 84/85	82/83 to 84/85	83/84 to 84/85	x̄	s
MALES													
G280	6 in'81	8.1	6.3	6.0	2.0	2.5	0.5	-	-	-	-	-	-
G342	3 in'82	-	-	-	1.3	7.1	7.4	-	-	-	-	-	-
G282	7 in'83	-	-	-	-	-	4.5	-	-	4.6	1.2	4.6	-
G399	20 in'83	-	-	-						-	1.5	-	-
G400	6 in'83	-	-	-						-	1.2	-	-
(MALES)	x̄ =	4.3	3.3	3.6	2.6	4.3	3.9	-	-	4.6	1.3	x̄ (n=14)=3.9	
	s =	2.7	2.3	2.2	2.0	5.1	5.1	-	-	-	0.8	s = 2.7	
												Range = 0.5-8.1	
(BOTH SEXES)													
	x̄ =	4.3	3.3	3.6	2.6	4.3	3.9	5.4	4.7	5.6	2.7	x̄ (N=91)=3.8	
	s =	2.7	2.3	2.2	2.0	5.1	5.1	4.0	6.6	5.0	2.4	s = 3.8	
												Range = 0.1-18.1	

Note: For G341, distance between dens, 81/82 to 85/86, is 2.1 miles (not included in above calculations).

Table 43. Number of observations and percent (in parentheses) of radio-marked black bears within nested impoundment proximity zones of the Watana Impoundment (den-related activities are not included).

TIME PERIOD	ZONE 1 (impoundment)		ZONE 2 (shore-1 mile)		ZONE 3 (1-5 miles)		ZONE 4 (over 5 miles)		TOTAL
1. April 1-30	6	(100)	0		0		0		6
2. May 1-15	31	(44)	31	(44)	8	(11)	0		70
3. May 16-31	84	(55)	55	(36)	13	(9)	0		152
4. June 1-15	142	(55)	69	(27)	43	(17)	6	(2)	260
5. June 16-30	74	(36)	79	(39)	49	(24)	3	(1)	205
6. July 1-15	25	(32)	30	(38)	23	(29)	1	(1)	79
7. July 16-31	50	(40)	46	(37)	28	(23)	0		124
8. August 1-15	40	(39)	41	(40)	22	(21)	0		103
9. August 16-31	37	(30)	44	(36)	40	(33)	2	(2)	123
10. Sept. 1-15	24	(29)	34	(41)	23	(28)	2	(2)	83
11. Sept. 16-March 31	38	(38)	40	(40)	22	(22)	0		100
TOTALS	551	(42)	469	(36)	271	(21)	14	(1)	1305
Area within zone (km^2)	159.32		327.07		1233.51		--		1719.00
%	9.29		19.02		71.72		--		100.0

Value of Chi-Square test of the null hypothesis that the use of each zone is equivalent to expected values based on the area of each zone for:

	ZONE 1 obs.	ZONE 1 E(x)	ZONE 2 obs.	ZONE 2 E(x)	ZONE 3 obs.	ZONE 3 E(x)	X^2	d.f.
All months, 3 zones	551	119.6	469	245.6	271	926.0	2,222**	2
All months, zones 1 & 2 only	551	334.1	469	685.9	--	--	210**	1

* Reject null hypothesis, p less than 0.10.

** Reject null hypothesis, p less than 0.05.

Table 44. Number of observations and percent (in parentheses) of radio-marked black bears within nested impoundment proximity zones of the Devil's Canyon Impoundment (den-related activities are not included).

TIME PERIOD	ZONE 1 (impoundment)	ZONE 2 (shore-1 mile)	ZONE 3 (1-5 miles)	ZONE 4 (over 5 miles)	TOTAL
1. April 1-30	0	1	0	0	1
2. May 1-15	2	33	16	2	53
3. May 16-31	2	43	43	0	88
4. June 1-15	8	70	86	0	164
5. June 16-30	3	45	75	2	125
6. July 1-15	0	21	29	1	51
7. July 16-31	0	13	33	1	47
8. August 1-15	0	17	17	2	36
9. August 16-31	2	18	26	2	48
10. Sept. 1-15	1	13	13	3	30
11. Sept. 16-March 31	0	18	16	2	36
TOTALS	18 (3)	292 (43)	354 (52)	15 (2)	679
Area within zone (km^2)	28.92	164.78	689.01	--	882.71
%	3.28	18.67	78.06	--	100.0

Value of Chi-Square test of the null hypothesis that the use of each zone is equivalent to expected values based on the area of each zone for:

	ZONE 1		ZONE 2		ZONE 3			
	obs.	E(x)	obs.	E(x)	obs.	E(x)	X^2	d.f.
All months, 3 zones	18	21.8	292	124.0	354	518.3	275**	2
May 1-June 30 3 zones	12	9.9	146	56.6	145	236.5	177**	2
May 1-June 30 2 zones	12	23.6	146	134.4	--	--	6.7**	1

* Reject null hypothesis, p less than 0.10.
** Reject null hypothesis, p less than 0.05.

Table 45. Numbers of point locations in each of 4 impoundment proximity zones for individual black bears for each impoundment and for both impoundments lumped. Subadult dispersers and den site locations are not included.

BLACK BEARS-WATANA IMPOUNDMENT ONLY

Bear ID	Sex	Zone 1	Zone 2	Zone 3	Zone 4	Totals
287	M		2	11		13
302	M	46	27	19		92
303	M	1	4	13		18
304	M			18	1	19
305	M			6	3	9
322	M	7	3	1		11
323	M	4	10	14		28
324	M	3	9	5		17
346	M	6	33	9		48
348	M		2	2		4
357	M	12	5		17	
359	M	36	35	14		85
360	M	11	22	3		36
387	M	17	19	30		66
401	M	19	4	2		25
416	M	3	4	6	4	17
342B	M	13	14	10	3	40
All Males		178	193	163	11	545
%		32.7	35.4	29.9	2.0	

	Sex	Zone 1	Zone 2	Zone 3	Zone 4	Totals
289	F	36	9	16		61
301	F	16	39		55	
317	F		6	4		10
318	F	3	1	3	3	10
321	F		3	2		5
327	F	39	11	2		52
328	F		5	21		26
329	F	90	15	1		106
349	F	22	35	28		85
354	F	12	35	3		50
358	F	34	33	6		73
361	F	65	21	2		88
363	F	16	35	3		54
364	F	37	22	11		70
Watana All Females		370	270	102	3	745
%		49.7	36.2	13.7	0.4	100
Watana ALL BEARS		548	463	265	14	1290
%		42.5	35.9	20.5	1.1	100

(continued)

Table 45. (cont'd)

BLACK BEARS-DEVILS CANYON IMPOUNDMENT ONLY						
Bear ID	Sex	Zone 1	Zone 2	Zone 3	Zone 4	Totals
287	M	1	16	14	1	32
303	M	11	29			40
304	M	4	12			16
319	M	8	6			14
324	M	23	19	7		49
348	M	4	5			9
359	M	2	4			6
401	M	4	31	11		46
416	M	2	11	22	3	38
All Males		7	110	122	11	250
%		2.8	44.0	48.8	4.4	
		Zone 1	Zone 2	Zone 3	Zone 4	Totals
288	F		12	4		16
289	F		27	35		62
290	F	2	14	13		29
317	F	2	42	51		95
318	F		16	19		35
321	F	3	29	29		61
325	F	1	2	6		9
327	F		6	5		11
328	F	2	10	38		50
329	F		1	1		2
Devils Canyon All Females		10	159	201	0	370
%		2.7	43.0	54.3	0.0	100
Devils Canyon ALL BEARS		17	269	323	11	620
%		2.7	43.4	52.1	1.8	100
Both impoundments All Males		185	303	285	22	795
%		23.3	38.1	35.8	2.8	100
Both impoundments All Females		380	429	303	3	1115
%		34.1	38.5	27.2	0.3	100
Both impoundments ALL BEARS		565	732	588	25	1910
%		29.6	38.3	30.8	1.3	100

Table 46. Number of Susitna River crossings by radio-marked black bears, 1980-1984.

Bear ID	Yr. initial capture (age)	No. river crossings by upstream bears 1980	1981	1982	1983	1984	Comments
Males (upstream)							
416	1984(A)	-	-	-	-	1	active
330	1981(1)	-	0	-	-	-	318's cub, died fall '81
323	1980(2)	2	4	2	3	-	-dead (in hunter's cabin)
358	1982(2)	-	-	0	2	0	natural mortality 7/84
319	1980(3)	4	3	-	-	-	dead, 9/81
401	1983(3)	-	-	-	2	8	active
291	1980(4)	0	-	-	-	-	dead 8/80
322	1980(4)	0	-	1	-	-	dead 6/82, (shed collar '81, recap '82)
320	1980(4)	1	-	-	-	-	shot (hunter) 9/80
357	1982(4)	-	-	4	-	-	dead 3/83
359	1982(4)	-	-	0	0	8	active
387	1983(4)	-	-	-	0	0	active
324	1980(5)	0	4	4	4	0	shot (hunter) 9/84
342B	1981(5)	-	0	-	-	-	shot (hunter) 9/81
343	1981(5)	-	3	3	2	4	active
300	1980(7)	-	-	-	-	-	dead 5/80
360	1982(7)	-	-	2	4	0	shed collar 4/84
302	1980(8)	0	12	2	-	2	collar shed '80; recaptured but radio failure in 1982
303	1980(8)	2	0	0	0	-	shot (hunter) 9/83
305	1980(9)	2	-	-	-	-	shot (hunter) 8/80
346	1981(9)	-	2	4	8	0	natural mortality 5/84
348	1981(9)	-	2	1	-	-	shot (hunter) 9/82
287	1980(10)	0	2	2	-	-	shot (hunter) 9/82
304	1980(10)	0	0	1	-	-	shed collar 5/82
Total males (upstream)		11	32	26	25	23	

(continued)

Table 46. (continued)

Bear ID	Yr. Initial capture (age)	No. river crossings by upstream bears 1980	1981	1982	1983	1984	Comments
Females (upstream)							
329	1981(1)	-	2	2	5	10	327's cub
349	1981(4)	-	0	0	0	0	shed collar 7/83
363	1982(4)	-	-	0	0	0_{*2}	active
379	1983(4)	-	-	-	0	-	dead; possibly killed by other bears
318	1980(5)	0_{*1}	0	0	0	-	shed collar
326	1980(5)	0	-	-	-	-	shot
327	1980(5)	1_{*2}	8_{y1}	7	1_{*2}	-	dead 7/83
354	1982(5)	-	-	0_{*2}	0	0_{*2}	active
328	1980(6)	-	0_{*2}	0	-	0	shed collar 1982, active
364	1982(6)	-	-	7	-	6_{y1}	missing ** 9/82
301	1980(7)	2	0_{*2}	0	-	-	shed collar 8/83
317	1980(7)	0_{*2}	0_{y1}	0	0_{*1}	0_{y1}	active
361	1982(7)	-	-	2	0_{*3}	0_{y3}	active
290	1980(8)	4_{*1}	0	-	-	-	not recollared (infected neck)
289	1980(9)	4	0_{*3}	0_{y1}	1_{*2}	5_{y1}	active
288	1980(10)	0_{*3}	-	-	-	-	shed collar 9/80
321	1980(10)	0	2_{*2}	0	0	0_{*1}	active
325	1980(11)	0	2	-	-	-	shed collar 1981, 1982
316	1980(11)	0	2	-	-	-	shed collar 1981, 1982
Total females (upstream)		11	14	18	7	21	
Total both sexes (upstream)		22	46	44	32	44	

(continued)

Table 46. (continued)

Bear ID	Yr. Initial capture (age)	No. of river crossings by downstream bears 1982	1983	1984	Comments
Males (downstream)					
408	1983(3)	-	0	2	active
365	1982(5)	0	0	-	dead 9/83
366	1982(6)	1	-	-	shot 8/82
Total Males		1	0	2	
Females (downstream)					
369	1982(3)	0	0	0_{*2}	active
367	1982(4)	0	0	-	shot ("DLP")
377	1982(4)	2	3	3	active
409	1983(5)	-	0	0	active
376	1982(6)	2_{y1}	4_{*3}	2_{y3}	active
378	1982(6)	0	0_{*1}	0_{y2}	active
410	1983(7)	-	0	-	shot ("DLP" 7/83)
374	1982(7)	0	0_{*3}	-	shot 9/83
370	1982(7)	0	0_{*2}	-	missing**
411	1983(8)	-	2_{y2}	2_{*2}	active
375	1982(9)	5	4_{*1}	3_{y2}	active
372	1982(9)	0	0_{*2}	-	missing**
402	1983(10)	-	2_{y3}	2	active
404	1983(11)	-	2_{*1}	2	active
406	1983(11)	-	0_{*2}	0_{y2}	missing 10/84
405	1983(17)	-	-	0_{y2}	active
Total females (downstream)		9	17	14	
Total both sexes (downstream)		10	17	16	

** possible unreported hunter kill, collar failure, or emigration.

Reprod. status: * = cub of year y = yrlg.

Table 47. Scat analyses of brown bear and black bear scats collected in the Su-Hydro study area, 1980-1982. (Analyses done by Paul Smith, ADF&G, Soldotna). Values are % volume (T=trace, 2=6-25%, 3=26-50%, 4=51-75%, 5=76-100%).

Date Collected	Species of bear	Location	Sample No.	Comments	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
5/26/82	BK (B352)	upstream	9	Capture site	5															T
5/27/82	BK (B363?)	upstream	12	capture site	5												T		T (ants)	T
5/27/82	BK (357)	upstream	30	Capture site		3		2		2				T	4 (calf hair?)				T (ants)	T
6/1/81	BK (B327)	upstream	25	Den				5			2			T						T
6/13/81	BK (B348)	upstream	14	Den	5															T
5/23/81	?	upstream	5	Helms	5														T (1 fly)	T
5/23/81	?	upstream	6	Helms	5	T		5			T		T	T						T
6/1/81	?	upstream	19	Pickup	5														T (ants, beetles)	T
6/6/79	?	upstream	39	Pickup	5															T
6/8/79	?	upstream	15	Helms									5						T (flies)	T
6/8/82	?	upstream	16	Helms	5											T			T (flies)	T
6/16/82	?	upstream	32	Pickup	5							T							T	T
6/19/82	?	upstream	37	Pickup	3								3						2 (ants)	T
6/24/82	?	upstream	33	Pickup	5											2 hare			T	T
6/28/82	?	upstream	54	Helms	4															2
7/1/82	?	upstream										T	5	T						T
7/1/82	?	upstream	51	Pickup								T	5	T						T
7/1/81	?	upstream	2	Pickup	5			T				T	T?		T					T
7/1/81	?	upstream	3	Pickup	5										T					
7/1/81	?	upstream	1	Pickup	5										T					
7/1/81	?	upstream	49	Pickup									3		3?				T	3
7/1/81	?	upstream	47	Pickup	5														T (ants)	T
5/24/79	BR (G245)	upstream	46	Yearling		T		T						T		5 (squirrel)				
SUMMER - FALL Upstream																				
8/18/80	BK (B327)	upstream	36	Capture				T			5			T						2
8/18/80	BK (328)	upstream	38	Capture				3			4			T						2
8/19/80	BK (B303)	upstream	35	Capture				3			3			T						2
SUMMER - FALL - Sloughs																				
8/31/82	?	downstream	13	A					5											T
8/31/82	?	downstream	42	8B		2		3	3									T		T
8/30/82	?	downstream	23	8A-8B	T				5											T
8/30/82	?	downstream	8	8B			T		5											T
8/31/82	?	downstream	31	A			2	T	4											3
8/31/82	?	downstream	20	21				3	3		T							2		T
9/2/82	?	downstream	41	8B					5											2

1. Equisetum spp. (horesetail)

Berries

2. Vaccinium vitis-idaea (lowbush cranberry)
3. Viburnum edule (highbush cranberry)
4. Empetrum nigrum (crowberry)
5. Oplopanax horridus (Devils club)
6. Arctostaphylos alpina (bearberrry)
7. Vaccinium uliginosum (blueberry)
8. Lichens
9. Grasses or sedges
10. Ledum sp. (Labrador tea)

Animal matter

11. Moose
12. Hare or ground squirrel
13. Feathers
14. Fish
15. Insects

Other

16.

Table 48. Analyses of brown bear and black bear scats collected in the Su-Hydro study area, 1983. (Analyses done by Paul Smith, ADF&G, Soldotna). Values are % volume (T=trace, 2=6-25%, 3=26-50%, 4=51-75%, 5=76-100%).

Date Collected	Species of bear	Place	Sample No.	Comments	1	2	3	4	5	7	9	10	11	12	13	14	15	16	17	18	19
Summer - Fall - Sloughs																					
8/18/82	?	upstm	25	Steigers-84										2							5
8/20/83	?	upstm	27	Steigers-84		2				3	3										
8/25/83	?	dstm	5	Slough 8A					5										2		
8/25/83	?	dstm	7	Slough 8A			T		5												
8/25/83	?	dstm	8	Slough 8A					5												
8/25/83	?	dstm	28	Slough 8A	T				5											2	
8/25/83	?	dstm	31	Slough 8A					4		2								T	T	
8/24/83	?	dstm	13	Slough 8B			T		5						T				T		
8/24/83	?	dstm	4	Slough 8B					5									T	T	T	
8/24/83	?	dstm	21	Slough 8B			T		5										T		
8/24/83	?	dstm	17	Slough 8B					5										T	T	
8/24/83	?	dstm	30	Slough 8B	T		T		4		T								T	T	
8/24/83	?	dstm	6	Slough 8B	T				4		T									2	
8/24/83	?	dstm	18	Slough 8B					3										T	2	
8/24/83	?	dstm	9	Slough 8B					3										3	T	
8/24/83	?	dstm	15	8B + nematode	3		3		3												
8/25/83	?	dstm	14	Slough 8A					4									T	T	T	
8/25/83	?	dstm	22	Slough 8A	T		2		2		5						T			2	
8/25/83	?	dstm	3	Slough 11					5												
8/26/83	BRB?	dstm	43	Slough 20					3												
8/26/83	BRB?	dstm	33	Slough 21					5											T	
8/26/83	BRB?	dstm	29	Slough 21			T		5		T								T		
8/26/83	BRB?	dstm	26	Slough 21					5												
8/26/83	?	dstm	24	Slough 21	3				3									2		T	
8/26/83	?	dstm	16	McKenzie Ck.					5					T			T		T	T	
8/25/83	?	dstm	19	Moose Ck.	2				5									T	T	T	
8/25/83	?	dstm	27	Moose Ck.					5											T	
8/25/83	?	dstm	11	Moose Ck.					5												
8/24/83	?	dstm	12	Slough 8	T		T		5											T	
8/25/83	?	dstm	23	Slough 8A			T		5								T				
8/25/83	?	dstm	20	Slough 8A					5												
8/25/83	?	dstm	25	Slough A'	T		3		3		T							T		T	
8/18/83	?	upstm	42	Berry Plot #1		3							T		T				2		
8/18/83	?	upstm	44	Berry Plot #2		3				3			T			T	T		T		
8/18/83	?	upstm	45	Berry Plot #1		T				3	T	T						3			
8/18/83	?	upstm	46	Berry Plot #1	2	3					2										
9/16/83	?	upstm	22	Steigers-84		2		2		4											
Spring Samples																					
5/19/83	?	upstm	23	Steigers-84				5						T							
5/19/83	BKB	upstm	36	B404	2						5										
5/31/83	?	upstm	24	Steigers-84	3	3															
5/19/83	?	upstm	26	Steigers-84									5								
6/7/83	?	upstm	32	Forest area	5																
6/7/83	BKB	upstm	34	B361 den	5	T					2										
6/8/83	?	upstm	35	+ nematodes		3		3													
6/8/83	BKB	upstm	40	B372 den							5										
6/9/83	BKB	upstm	10	B374							5										
6/10/83	BKB	upstm	37	B358 den		2		2		2		T	T					T			
6/9/83	?	dstm	38	Deadhorse Ck.	5												T				

(continued)

Table 48. (continued)

1. *Equisetum spp*. (horsetail)
8. Lichens
9. Grasses or sedges
19. Clover (*Trifolium* spp.)

Berries

2. *Vaccinium vitis-iadea* (lowbush cranberry)
4. *Empetrum nigrum* (crowberry)
5. *Oplopanax horridus* (devil's Club)
6. *Arctosptaphylos alpina* (bearberry)
7. *Vaccinium uliginosum* (blueberry)
18. *Streptopus amplexifolius* (watermelon berry)
17. Other berries
    Sambucus racemosa (red elderberry)
    Oxycoccus microcarpus (bog cranberry)
    Sorbus scopulina (Greene Mt. ashberry)
    Shepherdia canadensis (soapberry) - #42
    Cornus canadensis (Cornus berry)
    Vaccinium ovalifolium (early blueberry)
    Viburnum edule (highbush cranberry)
    Ribes triste (red currant)

Animal Matter

11. Moose
12. Hare or ground squirrel, misc.
13. Feathers
14. Fish
15. Insects

16. Other Misc.

Table 49. Analyses of brown bear and black bear scats collected in the Su-Hydro study area, 1984. (Analyses done by Paul Smith, ADF&G, Soldotna). Values are % volume (T=trace, 2=6-25%, 3=26-50%, 4=51-75%, 5=76-100%).

Date Collected	Species of bear	Place	Sample No.	Comments	1	2	3	4	5	6	9	11	12	13	14	15	16	17	18	19	
Summer - Fall - Sloughs																					
8/3/84	?	upstm	6	1700' elev.		2		2									T				4
8/5/84	?	upstm	19	Watana Camp	2	2					3					T				3	
8/5/84	?	upstm	4	Watana Camp		T										2	T			5	
8/15/84	?	dstm	55	Lane Ck.					4									2	2		
8/15/84	?	dstm	60	Slough 8B					3		3								2		
8/15/84	?	dstm	64	Portage Ck. S.					5										T		
8/15/84	?	dstm	65	McKensie Ck.					5												
5/15/84	?	dstm	66	Lane Ck.					5										T		
8/16/84	?	dstm	28	Slough 28					5								T	T			
8/16/84	?	dstm	29	Slough 8A					4					T				2			
8/16/84	?	dstm	30	Slough A					4									2	2		
8/16/84	BKB	dstm	31	Slough 9					3							T		3	2		
8/16/84	?	dstm	32	Slough A					3					T				3	T		
8/16/84	?	dstm	33	Slough A					3									3	2		
8/16/84	?	dstm	34	Slough 11					3		T					T	T	3	T		
8/16/84	?	dstm	35	Slough 8A					3									3			
8/16/84	?	dstm	36	Slough 9A					5				T						T		
8/16/84	?	dstm	37	Slough 11					4		T							2	2		
8/16/84	?	dstm	38	Slough 11					4									2	2		
8/16/84	?	dstm	39	Slough 9A	T				5									T			
8/16/84	?	dstm	40	Slough 21	2				2		2						T	2	2		
8/16/84	?	dstm	41	Slough 21					2		2		T					2	2		
8/16/84	?	dstm	42	Slough 21					3										2		
8/16/84	?	dstm	43	Slough 21	2				3		2								T		
8/16/84	?	dstm	44	Slough 21					5										T		
8/16/84	?	dstm	45	4th July Ck.					4									3	T		
8/16/84	?	dstm	46	Slough 8A					4		T							2			
8/16/84	?	dstm	47	Slough 11					2										5		
8/16/84	?	dstm	48	Slough 8A					T								T	3	T		
8/16/84	?	dstm	49	Slough 9A					3										3		
8/16/84	?	dstm	50	Riverbank					3									3			
8/16/84	?	dstm	51	Slough 8A					T									3			
8/16/84	?	dstm	52	Slough 8A					5		T							2			
8/16/84	?	dstm	53	Slough 8A	T				4									T	2		
8/16/84	?	dstm	54	5th July Ck.					5												
8/16/84	?	dstm	56	5th July Ck.		T			2	3									3		
8/16/84	?	dstm	57	5th July Ck.					3									2	2		
8/16/84	?	dstm	58	5th July Ck.														2	4		
8/16/84	?	dstm	62	Slough 9					2									3	2		
8/16/84	BKB	dstm	61	Slough 8A					2					2				3	T		
8/16/84	?	dstm	59	Slough A					5									T	T		
8/16/84	?	dstm	63	Slough 9					5												
8/23/84	?	upstm	15	E. Fk. Watana	2	T					3									3	
8/23/84	?	upstm	16	E. Fk. Watana	3	T					3						T			3	

(continued on next page)

Table 49. (cont'd)

Date Collected	Species of bear	Place	Sample No.	Comments	1	2	3	4	5	6	9	11	12	13	14	15	16	17	18	19
SPRING SAMPLES																				
5/15/84	BRB 299	upstm	7	Susitna		2		4				T								
5/15/84	BRB 418	upstm	5	ylg w/299		5						T								
5/15/84	BRB 417	upstm	11	ylg w/299		T		3				3					T			
5/15/84	BRB 419	upstm	12	ylg w/299				5				T					T			
5/15/84	BRB 399	upstm	14	Susitna		T					3	4								
5/16/84	BRB 312	upstm	8	Stomach		T					T		5							
5/16/84	BKB 349	upstm	1	Anal plug																
5/18/84	BRB 422	upstm	9	On old moose kill		2		2				4					T			
5/27/84	BRB	upstm	10	On calf kill		T		2				5					T			
5/27/84	BRB	upstm	21	On calf kill		2		2				3					T			
5/29/84	BRB cub	upstm	3	Abandoned cub				3		2		T					T	2		
5/30/84	BRB	upstm	17	On calf kill	2							5					T			
5/31/84	BRB	upstm	2	On calf kill				4				T		2		T				
5/31/84	BRB	upstm	13	On calf kill	5	2						T					T			
5/31/84	BRB	upstm	18	On calf kill	2	2		2			3	3					T			
6/20/84	BKB	upstm	20	den of B401	3	3		2				T					T			

1. Equisetum spp. (horsetail)
8. Lichens
9. Grasses or sedges
19. Clover (Trifolium spp.)

Berries

2. Vaccinium vitis-idaea (lowbush cranberry)
4. Empetrum nigrum (crowberry)
5. Oplopanax horridus (devil's Club)
6. Arctosptaphylos alpina (bearberry)
7. Vaccinium uliginosum (blueberry)
18. Streptopus amplexifolius (watermelon berry)
17. Other berries
    Sambucus racemosa (red elderberry)
    Oxycoccus microcarpus (bog cranberry)
    Sorbus scopulina (Greene Mt. ashberry)
    Shepherdia canadensis (soapberry) - #42
    Cornus canadensis (Cornus berry)
    Vaccinium ovalifolium (early blueberry)
    Viburnum edule (highbush cranberry)
    Ribes triste (red currant)

Animal Matter

11. Moose
12. Hare or ground squirrel, misc.
13. Feathers
14. Fish
15. Insects

16. Other Misc.

Table 50. Salmon abundance in downstream sloughs and streams, 1981-1984.

		No. Adult Salmon Enumerated*			
AREA	RIVER MILE	1981 (N**)	1982 (N**)	1983 (N**)	1984 (N**)
Slough 21	141.0	747 (5)	2424 (9)	1904 (13)	7197 (9)
Slough 11	135.3	5483 (9)	4806 (11)	5067 (23)	9749 (8)
Slough 8A	125.1	1283 (5)	1804 (10)	843 (20)	3054 (8)
Slough 20	140.0	27 (2)	220 (7)	201 (20)	695 (4)
Slough 9A	133.3	484 (6)	146 (3)	217 (3)	574 (5)
Moose Slough	123.5	555 (5)	115 (7)	392 (15)	405 (5)
Slough 8B	122.2	1 (1)	190 (6)	240 (6)	1749 (8)
Slough 8C	121.9	(0)	105 (3)	(0)	416 (5)
Slough 17	138.9	169 (7)	29 (4)	182 (8)	240 (4)
Slough 15	137.2	1 (1)	178 (3)	20 (5)	611 (1)
Slough B	126.3	NA	225 (6)	9 (1)	196 (5)
Slough 9	128.3	380 (5)	911 (6)	1081 (9)	499 (3)
Slough 6A	112.3	27 (3)	101 (4)	2 (1)	3 (1)
Sloughs A & A'	124.7	437 (10)	(0)	528 (16)	338 (5)
Slough 8	113.7	858 (5)	(0)	(0)	193 (6)
Slough 9B	129.2	678 (7)	(0)	(0)	181 (3)
Slough 19	139.7	84 (6)	(0)	18 (6)	147 (7)
Slough 22	144.5	NA	NA	274 (4)	199 (3)
Mainstream Zone 3	135.2	NA	NA	252 (2)	No data
Slough 2	100.2	44 (5)	0	103 (4)	287 (9)
Indian River***	138.6	232 (7)	6703 (12)	7958 (16)	14898 (9)
Lane Ck	113.6	569 (7)	2508 (11)	118 (9)	2837 (9)
4th of July Ck.	131.0	247 (6)	2832 (11)	636 (9)	6160 (7)
Little Portage Ck.	117.7	NA	407 (9)	10 (2)	384 (7)
Lower McKenzie Ck.	116.2	97 (6)	492 (6)	46 (6)	1067 (7)
5th of July Ck.	123.7	2 (1)	224 (4)	24 (4)	834 (5)
Skull Ck.	124.7	24 (3)	36 (4)	1 (1)	216 (3)
Portage Ck.	148.9	22 (1)	2238 (7)	4651 (13)	15319 (19)

(continued on next page)

Table 50. (cont'd)

AREA	RIVER MILE	No. Adult Salmon Enumerated* 1981(N**)	1982(N**)	1983(N**)	1984(N**)
Gash Ck.	111.6	258 (2)	163 (3)	35 (2)	711 (7)
Slash Ck.	111.2	NA	6 (1)	2 (1)	8 (2)
Whiskers Ck.	101.4	212 (7)	626 (5)	273 (9)	899 (11)
Jack Long Ck.	144.5	1 (1)	54 (7)	19 (5)	27 (3)
Deadhorse Ck	120.9	0	NA	NA	378 (2)
Upper McKenzie Ck.	116.7	0	24 (2)	(0)	23 (3)
Chase Ck.	106.9	328 (8)	332 (8)	26 (5)	1523 (9)
Gold Ck.	136.7	0	37 (3)	51 (3)	83 (1)
Sherman Ck.	130.8	32 (4)	40 (4)	(0)	126 (3)

* These data sum all live and dead fish (Chinook, Sockeye, Pink, Chum, and Coho Salmon) recorded by Su-Hydro AA personnel (ADF&G) during stream surveys. Different areas were surveyed from 1 to 11 times during the year which contributes to variation observed between areas and between years in this data, survey conditions also varied. Note that the same fish would likely be recorded numerous times in replicate surveys.

** N is the number of surveys conducted where salmon were enumerated, surveys where no salmon were seen are not counted.

*** The portion of the Indian River evaluated by Fisheries personnel varied in 1981 and 1982. Most fish were found in 1982 in a tributary about ½ mile up from the mouth (Crowe, per. commun.) during our investigation of the Indian River we did not observe this location.

Table 51. Ranking of bear and salmon use of downstream sloughs and creeks on 24-25 August, 1983. (0=lowest on scale of 0-10).

Slough No.	Index of salmon presence	Index of bear use	Comments	Apparent use by radio-collared individuals
7	0	1	entrance into slough blocked	
8	1	1		
8A	3	4		B376,B402
8B	2	4	less bear sign than last year flooded and muddy	B378
8C	1	1		
8D	0	1		
A	0	1	flooded	
A'	1	2		
9	1	2		B404
9B	1	2		B404,B411
9A	1	3		
10	1	1		
11	7	1		
17	4	1	flooded	
19	1	1		
20	1	1	BRB tracks	
21	2	3	1 salmon eaten by a bear, BRB tracks	
Lane Ck	2	1	about 20 pinks seen	
Lower McKensie Ck	1	1	few salmon	
McKensie Ck	0	1	human trail along Ck to homesite	
Portage Ck	0	1		
Deadhorse Ck	0	0		B343
Moose and Clear Creeks	1	3		
5th of July	1	1		B374
4th of July	5	1	lots of salmon at mouth of creek	B405, B411

* Had been lots of rain and sloughs were very high and muddy, salmon were difficult to spot in the sloughs.

Table 52. Ranking of bear and salmon use of downstream sloughs and creeks on 15-16 August, 1984. (0=lowest on scale of 0-10).

Slough No.	Index of salmon presence	Index of bear use	Comments	apparent use by radio-collared individuals
8	1	4		
8A	8	6	some salmon eaten	B404, G379
8B	3	6		
8C	1	2		
8D	0	1		
A	0	1		B343,
A'	4	1		
9	3	2		
9B	3	2		G379
9A	2	2		B409
10	ND	ND		B411
11	9	2		
17	3	1		
20	4	3		
21	5	6	salmon eaten	
Lane Ck	7	5	lots of Pinks, some eaten	
Lower McKensie Ck	3	2		
McKensie Ck	2	1		
Portage Ck	3	2	some salmon eaten	
Deadhorse Ck	2	2	entrance perched	
Moose and Clear Creeks	1	3		
5th of July	8	7		B376
4th of July	7	8	many salmon eaten	B405

Table 53. Summary of black bear litter size data based on observations of bears with litters of newborn cubs.

MOTHER'S ID (age-year)	LITTER SIZE	COMMENTS
B289 (10 in spring '81)	3	lost 1 in August, 2 survived
B289 (12 in spring '83)	2	lost 1 cub in September, other survived to den exit
B289 (14 in spring '85)	2 (in den) [2 at exit]	both survived to yearling age
B301 (8 in spring '81)	2	both survived to yearling age
B301 (10 in spring '83)	2 (in den) [2 at exit]	survivorship undetermined, female shed collar
B317 (7 in summer '80)	2 (summer)	initial capture in summer, both survived to fall, cubs not seen with bear at initial capture
B317 (10 in '83)	2 (in den) [2 at exit]	lost 1 in June, other survived to den exit
B317 (12 in spring '85)	2 (in den) [2 at exit]	1 survived to den entrance, 1 lost in July
B318 (5 in summer '80)	1 (summer)	survived
B318 (8 in '83)	2 (den) [2 at exit]	both lost by 6/6/83 apparently, shed collar
B328 (7 in summer '81)	2 (summer)	bred in 1980. Lost 1 by 7/29/81, shed collar in den (not sure if survived until exit)
B328 (11 in spring '85)	3 (in den) [3 at exit]	lost 6/6 - 7/24
B326 (5 in summer '80)	2 (summer)	bear shot in 1980, cubs may have been adopted by B317
B321 (11 in spring '81)	2	no cubs in summer 1980, both cubs lost by 8/24/81, no litter in '82, no litter verified in 1983 but may have lost a litter early in 1983, bred in 1983
B321 (14 in '84)	2	lost 1 of 2 by 6/29, other survived to den entrance
B327 (5 in summer '80)	2 (summer)	both survived to yearling age
B327 (8 in '83)	2 (den) [2 at exit]	cubs survived into June, female died in July

(continued on next page)

Table 53. (cont'd)

MOTHER'S ID (age-year)	LITTER SIZE	COMMENTS
B349 (6 in spring '83)	2 (den) [0 at exit?]	first litter, no cubs in summer '81 or spring '82, cubs apparently lost in May '83, collar shed in July -- no ylgs on 5/84
B349 (8 in spring '85)	2 (in den) [2 at exit]	one survived to den entrance, 1 lost in August
B354 (5 in '82)	2	both survived to den entrance, at least 1 ylg at exit in '83
B354 (7 in '84)	2	may have lost 1 by den entrance date
B354 (9 in '86)	2	both survived to den entrance
B361 (8 in '83)	4 (in den) [3 at exit]	lost 1 in den prior to exit, others survived to den exit in '84
B370 (8 in '83)	2 (in den) [2 at exit]	bear missing after 5/23/83, cubs alive at that time
B363 (6 in '84)	2 (in den) [2 at exit]	None lost to den entrance
B364 (10 in '86)	2	both survived to den entrance
B369* (6 in '84)	2 (in den) [2 at exit]	none lost to den entrance
B372* (10 in '83)	3(in den) [3 at exit]	lost 1 in early July, others survived to 7/20, female lost in September '83
B374* (7 in '83)	3	think lost 2 in July, bear shot in September '83
B375* (6 in '83)	2	both survived to exit in '84
B376* (5 in '83)	3 (in den) [3 at exit]	all survived to exit in '84
B377* (5 in '83)	[1-2??] NOT COUNTED	cubs may have been lost prior to or during capture, cubs not seen during capture but saw at least 1 cub 9 days earlier on 5/10/83
B377 (6 in '84)	some (in den) [0 at exit]	heard at least 1 cub in den, none seen at exit
B377 (7 in '85)	2 (in den) [2 at exit]	lost 1 in June, other in August-September

(continued on next page)

Table 53. (cont'd)

MOTHER'S ID (age-year)	LITTER SIZE	COMMENTS
B378* (7 in '83)	2(den) [2 at exit]	both survived to '84 den exit
B378* (9 in '85)	1	survived to den entrance
B379 (9 in '83)	3(den) [2 at exit]	lost all cubs by 5/23/83, bred again, died in July
B402* (12 in '85)	2 (in den) [2 at exit]	both survived to den entrance
B404* (11 in '83)	1	survived thru 7/20/83 at least, not seen in '84
B405* (17 in'83)	2	both survived to den exit in '84
B406* (11 in '83)	2	both survived to den exit in '84
B409* (?)(6 in '84)	?	not observed in '84
B409* (8 in '86)	[2(?)]	data not conclusive, not included in means
B410* (7 in '83)	2	both survived thru June, bear shot in July
B411* (9 in '84)	2	status at entrance into '84 den unknown
B438 (9 in '86)	3	B438 probably shot by 9/5/86, cub status unknown

Table 53. (cont'd)

Total number of cubs	Number of litters	Mean litter size (range)	Comments (includes)
90	42	2.1(1-4)	all cub litters counted at earliest observation
75	35	2.1(1-3)	spring observations only (w/o den data or summer litters)
81	36	2.3(1-4)	earliest observation excluding summer litters
44	19	2.3(2-4)	observations in dens only

* Downstream study area

Table 54. Summary of black bear litter size data based on observations of bears with litters of yearlings (age at exit from den).

MOTHER'S ID (age-year)	LITTER SIZE	COMMENTS
B288 (10 in 1980)	3	bred in 1980, ylgs with female into August, shed collar in 1980
B290 (8 in 1980)	2	weaned by 6/23/80, bred in 1981, collar removed on 8/5/81 (neck scarred)
B289 (9 in 1980)	2	weaned by 5/22/80, bred, 3 cubs in '81
B289 (13 in 1984)	1	with mom to September bred in June
B289 (11 in 1982)	2 (in den)	weaned by 6/9/82, bred, had 2 cubs in 1983
B289 (15 in 1986)	2	weaned by 7/9/86
B301 (7 in 1980)	1	weaned by 6/12/80, bred, had 2 cubs in 1981
B301 (9 in 1982)	2	weaned by 6/17/82, bred, had 3 cubs in 1983
B317 (8 in 1981)	2	weaned by 6/18/81, bred, 1 ylg returned and was with female until 9/9/81, no cubs in 1982
B317 (11 in 1984)	1	weaned in June, bred
B318 (6 in 1981)	1 (den)	ylg (B330) weaned by 5/29/81, bred, ylg died by 8/24/81, no (reason?) cubs in 1982, bred again, 2 cubs in 1983
B318 (10 in 1985)	2	B318 not located after 6/11/85
B327 (5 in 1981)	2 (den)	ylg B329 and sibling, sibling weaned by 6/5/81, B329 by 6/21, bred, no cubs in 1982, bred again, cubs in 1983
B349 (9 in 1986)	1	
B354 (6 in 1983)	1 (?)	at least 1 ylg exited den (perhaps both?), weaned by 6/2/83

(continued on next page)

Table 54. (cont'd)

MOTHER'S ID (age-year)	LITTER SIZE	COMMENTS
B363 (8 in 1985)	2	weaned by 9/4/85
B364 (8 in 1984)	3	2 weaned early, bred, still with one in September
B369* (7 in 1985)	2 (in den) [2 at exit]	
B402* (10 in 1983)	3	weaned in early July
B402* (13 in 1986)	2	weaned by September
B411* (8 in 1983)	2	weaned after 6/13
B321 (15 in 1986)	1	weaned by 6/27/85
B361 (9 in 1984)	3	entered den w/mom, weaned at age 2
B375* (11 in 1984)	2	weaned in June
B376* (8 in 1984)	3	weaned 2 in June, 1 with mom in October
B378* (8 in 1984)	2	Not seen after June
B404* (12 in 1984)	[?]	'84 status not verified
B405* (18 in 1984)	2	with mom into August
B406* (12 in 1984)	2	weaned by September
B432 (6 in 1985)	1	weaned by 6/3/85

Total number of ylgs. observed	number of litters	mean litter size (range)	comments
54	28	1.9(1-3)	all litters with ylgs. counted

* Downstream study area

Table 55. Sex ratio and morphometrics of black bear cubs-of-year handled in the Susitna Hydro Project.

CUB ID	MOTHER'S ID	DATE HANDLED	SEX	WT(lbs)	COMMENTS
355	B354	26 May 1982	F	--	ear tags
356	B354	26 May 1982	M	--	ear tags
--	B301	20 March 1983 (den)	F	2.6	
--	B301	20 March 1983 (den)	F	2.5	
--	B361	21 March 1983 (den)	M	3.5	
--	B361	21 March 1983 (den)	F	3.8	
--	B361	21 March 1983 (den)	F	3.5	
--	B361	21 March 1983 (den)	F	2.8	
--	B349	22 March 1983 (den)	F	3.5	
--	B349	22 March 1983 (den)	F	3.4	
--	B317	23 March 1983 (den)	M	4.3	neck=175mm
--	B317	23 March 1983 (den)	M	4.3	neck=180mm
--	B318	23 March 1983 (den)	M	2.8	
--	B318	23 March 1983 (den)	F	2.7	
--	B327	23 March 1983 (den)	M	5.3	neck=190mm
--	B327	23 March 1983 (den)	F	4.5	neck=180mm
--	B379	24 March 1983 (den)	M	2.8	
--	B379	24 March 1983 (den)	M	3.3	
--	B379	24 March 1983 (den)	M	3.3	
--	B372	15 April 1983 (den)	F	3.7	
--	B372	15 April 1983 (den)	F	4.1	
--	B372	15 April 1983 (den)	M	4.5	
--	B376	16 April 1983 (den)	M	6.0	neck=190mm
--	B376	16 April 1983 (den)	F	5.5	neck=190mm
--	B376	16 April 1983 (den)	F	5.8	neck=190mm
--	B370	16 April 1983 (den)	F	7.5	neck=200mm
--	B370	16 April 1983 (den)	F	7.0	neck=190mm
010	B374	19 May 1983	F	--	neck=175mm, ear tags
011	B374	19 May 1983	F	--	neck=200mm, ear tags
012	B374	19 May 1983	F	--	neck=195mm, ear tags

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Table 55. (cont'd)

CUB ID	MOTHER'S ID	DATE HANDLED	SEX	WT(lbs)	COMMENTS
013	B404	19 May 1983	F	10.0	neck=215mm, ear tags
014	B405	19 May 1983	F	6.5	neck=180mm, ear tags
015	B405	19 May 1983	F	6.0	neck=175mm, ear tags
--	B363	6 April 1984 (den)	M	6.0	neck=190mm
--	B363	6 April 1984 (den)	M	6.8	neck=192mm
--	B369	8 April 1984 (den)	M	4.0	
--	B369	8 April 1984 (den)	F	3.8	
--	B349	28 Feb. 1985 (den)	M	1.8	very small, eyes closed, sibling not handled
--	B328	29 March 1985 (den)	M	5.0	
--	B328	29 March 1985 (den)	M	4.1	
--	B328	29 March 1985 (den)	F	4.1	
--	B404	30 March 1985 (den)	M	4.1*	
--	B404	30 March 1985 (den)	M	4.1*	
--	B404	30 March 1985 (den)	F	3.5*	

Totals: 19 males and 25 females, In dens=18 males and 18 females.

* Estimated

Table 56. Morphometrics of black bear yearlings handled in the Susitna Hydro project, 1980-1985.

YLG ID	MOTHER'S ID	DATE HANDLED	SEX	WT (lbs)	COMMENTS
B329	B327	23 March 1981 (den)	F	15 (est.)	tagged and collared
B330	B318	25 March 1981 (den)	M	31	tagged and collared
B350	B289	1 April 1982 (den)	M	14	ear tagged
B351	B289	1 April 1982 (den)	M	16	ear tagged
B353	B301	26 May 1982	M	29	with mother, capture mortality
B412	B361	6 April 1984 (den)	M	30 (est.)	
B413	B361	6 April 1984 (den)	F	30 (est.)	
B414	B361	6 April 1984 (den)	F	19.5	
B415	B289	7 April 1984 (den)	F	23.5	Neck=299mm
B434	B432	2 June 1985	F	33	

Totals: 5 males and 5 females.

Table 57. Summary of known losses of black bear cubs-of-the-year. Losses calculated during first season out of den (in dens or at emergence from dens as cubs to entrance into dens as cubs)

Year	Upstream study area	Downstream study area	Both areas
1980	no data	no data	--
1981	4 of 9 lost (289, 301, 321, 328)	no data	4 of 9 lost
1982	0 of 2 lost (354)	no data	0 of 2 lost
1983 complete data	8 of 13 lost (289, 317, 361, 349)	1 of 12 lost (375, 376, 377**, 378, 405, 406)	9 of 25 lost
1983 incomplete data*	[2 of 2 lost (318]	[3 of 6 lost (372, 374)]	[5 of 8 lost]
1984 complete data	1 of 4 lost (321, 363)	0 of 2 lost (369)	1 of 6 lost
1984 incomplete data*	[1 of 2 lost (354)]	[1 of ? lost (377)]	[1 of 2 lost]
1985 complete data	7 of 11 lost (289, 317, 328, 349, 377)	0 of 3 lost (378, 402)	7 of 14 lost
1986 complete data***	0 of 4 lost (354, 364)	0 of 0 lost	0 of 4 lost
TOTALS (all years)	20 of 43 = 47% lost	1 of 17 = 6% lost	21 of 60 = 35% lost

* incomplete data resulted from not observing the family status of the bear before it entered its winter den, shed collars, collar failures, or early hunter kills. Tabulated losses occurred prior to loss of the female to these causes. These are not included in totals.

** B377 may have lost 2 of 2 rather than the 1 of 1 tabulated in 1983, the initial litter size was not known with certainty.

*** B438 and B409 had inadequate data.

Table 58. Reproductive histories of radio-marked female black bears. ("Shed" refers to removal by bear of radio collar.) Bears were in upstream study area unless otherwise indicated.

Year	289 (9 in '80)	290 (8 in '80)	301 (7 in '80)	317 (7 in '80)
1980	w/2@1 weaned in May-bred	w/2@1 weaned in June	w/1@1 weaned in June	w/2@0 in Aug.
1981	w/3@0, 1 lost in Aug.	alone, bred collar removed	w/2@0,	w/2@1, weaned in June, bred, reunitd w/1@1 thru Sept.
1982	weaned 2@1, May-June, bred	--	w/2@1, weaned in June, bred	no newborns, possibly w/1@2 into June,
1983	w/2@0, 1 lost in Sept.,		w/2@0, shot in Sept.	w/2@0, 1 lost in June
1984	weaned 1@1 in May, bred, reunited June-Sept. weaned in Sept.		--	w/1@1, weaned, June, bred, reunited predenning
1985	w/2@0, survived		--	w/2@0, 1 lost in July, other okay thru Sept. at least
1986	w/2@1, weaned (date?)		--	alone in June

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Table 58. (cont'd)

Year	318 5 in '80	321 10 in '80	325 11 in '80	327 5 in '80	328 6 in '80	329 1 in '81	349 4 in '81	354 5 in '82	361 7 in '82	363 4 in '82
1980	w/1@0 in Aug.	alone in Aug.	alone in Aug.	w/2@0 in in Aug.	alone in Aug.	with mother 327	--	--	--	--
1981	w/1@1, weaned in May, bred	w/2@0, lost both in Aug.	alone, shed in next den	w/2@1 in den, 1 weaned in May, other in June, bred	w/2@0, 1 lost in July, other okay thru Sept., collar shed	weaned from 327 in June	alone	--	--	--
1982	alone	alone	--	alone, bred	?	alone	alone	w/2@0 to den entrance	alone	alone, bred?
1983	w/2@0, suspect lost both June, shed	think lost litter very early, bred	--	w/2@0, mother died in July	?	alone, bred?	w/2@0, both lost in den	w/1@1 weaned in May, bred	w/4@0 in den, 1 lost in den	alone, bred
1984	[must have had at least 2@0 based on 1985]	w/1@0 (in July)	--	--	alone, bred	alone, bred?	alone	w/2@0, 1 lost in Sept.	w/3@1 not weaned--seen in den	w/2@0 survived
1985	w/2@1 in June when reported	w/1@1 weaned in June	--	--	w/3@0, all lost in June-July	alone, bred?	w/2@0 in den, 1 lost in Aug.	alone (June)	w/3@2, weaned in June	w/2@1 weaned, date?
1986	?	alone	--	--	alone	alone	w/1@1, weaned (date?)	w/2@0 (Sept.), 1 lost in Sept.?	alone in June	alone, bred

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Table 58. (cont'd)

Year	364 6 in '82	Downstream 367 4 in '82	Downstream 369 4 in '82	Downstream 370 7 in '82	Downstream 372 9 in '82	Downstream 374 7 in '82	Downstream 375 9 in '82	Downstream 376 6 in '82	Downstream 377 4 in '82	Downstream 378 6 in '82	Downstream 402 10 in '83
1982	alone, bred, collar failed	alone	alone	alone	alone, bred	alone?	w/3@1?	alone?	alone	alone	--
1983	[must have had cubs based on 1984]	alone-shot	alone	w/2@0, failed collar	w/2@0, failed collar	w/3@0, 2 died in July, shot in fall	w/2@0, survived	w/3@0	alone?	w/2@0, survived	w/3@1, weaned in June
1984	w/3@1, weaned in June-July, bred, reunited w/1 in Sept.	--	2@0 in den lost 1 in Sept.	--	--	--	w/2@1 weaned in July	w/3@1, weaned in May, reunited in July and Sept.	alone	w/2@1, weaned	alone
1985	w/1@2 in June	--	w/1@1 weaned in June-July	--	--	--	shot in spring	alone?	w/2@0, 1 lost in June, other in July-Aug.	w/1@0, survived	w/2@0
1986	w/2@0, survived thru Sept.	--	alone?	--	--	--	--	alone	alone	alone	w/2@1, survived

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Table 58. (cont'd)

Year	Downstream 404 11 in '83	Downstream 405 17 in '83	Downstream 406 11 in '83	Downstream 409 5 in '83	Downstream 410 7 in '83	Downstream 411 8 in '83	431 11 in '85	432 6 in '85	438 8 in '85	441 9 in '85	448 6 in '85
1982	--	--	--	--	--	--	--	--	--	--	
1983	w/1@0 thru July, then ??	w/2@0, survived	w/2@0, survived	alone?	w/2@0 shot	w/2@1, weaned June-Aug.	--	--	--	--	
1984	alone in Aug.	w/2@1, not weaned	w/2@1, weaned in June-Aug., collar failed	alone?	--	w/2 c, survived	--	--	--	--	
1985	3@0 in den, shot in spring	w/2@2, weaned in June, shot	--	w/2@ age? not used	--	w/2@1	alone, bred	w/1@1, weaned in June, bred	w/2@2?, age??	alone, bred	alone, bred
1986		--	--	w/2@ age? not used	--	alone	alone in June	alone in June	w/3@0, shot	alone bred	alone

Table 59. Summary of reproductive intervals for black bears by bear ID. (* indicates bear from downstream study area. Year of litter and reason for intervals >2 years are indicated in parentheses - "lost" means lost complete litter).

COMPLETE INTERVALS OF:

2 YEARS		3 YEARS	4 YEARS	5 YEARS
289 (81)	363 (84)	317 (83, skipped 1)	318 (83, lost 2)	321 (84, lost 1-2)
289 (83)	364 (83)	361 (83, weaned @2)	349 (85, 1 lost, 1 skip)	
289 (85)	369* (84)	402* (85, skipped 1)		
301 (81)	375* (83)	405* (83, weaned @2)		
317 (80)	376* (83)			
318 (80)	378* (83)			
327 (80)	378* (85)			
354 (82)	406* (83)			
354 (84)	410* (84)			

INCOMPLETE INTERVALS THAT WILL BE AT LEAST INDICATED LENGTH:

2 YEARS	3 YEARS	4 YEARS	5 YEARS
317 (85)	327 (83, skipped)	376* (87, skipped 2)	328 (87, 2 skips, 1 lost)
328 (81)	361 (87, skipped)	377* (87, skipped 2)	
354 (86)	363 (87, skipped)		
	364 (86, skipped)		
	431 (87, skipped)		
	432 (87, skipped)		
	441 (87, skipped)		
	448 (87, skipped)		
	411* (87, skipped)		

AVERAGE REPRODUCTIVE INTERVAL, UPSTREAM AREA ONLY	
COMPLETE INTERVALS ONLY (N = 16)	2.6
INCOMPLETE INTERVALS ONLY (N = 12)	2.9
COMPLETE AND INCOMPLETE(N = 28)	2.7
AVERAGE REPRODUCTIVE INTERVAL, DOWNSTREAM AREA ONLY	
COMPLETE INTERVALS ONLY (N = 9)	2.2
INCOMPLETE INTERVALS ONLY (N = 3)	3.7
COMPLETE AND INCOMPLETE (N = 12)	2.6
AVERAGE REPRODUCTIVE INTERVAL, BOTH AREAS LUMPED	
COMPLETE INTERVALS ONLY (N = 25)	2.4
INCOMPLETE INTERVALS ONLY (N = 15)	3.1
COMPLETE AND INCOMPLETE (N = 40)	2.7

Table 60. Summary of age at first reproduction for Su-hydro area black bears by bear ID. Based on first observed litter, status in previous year(s) is given in parentheses.

FIRST REPRODUCTION AT AGE:

5 YEARS	6 YEARS	7 YEARS	8 YEARS
327 (?)	349 (alone prev. 2)	377 (alone prev. 3)	448 (alone prev. 2 expected '87)
354 (?)	363 (alone prev. 2)	409 (alone prev. 2)	*361 (alone prev. 1)
432 (?)	369 (alone prev. 2)	329 (expected '87)	*370 (alone prev. 1)
	328 (alone prev. 1)	*374 (alone prev. 1)	
	364 (alone prev. 1)		
	376(alone prev. 1)		
	378(alone prev. 1)		
	*410(?)		
	*411(?)		

* Not included in calculations of mean age at first reproduction as possible earlier litter could easily have been missed.

Table 61. Black bear hunter kills in the Su-hydro study area.

Year	Males	Females	Sex Unk.	Total	% in Spring
1973	14	6	2	22	0
1974	2			2	0
1975	6	2	2	10	0
1976	4	4	1	9	11
1977	1		1	2	50
1978	10			10	0
1979	8	4		12	17
1980	14	9	1	24	13
1981	10	4	2	16	31
1982	9	5		14	29
1983	5	5		10	20
1984	11	5		16	38
1985	11	5	1	17	29

Table 62. Status of black bears first marked during Su-Hydro studies, 1980-1985. (A=alive, ND=no data available, F=shot in fall season, SP=shot in spring season). ND in year of capture indicates 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
1980 Captures								
287	M/10 in '80	A	A	Shot-F	-	-	-	-
288	F/10 in '80	Shed/dead?	ND	ND	ND	ND	ND	ND
289	F/9 in '80	A	A	A	A	A	A	A
290	F/8 in '80	Removed-F	ND	ND	ND	ND	ND	ND
301	F/7 in '80	A	A	A	A	Shot-F	-	-
302	M/8 in '80	A	A	A	A	A	A	ND
303	M/8 in '80	A	A	A	Shot-F	-	-	-
304	M/10 in '80	A	A	Shed	ND	ND	ND	ND
305	M/9 in '80	Shot-F	-	-	-	-	-	-
307	M/2 in '80	A	Shot-Sp	-	-	-	-	-
310	M/2 in '80	A	A	A	A	A	A*	A
316	M/2 in '80	Shot-Sp	-	-	-	-	-	-
317	F/7 in '80	A	A	A	A	A	A	A
318	F/5 in '80	A	A	A	A	A*	A*	ND
319	M/3 in '80	A	Died-F	-	-	-	-	-
320	M/4 in '80	Shot-F	-	-	-	-	-	-
321	F/10 in '80	A	A	A	A	A	A	A
322	M/4 in '80	A	A	Died-Sum	-	-	-	-
323	M/2 in '80	A	A	A	Shot-F	-	-	-
324	M/5 in '80	A	A	A	A	Shot-F	-	-
325	F/11 in '80	A	Shed in den	ND	ND	ND	ND	ND
326	F/5 in '80	Shot-F	-	-	-	-	-	-
327	F/5 in '80	A	A	A	Died-Sum	-	-	-
328	F/6 in '80	A	A	A	A	A	A	A
1981 Captures								
329	F/1 in '81	-	Ylg	A	A	A	A	A
330	M/1 in '81	-	Ylg, died-Sum	-	-	-	-	-
342	M/5 in '81	-	Shot-F	-	-	-	-	-
343**	M/5 in '81	-	A	A	A	Died-F	-	-
346	M/9 in '81	-	A	A	A	Died-Sp	-	-
348	M/9 in '81	-	A	Shot-F	-	-	-	-
349	F/4 in '81	-	A	A	A	A	A	A
1982 Captures								
350	M/1 in '82	-	-	Ylg	-	-	-	-
351	M/1 in '82	-	-	Ylg	A	A	A*-Sp	ND
354	F/5 in '82	-	-	A	A	A	A	A
357	M/4 in '82	-	-	Died winter	-	-	-	-
358	F/2 in '82	-	-	A	A	Died-F	-	-
359	M/4 in '82	-	-	A	A	A	A	A
360	M/7 in '82	-	-	A	A	Shed-Sp	ND	ND
361	F/7 in '82	-	-	A	A	A	A	A
362	F/2 in '82	-	-	A-Sp	ND	ND	ND	ND
363	F/4 in '82	-	-	A	A	A	A	A
364	F/9 in '82	-	-	A	A	A	A	A
365**	M/5 in '82	-	-	A	Died-F	-	-	-

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Table 62. (cont'd)

Bear ID	Sex/age	1981	1982	1983	1984	1985	1986
1982 Captures (cont'd)							
366**	M/6 in '82	-	Shot-F	-	-	-	-
367**	F/4 in '82	-	A	Shot-Sum	-	-	-
369**	F/4 in '82	-	A	A	A	A	A
370**	F/7 in '82	-	A	?Shot?-Sp	-	-	-
372**	F/9 in '82	-	A	?Shot?-F	-	-	-
374**	F/7 in '82	-	A	Shot-F	-	-	-
375**	F/9 in '82	-	A	A	A	Shot-F	-
376**	F/6 in '82	-	A	A	A	A	A
377**	F/4 in '82	-	A	A	A	A	A
378*	F/6 in '82	-	A	A	A	A	A
1983 Captures							
379	F/9 in '83	-	-	Died-Sum	-	-	-
387	M/4 in '83	-	-	A	A	Shot-F	-
401	M/3 in '83	-	-	A	A	A	Shot?-Sp
402**	F/10 in '83	-	-	A	A	A	A
404**	F/11 in '83	-	-	A	A	Shot?-Sp	-
405**	F/17 in '83	-	-	A	A	Shot-F	-
406**	F/11 in '83	-	-	A	A	ND	ND
408**	M/3 in '83	-	-	A	A	A	ND
409**	F/5 in '83	-	-	A	A	A	A
410**	F/7 in '83	-	-	Shot-Sum	-	-	-
411**	F/8 in '83	-	-	A	A	A	A
1984 Captures							
412	M/1 in '84	-	-	-	Ylg w/361	ND-Weaned	ND
413	F/1 in '84	-	-	-	Ylg w/361	ND-Weaned	ND
414	F/1 in '84	-	-	-	Ylg w/361	ND-Weaned	ND
415	F/1 in '84	-	-	-	Ylg w/289-ND	-	-
416	M/9 in '84	-	-	-	A	A	ND
1985 Captures							
428	M/5 in '85	-	-	-	-	A	A
430	M/9 in '85	-	-	-	-	A	ND
431	F/11 in '85	-	-	-	-	A	A
432	F/6 in '85	-	-	-	-	A	A
434	F/1 in '85	-	-	-	-	Ylg w/432-W	ND
433	M/3 in '85	-	-	-	-	A	ND
435	M/7 in '85	-	-	-	-	Shot-F	-
436	M/2 in '85	-	-	-	-	ND w/436-W	ND
438	F/8 in '85	-	-	-	-	A	Shot-F
441	F/9 in '85	-	-	-	-	A	A
444	M/3 in '85	-	-	-	-	A	ND
445	M/8 in '85	-	-	-	-	A	ND
448	F/6 in '85	-	-	-	-	A	A
449	M/6 in '85	-	-	-	-	A	ND
451	F/2 in '85	-	-	-	-	A	ND

(continued on next page)

Table 62. (continued)

	1980	1981	1982	1983	1984	1985	1986 prelim.
A. Max. no. marked bears potentially alive in year, includes ND. Excludes tagging and natural spring mortalities and coy and ylgs (M:F)	24(12:12)	25(14:11)	43(16:27)	50(15:35)	41(13:28)	53(20:33)	48(17:31)
B. No. KNOWN shot in year (M:F)	4(2:2)	2(2:0)	3(3:0)	5(2:3)	2(1:1)	5(2:3)	1(0:1)
Min. % known shot (Row B/Row A)	17%	8.0%	7.0%	10.0%	4.9%	9.4%	2.1%
C. No. known shot plus suspected (unreported) shot in year (M:F)	4(2:2)	2(2:0)	3(3:0)	7(2:5)	2(1:1)	5(2:3)	2(1:1)
Probable min. % shot (Row C/Row A)	17%	8.0%	7.0%	14.0%	4.9%	9.4%	4.2%
D. No. bears known alive (excludes ND, died, lost, cubs or ylgs)	24(12:12)	24(14:10)	40(16:24)	45(14:31)	35(11:24)	45(16:29)	26(4:22)
Probable % shot (Row C/Row D)	17%	8%	7.5%	15.6%	5.7%	11.1%	7.7%
Cumulative % shot (based on bear-years available, from Row A and Row C).	17%	12.5%	9.8%	11.3%	9.8%	9.7%	8.8%

Not included: in 1980:

291(M@3), 296(M@10), 300(M@7)

in 1982:
352(M@2), 353(M@1), 368**(F@3), 371(M@2), 2 coy w/B354

in 1983:
3 coy w/B374, 1 coy w/B404, 2 coy w/B405

in 1984:
2 coy w/B369

in 1985:
426(M@2), 439(M@2 w/B438-hurt leg), B446(F@5), 2 coy w/B349,
3 coy w/B328, 3 coy w/B404

* Previous alive status based in part at least, on knowledge from this year.
** Bear in downstream study area.

Table 63. Status of black bears marked during Su-Hydro studies, 1980-1983. (A=alive, ND=no data, F=shot in fall season, Sp=shot in spring season, S=Summer capture or mortality).

Bear ID	Sex/Age	1980	1981	1982	1983	1984	1985	1986
Upstream Study Area								
287	M/10 in '80	A	A	Shot-F	-	-	-	-
288	F/10 in '80	A(shed)	ND	ND	ND	ND	ND	ND
289	F/9 in '80	A	A	A	A	A	A	A
290	F/8 in '80	A	A(remvd)	ND	ND	ND	ND	ND
301	F/7 in '80	A	A	A	A(shed)	Shot-F	-	-
302	M/8 in '80	A	A	A	A	A	A	ND
303	M/8 in '80	A	A	A	Shot-F	-	-	-
304	M/10 in '80	A	A	A(shed)	ND	ND	ND	ND
305	M/9 in '80	Shot-F	-	-	-	-	-	-
307	M/2 in '80	A	Shot-Sp.	-	-	-	-	-
310	M/2 in '80	A	A	A	A	A	A*	A
316	F/12 in '80	Shot-F	-	-	-	-	-	-
317	F/7 in '80	A-S	A	A	A	A	A	A
318	F/5 in '80	A-S	A	A	A*	A*	A	ND
319	M/3 in '80	A-S	Died	-	-	-	-	-
320	M/4 in '80	Shot-F	-	-	-	-	-	-
321	F/10 in '80	A-S	A cubs	A	A	A	A	A
322	M/4 in '80	A-S	A	Died	-	-	-	-
323	M/2 in '80	A-S	A	A	Shot-F	-	-	-
324	M/5 in '80	A-S	A	A	A	Shot-F	-	-
325	F/11 in '80	A-S	A	Shed	ND	ND	ND	ND
326	F/5 in '80	Shot-F	-	-	-	-	-	-
327	F/5 in '80	A-S	A	A	Died-S	-	-	-
328	F/6 in '80	A-S	A	A	A	A	A	A
329	F/1 in '81	-	Ylg.	A	A	A	A	A
330	M/1 in '80	-	Ylg. died-S	-	-	-	-	-
342b	M/5 in '81	-	Shot-F	-	-	-	-	-
346	M/9 in '81	-	A	A	A	Died	-	-
348	M/9 in '81	-	A-S	Shot-F	-	-	-	-
349	F/4 in '81	-	A-S	A	A	A	A	A
350	M/1 in '82	-	-	Ylg.	-	-	-	-
351	M/1 in '82	-	-	Ylg.	A	A	A*	ND
354	F/5 in '82	-	-	A	A	A	A	A
357	M/4 in '82	-	-	Died-W	-	-	-	-
358	M/2 in '82	-	-	A	A	Died-F	-	-
359	M/4 in '82	-	-	A	A	A	A	A

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Table 63. (cont'd)

Bear ID	Sex/Age	1981	1982	1983	1984	1985	1986
Upstream Study Area (cont'd)							
360	M/7 in '82	-	A	A	A	ND	ND
361	F/7 in '82	-	A	A	A	A	A
362	F/2 in '82	-	A-Sp.	ND	ND	ND	ND
363	F/4 in '82	-	A	A	A	A	A
364	F/9 in '82	-	A	A	A	A	A
379	F/9 in '83	-	-	Died-S	-	-	-
387	F/4 in '83	-	-	A	A	Shot-F	-
401	M/3 in '83	-	-	A	A	A	Shot?-Sp.
412	M/1 in '84	-	-	-	Ylg.	A	ND
413	F/1 in '84	-	-	-	Ylg.	A	ND
414	F/1 in '84	-	-	-	Ylg.	A	ND
416	M/9 in '84	-	-	-	A	A	A
428	M/5 in '85	-	-	-	-	A	A
430	M/9 in '85	-	-	-	-	A	ND
431	F/11 in '85	-	-	-	-	A	A
432	F/6 in '85	-	-	-	-	A	A
433	M/3 in '85	-	-	-	-	A	ND
434	F/1 in '85	-	-	-	-	Ylg.	-
435	M/7 in '85	-	-	-	-	Shot-F	-
436	M/2 in '85	-	-	-	-	ND	ND
438	F/8 in '85	-	-	-	-	A	Shot-F
441	F/9 in '85	-	-	-	-	A	A
444	M/3 in '85	-	-	-	-	A	ND
445	M/8 in '85	-	-	-	-	A	ND
448	F/6 in '85	-	-	-	-	A	A
449	M/6 in '85	-	-	-	-	A	ND
451	F/2 in '85	-	-	-	-	A	ND

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Table 63. (cont'd)

	1980	1981	1982	1983	1984	1985	1986
Upstream subtotals							
Maximum no. bears potentially alive (includes ND) in year (excludes natural mortalities) (M:F)	24(12:12)	24(13:11)	31(14:17)	31(12:19)	28(11:17)	41(17:24)	39(16:21)
No. known shot (M:F)	4(2:2)	2(2:0)	2(2:0)	2(2:0)	2(1:1)	2(1:1)	2(1:1)
No. additional bears suspected shot	0	0	0	0	0	0	0
% known or suspected shot	17%	8%	7%	7%	7%	5%	5%

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Table 63. (cont'd)

		1981	1982	1983	1984	1985	1986
Downstream Study Area							
343	M/5 in '81	A	A	A	Died-F	-	-
365	M/5 in'82	-	A	Died-F	-	-	-
366	M/6 in '82	-	Shot-F	-	-	-	-
367	F/4 in '82	-	A	Shot-Sum.	-	-	-
369	F/4 in '82	-	A	A	A	A	A
370	F/7 in '82	-	A	(Shot?)-S	-	-	-
372	F/9 in '82	-	A	(Shot?)-F	-	-	-
374	F/7 in '82	-	A	Shot-F	-	-	-
375	F/5 in '82	-	A	A	A	Shot-F	-
376	F/6 in '82	-	A	A	A	A	A
377	F/5 in '82	-	A	A	A	A	A
378	F/6 in '82	-	A	A	A	A	A
402	F/10 in '83	-	-	A	A	A	A
404	F/11 in '83	-	-	A	A	Shot?-Sp.	-
405	F/17 in '83	-	-	A	A	Shot-F	-
406	F/11 in '83	-	-	A	A	ND	ND
408	M/3 in '83	-	-	A	A	A	ND
409	F/5 in '83	-	-	A	A	A	A
410	F/7 in '83	-	-	Shot-S	-	-	-
411	F/8 in '83	-	-	A	A	A	A
Downstream subtotals							
Max. no. bears potentially alive (includes ND) in year (excludes natural mortalities) (M:F)		1(1:0)	12(3:9)	19(3:16)	13(2:11)	12(1:11)	9(1:10)
No. known shot (M:F)		0	1(1:0)	3(0:3)	0	2(0:2)	0
No. additional bears suspected shot (M:F)		0	0	2(0:2)	0	1(0:1)	0
% known or suspected shot (M:F)		-	8%	26%	0	25%	0

Table 63. (cont'd)

	1980	1981	1982	1983	1984	1985	1986
Upstream subtotals							
Upstream and Downstream Areas Combined							
Total bears potentially alive in year (excludes natural mortalities, includes ND) (M:F)	24(12:12)	25(14:11)	43(17:26)	50(15:35)	41(13:28)	53(18:35)	48(17:31)
No. known shot (M:F)	4(2:2)	2(2:0)	3(3:0)	5(2:3)	2(1:1)	4(1:3)	2(1:1)
No. additional bears suspected shot (M:F)	0	0	0	2(0:2)	0	1(0:1)	0
% known or suspected shot	17%	8%	7%	14%	5%	9%	4%

* Based on information obtained after this year.

Table 64. Black bear home range size. Code 99 in year or age column indicates lumping of all years. Area 1 = upstream area, area 2 = downstream study areas; sex 1 = male, and 2 = female; 0 = w/o cubs-of-the-year and 1 = with COY.

ID No.	Area	Sex	Year	Age (yrs.)	No. Points Locations	Size Sq. Km.	Period	Comments	COY
287	1	1	80	10	17	136.3	May-Oct	w/o atypical den	0
287	1	1	81	11	15	268.2	Apr-Oct	w/o atypical den	0
287	1	1	82	12	18	250.0	Apr-Sept	shot 9/82	0
287	1	1	99	99	50	313.7	1980-82		0
302	1	1	81	9	36	325.7	Apr-Oct	captured 5/80	0
302	1	1	82	10	11	51.1	Apr-Jul	missing 7/82	0
302	1	1	84	11	42	351.6	May-Aug	recaptured	0
302	1	1	99	99	03	498.3	1980-85		0
303	1	1	80	8	15	94.9	May-Oct		0
303	1	1	81	9	18	92.5	Apr-Oct		0
303	1	1	82	10	20	73.6	Apr-Oct		0
303	1	1	83	11	11	43.2	Apr-Sept	shot 9/83	0
303	1	1	99	99	64	167.0	1980-83		0
304	1	1	80	10	15	35.1	May-Sept	w/o atypical den	0
304	1	1	81	11	18	40.8	Apr-Oct	shed 7/82	0
304	1	1	99	99	39	138.7	1980-82	shed 7/82	0
305	1	1	80	9	9	47.9	May-Aug	shot 8/80	0
305	1	1	99	9	9	47.9	1980		0
319	1	1	81	4	10	43.1	Apr-July	captured 8/80	0
319	1	1	99	99	16	455.8	1980-1981	died 7/81	0
322	1	1	99	99	12	48.5	1980-82	shed=2, died 7/82	0
323	1	1	81	3	19	382.9	Apr-Oct	captured 8/80	0
323	1	1	82	4	20	1126.0	Apr-Oct		0
323	1	1	83	5	17	1089.3	Apr-Sept	shot 9/83	0
323	1	1	99	99	62	1514.3	1980-83t		0
324	1	1	81	6	20	247.8	Apr-Oct	captured 8/80	0
324	1	1	82	7	21	139.9	Apr-Oct		0
324	1	1	83	8	17	170.2	Apr-Oct		0
324	1	1	84	9	11	236.8	Apr-Sept	shot 9/84	0
324	1	1	99	99	75	776.5	1980-1984		0
330	1	1	81	1	14	10.0	May-Oct	died 7/81	0
330	1	1	99	99	14	10.0	1981,82		0
346	1	1	81	9	16	61.5	May-Oct		0

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Table 64. (continued)

ID No.	Area	Sex	Year	Age (yrs.)	No. Points Locations	Size Sq. Km.	Period	Comments	COY
346	1	1	82	10	22	90.5	Apr-Oct		0
346	1	1	83	11	16	119.0	Apr-Oct		0
346	1	1	99	99	56	175.0	1981-1983	died 6/84	0
348	1	1	82	10	9	135.5	8/81-9/82	shot 9/82	0
348	1	1	99	99	16	522.4	1981-82	8/81-shot 9/82	0
357	1	1	82	4	18	11.2	May-Oct	died 10/82	0
357	1	1	99	4	18	11.2	1982		0
359	1	1	82	4	18	83.2	May-Oct		0
359	1	1	83	5	19	154.2	Apr-Oct		0
359	1	1	84	6	59	455.5	Apr-Oct		0
359	1	1	99	99	05	698.8	1982-85		0
387	1	1	83	4	16	163.8	May-Oct		0
387	1	1	84	5	53	152.5	Apr-Oct	shot 9/85	0
387	1	1	99	99	75	207.7	1983-85		0
401	1	1	83	3	18	91.4	May-Oct		0
401	1	1	84	4	56	240.5	Apr-Oct		0
401	1	1	99	99	86	241.0	1983-85		0
416	1	1	84	9	55	377.6	May-Oct		0
416	1	1	99	99	61	377.6	1984-85		0
342b	1	1	81	5	40	611.3	May-Sept	shot 9/81	0
342b	1	1	99	5	40	611.3	1981	shot 9/81	0
343	2	1	81	5	16	288.7	May-Oct		0
343	2	1	82	6	19	369.5	Apr-Oct		0
343	2	1	83	7	20	500.6	Apr-Oct		0
343	2	1	84	8	14	653.8	Apr-Oct	died 12/84	0
343	2	1	99	99	69	1000.2	1981-85		0
365	2	1	82	5	11	656.4	May-Oct		0
365	2	1	83	6	15	251.6	Apr-Sept	died 9/83	0
365	2	1	99	99	26	711.7	1982-83		0
366	2	1	82	6	10	136.1	May-Aug	shot 9/82	0
366	2	1	99	6	10	136.1	1982		0
408	2	1	83	3	16	226.6	May-Oct		0
408	2	1	84	4	11	230.5	Apr-Oct		0
408	2	1	99	99	30	652.7	1983-85		0

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Table 64. (continued)

ID No.	Area	Sex	Year	Age (yrs.)	No. Points Locations	Size Sq. Km.	Period	Comments	COY
288	1	2	80	10	16	7.4	May-Aug	shed 8/80	0
288	1	2	99	10	16	7.4	1980		0
289	1	2	80	9	14	43.4	May-Oct		0
289	1	2	81	10	20	26.1	Apr-Oct	w/coy, survived	1
289	1	2	82	11	20	29.0	Apr-Oct		0
289	1	2	83	12	17	18.6	Apr-Oct	w/coy, survived	1
289	1	2	84	13	62	52.7	Apr-Oct	w/@1	0
289	1	2	99	99	42	79.8	1980-85	coy in ±85	0
290	1	2	80	8	18	44.7	May-Oct		0
290	1	2	81	9	15	116.3	Apr-Aug	collar removed 8/81	0
290	1	2	99	99	33	163.4	1980-81		0
301	1	2	80	7	20	18.1	May-Oct		0
301	1	2	81	8	15	12.5	Apr-Oct	w/coy, survived	1
301	1	2	82	9	18	18.3	Apr-Oct	shed 7/83	0
301	1	2	99	99	62	29.6	1980-83		0
317	1	2	81	8	19	13.9	May-Oct	captured 8/80	0
317	1	2	82	9	18	44.2	Apr-Oct		0
317	1	2	83	10	19	16.8	Apr-Oct	w/coy, survived	1
317	1	2	84	11	58	40.4	Apr-Oct	w/@1	0
317	1	2	99	99	30	59.0	1980-85		0
318	1	2	81	6	20	1036.4	Apr-Oct	captured 8/80	0
318	1	2	82	7	20	471.9	Apr-Oct	shed 7/83	0
318	1	2	99	99	58	1095.4	1980-83, 85	recaptured 6/85	0
321	1	2	81	11	14	771.0	Apr-Oct	w/coy, lost coy 7/81	1
321	1	2	82	12	20	13.8	Apr-Oct	prev. lost 8/81	0
321	1	2	83	13	18	28.5	Apr-Oct		0
321	1	2	84	14	17	14.5	Apr-Oct	w/coy, survived	1
321	1	2	99	99	81	836.0	1980-85		0
325	1	2	99	99	15	145.7	1980-81	fall data only	0
327	1	2	81	6	35	31.3	Apr-Oct	captured 7/80	0
327	1	2	82	7	19	34.2	Apr-Oct		0
327	1	2	99	99	69	51.5	1980-83	died 7/83	0
328	1	2	81	7	19	28.0	Apr-Oct	w/coy, captured 8/80	1
328	1	2	84	10	56	31.7	May-Oct	recaptured, shed 1981	0
328	1	2	99	99	89	64.4	1980-85	lost coy in 1985	0

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Table 64. (continued)

ID No.	Area	Sex	Year	Age (yrs.)	No. Points Locations	Size Sq. Km.	Period	Comments	COY
329	1	2	81	1	19	14.7	May-Oct		0
329	1	2	82	2	19	9.4	Apr-Oct		0
329	1	2	83	3	18	24.1	Apr-Oct		0
329	1	2	84	4	62	36.0	Apr-Oct		0
329	1	2	99	99	28	100.0	1981-85	never had coy	0
349	1	2	82	5	20	47.4	Apr-Oct	captured 8/81	0
349	1	2	84	7	56	53.9	May-Oct	recaptured, alone	0
349	1	2	99	99	00	82.7	1981-85	shed 7/83	0
354	1	2	82	5	19	64.8	May-Oct	w/2@0	1
354	1	2	83	6	17	61.6	Apr-Oct		0
354	1	2	84	7	23	118.3	Apr-Oct	w/coys, lost 6/84	0
354	1	2	99	99	63	140.9	1982-1985		0
358	1	2	82	2	17	10.7	May-Oct		0
358	1	2	83	3	17	53.2	Apr-Oct		0
358	1	2	84	4	43	57.5	Apr-Aug	died 8/84	0
358	1	2	99	99	77	71.1	1982-84		0
360	1	2	82	7	20	144.5	May-Oct		0
360	1	2	83	8	19	299.2	Apr-Oct		0
360	1	2	99	99	42	429.1	1982-84		0
361	1	2	82	7	18	87.9	May-Oct		0
361	1	2	83	8	16	59.9	Apr-Oct	w/coy, survived	1
361	1	2	84	9	59	66.6	Apr-Oct	w/@1 all year	0
361	1	2	99	99	07	111.3	1982-1985		0
363	1	2	82	3	18	19.9	May-Oct		0
363	1	2	83	4	18	20.6	Apr-Oct		0
363	1	2	84	5	23	19.6	Apr-Oct	w/2@0, survived	1
363	1	2	99	99	65	30.0	1982-85	no coy in 85 or 86	0
364	1	2	82	9	16	121.5	May-Sept	lost 9/82	0
364	1	2	99	9	16	121.5	1982		0
367	2	2	82	4	17	17.5	May-Oct		0
367	2	2	99	99	26	17.7	1982-83	shot 7/83	0
369	2	2	82	4	19	10.2	May-Oct		0
369	2	2	83	5	20	26.0	Apr-Oct		0
369	2	2	84	6	12	20.0	Apr-Oct	w/coy, survived	1
369	2	2	99	99	59	30.9	1982-85		0

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Table 64. (continued)

ID No.	Area	Sex	Year	Age (yrs.)	No. Points Locations	Size Sq. Km.	Period	Comments	COY
370	2	2	82	7	18	16.0	May-Oct	lost 5/83	0
370	2	2	99	99	22	16.0	1982-83		0
372	2	2	82	9	17	56.1	May-Oct		0
372	2	2	83	10	13	75.6	Apr-Aug	w/coy, failed 9/83	1
372	2	2	99	99	30	101.6	1982-83		0
374	2	2	83	8	16	30.3	Apr-Sept	shot 9/83	0
374	2	2	99	99	20	34.5	1982-9/83		0
375	2	2	82	9	16	16.8	Jun-Oct		0
375	2	2	83	10	19	19.3	Apr-Oct	w/coy	1
375	2	2	84	11	14	38.2	Apr-Oct	shot 5/85	0
375	2	2	99	99	49	53.1	1982-85		0
376	2	2	82	6	13	21.1	Jun-Oct		0
376	2	2	83	7	21	34.0	Apr-Oct	w/coy	1
376	2	2	84	8	14	36.3	Apr-Oct	w/@1	0
376	2	2	99	99	56	108.5	1982-85		0
377	2	2	82	4	15	11.9	Jun-Oct		0
377	2	2	83	5	18	24.5	Apr-Oct	w/coy, lost 5/83	0
377	2	2	84	6	12	13.2	Apr-Oct		0
377	2	2	99	99	52	81.5	1982-85	coy in 85	0
378	2	2	82	6	14	8.0	Jun-Oct		0
378	2	2	83	7	20	9.8	Apr-Oct	w/coy, survived	1
378	2	2	84	8	12	7.3	Apr-Oct		0
378	2	2	99	99	52	17.5	1982-85	coy in ±85	0
402	2	2	83	10	17	13.4	May-Oct		0
402	2	2	84	11	16	15.6	Apr-Oct	alone	0
402	2	2	99	99	40	26.8	1983-85	coy in ±85	0
404	2	2	83	11	16	36.3	May-Oct	coy	1
404	2	2	84	12	13	89.5	Apr-Oct	coy in '85	0
404	2	2	99	99	31	137.8	1983-85	died 5/85	0
405	2	2	83	11	17	24.7	May-Oct	w/coy	1
405	2	2	84	12	11	53.6	Apr-Oct	w/@1	0
405	2	2	99	99	32	70.7	1983-85	coy in ±85	0
406	2	2	83	11	17	17.9	May-Oct	w/coy, survived	1
406	2	2	84	12	13	16.2	Apr-Sept	lost 9/84	0

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Table 64. (continued)

ID No.	Area	Sex	Year	Age (yrs.)	No. Points Locations	Size Sq. Km.	Period	Comments	COY
406	2	2	99	99	30	20.7	1983-84		0
409	2	2	83	5	16	26.4	May-Oct		0
409	2	2	84	6	14	15.9	Apr-Oct		0
409	2	2	99	99	35	32.3	1983-85		0
411	2	2	83	8	17	31.3	May-Oct		0
411	2	2	84	9	12	45.7	Apr-Oct	w/coy, survived	1
411	2	2	99	99	36	105.5	1983-85		0

Table 65. Black bear home range size by sex and age categories. (COY = cubs-of-year).

Category	No. Individuals	Number of radio-location points			Home Range Size (km^2)*			
		Mean	Max.	Min.	Mean	S.D.	Max.	Min.
TOTAL HOME RANGE (Summation all years)								
All bears	55	52.7	142	9	250.7	324.8	1514.3	7.4
All males	22	47.1	105	9	423.5	372.8	1514.3	10.0
All females	33	56.5	142	15	135.6	229.4	1095.7	7.4
ANNUAL HOME RANGES (all points in calendar year)								
All bears	123	20.9	62	9	134.6	212.8	1126.0	7.3
All males	45	20.9	59	9	251.5	250.8	1126.0	10.0
All females	78	20.8	62	11	67.1	152.3	1036.4	7.3
Females 5.0+, without coy	47	21.6	62	11	77.3	163.5	1036.4	7.3
Females 5.0+, with coy	19	17.2	23	12	69.2	171.0	771.0	9.8

* Standard minimum grid method.

Table 66. Black bear predation rates during periods of intensive monitoring. Sex 1= male, 2=female, status 1= alone or w/@2, 2=w/coy, 3=w/@1; based on status on 15 June. If another bear or wolves also on kill, each credited with 0.5 kills. Consecutive observation day sums all days, for periods of >2 consecutive days. Only spring data included, summer 1984 not included. Misc. kills include suspected and probable kills.

Bear ID	Sex	age	year	Repro. Status	No. Consec. Obsv.-days	Period	No.moose calves	No.adlt. caribou	Misc. Kills	Total Kills	Kills/100 con. ob. day	No. Con. ob. days per kill
289	2	13	84	3	25	5/28-7/1				0	0.00	--
302	1	12	84	1	14	5/29-7/1	3			3	21.43	4.67
317	2	11	84	3	27	5/28-7/1				0	0.00	--
328	2	10	84	1	22	5/28-7/1				0	0.00	--
329	2	4	84	1	17	5/28-7/1	1			1	5.88	17.00
349	2	7	84	1	21	5/28-7/1				0	0.00	--
358	2	4	84	1	12	5/28-7/1				0	0.00	--
359	1	6	84	1	23	5/28-7/1	1			1	4.35	23.00
361	2	9	84	3	19	5/28-7/1				0	0.00	--
364	2	11	84	1	23	5/28-7/1			1	1	4.35	23.00
387	1	5	84	1	17	5/28-7/1	1			1	5.88	17.00
401	1	4	84	1	15	5/28-7/1				0	0.00	--
416	1	9	84	1	23	5/28-7/1				0	0.00	--
302	1	9	81	1	13	5/21-6/22				0	0.00	
342	1	5	81	1	15	5/21-6/22	1	1		2	13.33	7.50
TOTALS, all bears =					286		7	1	1	9	3.15	31.78
No. of bear-years =					15							
Totals, males only =					120		6	1	0	7	5.83	17.14
No. of bear-years =					7							
Totals, females only =					166		1	0	1	2	1.20	83.00
No. of bear years =					8							
Totals, females status 1 =					95		1	0	1	2	2.11	47.50
No. bear-years =					5							
Totals, females status 3 =					71		0	0	0	0	0.00	--
No. of bear-years =					3							

Table 67. Subjective characterization of berry abundance in the upstream study area since 1980.

Year	Characterization of Berry Abundance	Comments
1980	normal	No special effort was made to evaluate berry abundance, black bears were very common in the shrublands adjacent to forested habitats and in forested habitats.
1981	very poor	Extensive unanticipated movements of radio-marked black bears in late summer provided first clue that something was amiss. On the ground inspection supported hypothesis that blueberries were very scarce. Bears were in very poor condition the following spring in both upstream and downstream area. Three marked black bears died (Table 34) in 1981 following the summer berry failure. Bears were common in semi-open shrublands.
1982	slightly subaverage	Berry transects supported hypothesis that berries were more abundant in shrublands than in adjacent forests. Low reproductive success evident in spring 1982 and bears tended to be very skinny. In summer bears foraged in shrublands but there appeared to be many fewer bears in the study area than in 1980. Would have concluded a massive emigration in 1981 except that the marked bears that moved away had all returned. Possibly there was an increased mortality rate resulting from the 1981 berry failure. One marked bear died in 1982 compared to 3 in the previous and following years. Mortality could have been most marked on subadults, only 2 of these were radio-marked.

Table 67. (cont'd)

Year	Characterization of Berry Abundance	Comments
1983	above average	Berry transects suggest more berries than in 1982, especially crowberries and lowbush cranberries. Although not evident in the transect data, it appeared that blueberries were locally very abundant in forested habitats and bears did not have to, and didn't, move into the shrubland habitat types to forage for berries in late summer. Some black bears expected to produce their first litters in 1983 failed to do so suggesting delayed age of first reproduction may have resulted from 1981 berry failure. Appeared to be many fewer bears present than in 1980. Craig Gardner noted that along the Denali highway "Berries were very abundant along the Denali Hwy from Paxton to the McClaren River."
1984	below average	Berry transects support substantially fewer blueberries and crowberries in upstream areas, about average in downstream areas. Berries appeared to be very abundant in highly localized pockets, more patchy than is typically the case. Black bear movements appeared normal but some brown bears made atypically large movements in fall 1984. Between Paxton and the McClaren River, Craig Gardner (pers. comm.) reported "Berries were less abundant than in 1983 but more abundant than in 1981."
1985		In the vicinity of Watana Camp berries appeared to be slightly below average in abundance. In more upstream habitat they appeared to be slightly above average. Saw nowhere where blueberries were really thick, pretty well dispersed. Along the Denali Hwy both Craig Gardner and Jack Whitman noted independently that berry crops "appeared to be a bust" -- very few were seen.
1986		No data collected in study area. Along the Denali Highway on 8/10/86, Jack Whitman noted "I spent 3 days on west end of Denali Highway. Walked many miles in vicinity of 25 mile, 22 mile, and 15 mile. Excellent berry crop in all locations. Best I've noted in 4 years."

Table 68. Den entrance and emergence dates of radio-collared black bears for the winter of 1980-81 ("S" is the standard deviation, but it includes variability from the fluctuating time between observations, as well as variability in denning times).

Bear ID	Sex	Reproductive status at exit	1980 Entrance Min.	1980 Entrance Max.	1980 Entrance Mid.	1981 Emergence Min.	1981 Emergence Max.	1981 Emergence Mid.	Days In Den Min.	Days In Den Max.	Days In Den Mid.
287	M		9 Sept.	29 Sept.	19 Sept.	30 Apr.	5 May	2 May	213	238	212
289	F	3@0	9 Sept.	29 Sept.	19 Sept.	5 May	15 May	10 May	221	248	235
290	F	w/o	1 Oct.	9 Oct.	5 Oct.	5 May	10 May	8 May	208	221	215
301	F	2@0	29 Sept.	13 Oct.	6 Oct.	9 May	29 May	19 May	208	242	225
303	M					30 Apr.	5 May	2 May			
304	M					5 May	10 May	8 May			
317	F	2@1	9 Sept.	29 Sept.	19 Sept.	5 May	15 May	10 May	218	248	233
318	F	1@1	29 Sept.	13 Oct.	6 Oct.	30 Apr.	5 May	2 May	199	218	209
319	M		29 Sept.	13 Oct.	6 Oct.	30 Apr.	5 May	2 May	199	218	209
321	F	2@0	9 Sept.	29 Sept.	19 Sept.	10 May	15 May	12 May	223	248	236
322	M		9 Sept.	13 Oct.	26 Sept.						
323	M		29 Sept.	13 Oct.	6 Oct.	6 May	8 May	7 May	205	228	217
324	M		29 Sept.	13 Oct.	6 Oct.	30 Apr.	5 May	2 May	199	218	209
325	F	w/o	29 Sept.	9 Oct.	4 Oct.						
327	F	1@1	9 Sept.	29 Sept.	19 Sept.	8 May	10 May	9 May	221	243	232
328	F	2@0	9 Sept.	29 Sept.	19 Sept.	21 May	29 May	25 May	234	262	248
	MALES		19 Sept.	6 Oct.	28 Sept.	5 May	12 May	8 May	212	236	223
	"S"		11	7	8	6	8	7	11	15	13
	n		14	14	14	14	14	14	12	12	12

Table 69. Den entrance and emergence dates of radio-collared black bears for the winter of 1981-82 ("S" is the standard deviation, but it includes variability from the fluctuating time between observations, as well as variability in denning times).

			1981 Entrance			1982 Emergence			Days In Den		
Bear ID	Sex	Repro-ductive status at exit	Min.	Max.	Mid.	Min.	Max.	Mid.	Min.	Max.	Mid.
287	M		24 Aug.	9 Sept.	9 Sept.	4 May	6 May	5 May	237	255	246
289	F	2@1	23 Sept.	1 Oct.	28 Sept.	12 May	18 May	15 May	223	237	230
301	F	2@1	16 Sept.	22 Sept.	19 Sept.	6 May	18 May	12 May	226	244	235
302	M		16 Sept.	22 Sept.	19 Sept.	?	6 May	6 May*		232	229
303	M		16 Sept.	22 Sept.	19 Sept.	12 May	18 May	15 May	232	244	238
304	M		16 Sept.	1 Oct.	24 Sept.	6 May	12 May	9 May	217	238	228
317	F	w/o	9 Sept.	16 Sept.	12 Sept.	12 May	18 May	15 May	238	251	244
318	F	w/o	16 Sept.	22 Sept.	19 Sept.	18 May	26 May	22 May	238	252	245
321	F	w/o	16 Sept.	22 Sept.	19 Sept.	6 May	12 May	9 May	226	238	232
323	M		22 Sept.	1 Oct.	27 Sept.	6 May	12 May	9 May	217	232	224
324	M		1 Oct.	7 Oct.	4 Oct.	4 May	6 May	5 May	209	217	213
327	F	w/o	16 Sept.	22 Sept.	19 Sept.	12 May	18 May	15 May	232	244	238
329	F	w/o	22 Sept.	1 Oct.	27 Sept.	12 May	18 May	15 May	223	238	230
343	M		16 Sept.	22 Sept.	19 Sept.	12 May	18 May	15 May	232	244	238
346	M		9 Sept.	16 Sept.	12 Sept.	?	6 May	6 May*		239	236
348	M		16 Sept.	22 Sept.	19 Sept	4 May	6 May	5 May	224	232	228
349	F	w/o	9 Sept.	16 Sept.	12 Sept.	?	6 May	6 May*		239	236
325	F	?	9 Sept.	16 Sept.	12 Sept.						
328	F	?	16 Sept.	22 Sept.	19 Sept.						
	MEAN		15 Sept.	23 Sept.	19 Sept.	9 May	13 May	11 May	227	240	234
	"S"		8	7	6	4	6	5	9	9	8
	n		19	19	19	14	17	17	14	17	17

* Dates were designated from a point value rather than a time period, because a more accurate mean emergence date was produced.

Table 70. Den entrance and emergence dates of radio-collared black bears for the winter of 1982-83 ("S" is the standard deviation, but it includes variability from the fluctuating time between observations, as well as variability in denning times).

Bear ID	Sex	Reproductive status at exit	1982 Entrance Min.	1982 Entrance Max.	1982 Entrance Mid.	1983 Emergence Min.	1983 Emergence Max.	1983 Emergence Mid.	Days in Den Min.	Days in Den Max.	Days in Den Mid.
289	F	2@0	28 Sep	6 Oct	2 Oct	10 May	15 May	13 May	216	230	223
303	M		29 Sep	20 Oct	10 Oct	4 May	10 May	7 May	196	223	210
317	F	2@0	20 Sep	29 Sep	24 Sep	10 May	23 May	17 May	223	245	234
318	F	2@0	6 Oct	15 Oct	10 Oct	10 May	23 May	17 May	207	229	218
321	F	w/o	20 Sep	29 Sep	24 Sep	10 May	15 May	13 May	223	237	230
323	M		6 Oct	15 Oct	10 Oct	25 Apr	4 May	30 Apr	192	210	201
324	M		29 Sep	6 Oct	2 Oct	25 Apr	4 May	30 Apr	201	217	209
327	F	2@0	6 Oct	15 Oct	10 Oct	4 May	10 May	7 May	201	216	209
329	F	w/o	29 Sep	6 Oct	2 Oct	25 Apr	4 May	30 Apr	201	217	209
343	M		6 Oct	20 Oct	13 Oct	4 May	10 May	7 May	196	216	206
346	M		6 Oct	15 Oct	10 Oct	25 Apr	4 May	30 Apr	192	210	201
349	F	w/o	29 Sep	6 Oct	2 Oct	10 May	18 May	14 May	216	231	224
354	F	1@1	6 Oct	15 Oct	10 Oct	10 May	23 May	17 May	207	229	218
357	M		6 Oct	15 Oct	10 Oct	(BEAR KILLED DURING WINTER)			-	-	-
358	M		29 Sep	6 Oct	2 Oct	4 May	10 May	7 May	210	223	217
359	M		6 Oct	15 Oct	10 Oct	4 May	10 May	7 May	201	216	209
360	M		6 Oct	15 Oct	10 Oct	25 Apr	4 May	30 Apr	192	210	201
361	F	3@0	6 Oct	15 Oct	10 Oct	10 May	23 May	17 May	207	229	218
363	F	w/o	6 Oct	15 Oct	10 Oct	25 Apr	4 May	30 Apr	192	210	201
365	M		6 Oct	20 Oct	13 Oct	25 Apr	4 May	30 Apr	187	210	199
367	F	w/o	6 Oct	15 Oct	10 Oct	10 May	19 May	15 May	207	225	216
369	F	w/o	6 Oct	15 Oct	10 Oct	25 Apr	4 May	30 Apr	192	210	201
370	F	2@0	6 Oct	15 Oct	10 Oct	4 May	10 May	7 May	201	216	209
372	F	3@0	29 Sep	6 Oct	2 Oct	10 May	19 May	15 May	216	232	224
375	F	2@0	29 Sep	6 Oct	2 Oct	25 Apr	4 May	30 Apr	201	217	209
376	F	3@0	6 Oct	15 Oct	10 Oct	25 Apr	4 May	30 Apr	192	210	201
377	F	1@0	29 Sep	6 Oct	2 Oct	4 May	10 May	7 May	210	223	217
378	F	2@0	20 Sep	29 Sep	24 Sep	4 May	10 May	7 May	217	232	225
379	F	3@0	N. D.	N. D.	N. D.	4 May	10 May	7 May	-	-	-
301	F	2@0	N. D.	N. D.	N. D.	4 May	10 May	7 May	-	-	-
374	F	3@0	N. D.	N. D.	N. D.	10 May	19 May	15 May	-	-	-
	MEAN		2 Oct	11 Oct	6 Oct	3 May	11 May	7 May	204	221	213
	"S"		5	6	6	6	7	6	10	10	10
	n		28	28	28	30	30	30	27	27	27

Table 71. Black bear den entrance and emergence dates, winter of 1983/84.

		Repro-ductive status	1983 Entrance			1984 Emergence			Days in Den		
Bear ID	Sex	at exit	earliest	latest	Mid.	earliest	latest	Mid.	Min.	Max.	Mid.
B289	F	1@1	5 Oct	24 Oct	10 Oct	30 Apr	10 May	5 May	189	218	208
B317	F	1@1	26 Sep	5 Oct	1 Oct	30 Apr	10 May	5 May	208	227	217
B321	F	1@0	26 Sep	5 Oct	1 Oct	10 May	16 May	13 May	218	233	225
B324	M		15 Sep	27 Sep	21 Sep	30 Apr	10 May	5 May	216	238	227
B329	F	w/o	5 Oct	24 Oct	15 Oct	18 Apr	30 Apr	24 Apr	177	208	192
B343	M		5 Oct	24 Oct	15 Oct	24 Apr	30 Apr	27 Apr	183	208	195
B346	M		16 Sep	27 Sep	22 Sep	18 Apr	10 May	29 Apr	204	237	220
B354	F	2@0	27 Sep	5 Oct	1 Oct	10 May	15 May	13 May	218	231	225
B358	M		5 Oct	24 Oct	15 Oct	30 Apr	10 May	5 May	189	218	203
B359	M		5 Oct	24 Oct	15 Oct	30 Apr	10 May	5 May	189	218	203
B360	M		5 Oct	24 Oct	15 Oct	7 Apr	18 Apr	13 Apr	166	196	181
B361	F	3@1	5 Oct	24 Oct	15 Oct	18 Apr	30 Apr	24 Apr	177	208	192
B363	F	2@0	5 Oct	24 Oct	15 Oct	30 Apr	10 May	5 May	189	218	203
B369	F	2@0	5 Oct	24 Oct	15 Oct	10 May	23 May	17 May	199	231	215
B375	F	2@1	26 Sep	5 Oct	1 Oct	18 Apr	30 Apr	24 Apr	196	217	206
B376	F	3@1	5 Oct	24 Oct	15 Oct	30 Apr	10 May	5 May	189	218	203
B377	F	w/o	15 Sep	26 Sep	21 Sep	10 May	23 May	17 May	240	251	239
B378	F	2@1	5 Oct	24 Oct	15 Oct	30 Apr	10 May	5 May	188	218	203
B387	M		5 Oct	25 Oct	15 Oct	30 Apr	10 May	5 May	189	218	203
B401	M		5 Oct	24 Oct	15 Oct	7 Apr	18 Apr	13 Apr	166	196	181
B402	F	w/o	26 Sep	5 Oct	1 Oct	30 Apr	10 May	5 May	208	224	217
B404	F	?	26 Sep	5 Oct	1 Oct	10 May	23 May	17 May	218	240	229
B405	F	2@1	5 Oct	24 Oct	15 Oct	10 May	23 May	17 May	199	231	215
B406	F	2@1	5 Oct	25 Oct	15 Oct	18 Apr	30 Apr	24 Apr	176	208	192
B408	M		5 Oct	25 Oct	15 Oct	30 Apr	10 May	5 May	188	218	203
B409	F	?	26 Sep	5 Oct	1 Oct	10 May	23 May	17 May	218	240	229
B411	F	2@0	5 Oct	24 Oct	15 Oct	10 May	23 May	17 May	199	231	215
	Mean		2 Oct	16 Oct	8 Oct	29 Apr	10 May	4 May	196	222	209
	"S"		6.6	10.6	8.3	9.9	9.9	9.9	17.7	13.5	14.9
	n		27	27	27	27	27	27	27	27	27

Table 72. Black bear den entrance and emergence dates, winter of 1984/85.

		Repro-ductive status	1983 Entrance			1984 Emergence			Days in Den		
Bear ID	Sex	at exit	earliest	latest	Mid.	earliest	latest	Mid.	Min.	Max.	Mid.
B289	F	2@0	1 Oct	11 Oct	6 Oct	23 May	1 June	28 May	224	243	234
B317	F	2@0	1 Oct	11 Oct	6 Oct	23 May	1 June	28 May	224	243	234
B321	F	1@1	1 Oct	11 Oct	6 Oct	9 May	16 May	13 May	210	227	219
B329	F	w/o	11 Oct	24 Oct	18 Oct	9 May	16 May	13 May	197	217	207
B354	F	w/o	1 Oct	11 Oct	6 Oct	23 May	4 June	29 May	224	246	235
B359	M		1 Oct	11 Oct	6 Oct	9 May	16 May	13 May	210	227	219
B361	F	3@2	11 Oct	24 Oct	18 Oct	9 May	16 May	13 May	197	217	207
B363*	F	2@1	1 Oct	11 Oct	6 Oct	9 May	16 May	13 May	210	227	219
B369*	F	1@1	11 Oct	24 Oct	18 Oct	9 May	16 May	13 May	197	217	207
B375*	F	?	11 Oct	24 Oct	18 Oct	23 May	31 May	27 May	211	232	221
B376*	F	w/o	11 Oct	24 Oct	18 Oct	9 May	16 May	13 May	197	217	207
B377*	F	2@0	1 Oct	11 Oct	6 Oct	16 May	23 May	20 May	212	234	226
B378*	F	1@0	21 Sep	1 Oct	26 Sep	23 May	5 June	30 May	234	257	246
B387	M		1 Oct	11 Oct	6 Oct	30 Apr	9 May	5 May	201	220	211
B401	M		1 Oct	24 Oct	13 Oct	30 Apr	9 May	5 May	189	220	204
B402*	F	2@0	24 Oct	7 Nov	31 Oct	16 May	23 May	20 May	190	211	201
B404*	F	3@0	11 Oct	24 Oct	18 Oct	16 May	23 May	20 May	204	224	214
B405*	F	2@2	21 Sep	1 Oct	26 Sep	23 May	5 June	30 May	234	257	246
B408*	M		11 Oct	24 Oct	18 Oct	No effort	--	--	--	--	--
B409*	F	w/o	11 Oct	24 Oct	18 Oct	16 May	23 May	20 May	204	224	214
B411*	F	2@1	1 Oct	11 Oct	6 Oct	16 May	23 May	20 May	212	234	226
B328	F	3@0	6 Sep	21 Sep	14 Sep	16 May	23 May	20 May	237	259	248
B349	F	2@0	1 Oct	11 Oct	6 Oct	16 May	23 May	20 May	212	234	226
B364	F	w/o	21 Sep	1 Oct	26 Sep	23 May	3 June	28 May	234	255	244
B416	M		21 Sep	1 Oct	26 Sep	16 May	23 May	20 May	227	244	236
B302	M		1 Oct	24 Oct	13 Oct	9 May	16 May	13 May	197	227	212
	Mean		3 Oct	15 Oct	9 Oct	14 May	23 May	19 May	212	233	223
	"S"		9.5	10.5	9.9	7.0	8.1	7.5	14.6	14.3	14.5
	n		28	27	27	25	25	25	25	25	25

* Downstream bear

Table 73. Characteristics of black bear dens in the Susitna study area during winters of 1980/1981, 1981/1982, 1982/1983, 1983/84, 1984/85.

	Den No.	Bear ID No.	Age at Exit	Elevation (feet)	Slope (Degrees)	Aspect **** (True N)	Vegetation	% Canopy Tree Coverage	ENTRANCE Ht. (cm.)	ENTRANCE Width (cm.)	CHAMBER Ln. (cm.)	CHAMBER Width (cm.)	CHAMBER Ht. (cm.)	Total Length (cm)	Previously Used? (Yes/No)	A	B	C
NATURAL CAVITIES																		
FEMALES w/offspring (at exit)																		
w/2 cubs	8	B321	11	2825	42	208	Alder	0	79	26	127	68	71	610	Yes	2	No	-
w/2 cubs	19	B328	7	1950	40	218	Alder	0	41	93	-	-	-	-	Yes	4	No	-
w/1@1	32	B328	8	2075	64	298	Alder/Birch/Moss	50	49	39	84	54	44	180	Yes	3	No	-
w/2@0	73###	B327	8	2070	58	270	Alder	90	43	41	249	91	58	328	Yes	4	-	Yes
w/1@0	88###	B375	6	875	26	270	Alder/Birch/Spruce	85	-	-	-	-	-	-	Yes	2	-	-
w/3@0	92###	B374	7	1825	22	353	Alder/Willow	30	41	48	1220	-	-	1220	Yes	1	-	-
w/3@0	93sp.	B374	7	1775	42	204	Alder/Grass	60	33	81	-	-	36	117	Yes	-	-	-
w/2@0	113	B354	5	2650	40	59	Spruce/D. Birch/Grass	10	64	34	179	99	66	480	Yes	2	No	-
w/1@1	129	B289	13	1875	49	249	Aspen/Willow/Alder	55	55	32	327	40	64	327	Yes	2	-	Yes
w/2@1	168	B363	7	3000	-	-	-	-	-	-	-	-	-	-	-	-	-	No
w/2@1	169	B354	8	3140	27	47	Shrub/Tundra	0	38	50	172	111	69	-	Yes?	3	-	No
w/1@1	172*	B321	15	2845	47	28	Shrub/Tundra	0	-	-	-	-	-	-	-	-	No	-
2/3@0	180	B328	11	2095	57	289	Alder/Birch	0	57	54	137	54	76	229	Yes?	4	No	-
w/2@1	184	B411	10	1490	38	97	Alder/Birch	10	40	32	132	82	58	212	Yes	2	-	-
w/2@0###	158***	B289	9	1960	47	247	Alder/Birch	15	22	42	219	73	74	390	Yes	3	-	Yes
FEMALES w/o offspring (at exit)																		
	85*	B377	6	2270	47	127	Alder/Grass	10	-	-	-	-	-	-	-	-	-	-
	33	B318	7	1890	41	1	Birch	0	51	43	69	76	62	654	Yes	3	No	-
? collar shed in den	6	B325	12	1490	30	178	Birch/Alder/Spruce	50	49	27	100	74	55	113	Yes	2	No	-
	115	B348	4	3125	38	189	Shrub	20	106	33	146	73	80	475	Yes	2	-	-
	144	B376	7	2075	23	185	Alder/Grass	30	53	43	189	96	75**	433	Yes	3	-	No
	185	B405	19	1985	18	105	Alder	0	38	58	232	103	61	336	Yes	3	-	-
	191*	B375	12	1700	45	118	Alder	0	-	-	-	-	-	-	-	-	-	-

(continued on next page)

Table 73. (continued)

	Den No.	Bear ID No.	Age at Exit	Elevation (feet)	Slope (Degrees)	Aspect*** (True N)	Vegetation	% Canopy Tree Coverage	ENTRANCE Ht. (cm.)	ENTRANCE Width (cm.)	CHAMBER Ln. (cm.)	CHAMBER Width (cm.)	CHAMBER Ht. (cm.)	Total Length (cm)	Previously Used? (Yes/No)	A	B	C
MALES																		
	7#	B287	11	1700	46	170	Cottonwood/Willow/Birch	50	62	44	122	89	42	-	Yes	2	No	-
	9###	B324	6	2240	30	88	Alder	0	38	34	137	70	45	-	Yes	3	No	-
	10#	B303	8	1690	50	48	Willow/Alder/Aspen	-	93	36	108	82	94	869	Yes	1	No	-
	13*	B304*	11	4340	24	52	Rock pile/Tundra	0	-	-	-	-	-	-	?*	-	No	-
	18*	B322*	5	1840	53	158	Alder/rock slide	0	-	-	-	-	-	-	?*	-	-	Yes
	###49***	B323	4	1950	-	204	Spruce/Birch	-	-	-	-	-	-	-	-	-	-	Yes
	51	B323	5	2370	30	168	Spruce/Birch	0	38	53	-	-	48	-	Yes	4	-	No
	66	B343	7	1900	60	300	Alders	40	76	86	-	-	71	488	Yes	3	No	-
	95	B360	8	2150	48	153	Birch/Spruce	40	81	38	-	64	97	465	Yes	3	-	Yes
	157	B401	4	1700	41	202	Birch/Spruce	80	51	30	134	63	71	280	Yes	2	-	Yes
	96	B346	11	2200	42	198	Alder/Birch/Spruce	40	46	48	211	185	91	318	Yes	5	-	Yes
	98	B359	5	1875	30	58	Birch/Spruce	55	58	39	216	89	51	272	Yes	3	-	Yes
	100	B358	3	3450	30	283	Alder/Tundra	0	20	53	-	-	-	-	No	5	-	No
	156	B408	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	167	B387	6	3500	39	317	Alpine tundra	0	40	56	145	106	74	421	Yes?	3	-	No
	173	B359	7	2435	43	196	Birch	60	52	49	143	69	74	283	Yes	4	No	-
UNKNOWN SEX	72	-	-	2370	30	168	Spruce/Birch	0	41	23	-	58	89	1068**	Yes	3	-	No
HOLLOW TREES																		
FEMALES (status at exit)																		
w/?@0	146	B377	6	650	0	flat	Cottonwood/Alder/Fern	90	-	36	-	89	-	-	Yes	3	-	-
w/2@1	154*	B378	8	2200	-	218	Cottonwood/Alder/Birch	-	-	-	-	-	-	-	Unk.	-	-	-
w/o	145	B402	11	625	0	flat	Cottonwood/Alder/Fern	100	63	27	80	102	-	-	Yes	2	-	-

(continued on next page)

Table 73. (continued)

	Den No.	Bear ID No.	Age at Exit	Elevation (feet)	Slope (Degrees)	Aspect*** (True N)	Vegetation	% Canopy Tree Coverage	ENTRANCE Ht. (cm.)	ENTRANCE Width (cm.)	CHAMBER Ln. (cm.)	CHAMBER Width (cm.)	CHAMBER Ht. (cm.)	Total Length (cm)	Previously Used? (Yes/No)	A	B	C
DUG DENS																		
FEMALES w/offspring (at exit)																		
w/2 cubs	2	B301	8	2065	34	191	Alder/Birch	90	49	43	97	92	51	151	Yes	3	-	Yes
w/3 cubs	4#	B289	10	2000	18	211	Alder/Willow/Spruce	70	39	72	142	127	55	290	No	1	-	Yes
w/2 ylgs	11	B317	8	2050	36	86	Alder	0	27	41	93	93	78	128	No	3	No	-
w/1 ylg	12	B318	6	2725	24	122	Dwarf Birch/Moss/ Tundra	0	24	42	95	84	40	145	No	5	No	-
w/2 ylgs	21##	B327	6	2000	35	19	Alder/Birch	80	22	59	163	203	116	198	?	4	-	Yes
w/2 ylgs	50	B301	9	2275	43	227	Cottonwood/Spruce	20	28	56	76	136	98	193	Yes	2	-	No
w/2@0	68*	B318	8	1975	32	360	Alder/Spruce	20	-	-	-	-	-	366	-	3	No	-
w/2@0	69	B317	10	1820	35	28	Birch	40	46	43	-	122	58	51	No	4	No	-
w/2@0	70	B301	10	2400	26	130	Alder/Birch	90	43	66	-	160	41	188	-	4	-	No
w/2@0	74*	B349	6	3250	38	245	Alder	0	-	74	-	119	43	188	No	3	-	No
w/4@0	75	B361	-	2300	21	273	Alder/Spruce	70	27	69	114	114	72	173	Yes	2	-	No
w/2@0	81	B289	12	1960	24	350	Alder	70	38	58	142	107	72	173	Yes	2	-	Yes
w/2@0	83	B370	8	1750	31	212	Alder/Birch	90	30	38	119	130	71	124	No	3	-	-
w/3@0	84	B372	10	1825	17	50	Alder/Birch/Spruce	90	36	43	76	206	60	119	No	3	-	-
w/2@0	90	B378	4	1225	34	298	Alder/Fern	90	30	79	117	147	76	185	No	2	-	-
w/3@0	91	B376	-	1425	24	151	Alder/Birch	-	38	69	84	91	74	170	Yes	3	-	-
w/2 @1	97*	B354	6	2375	24	19	Willows/Alder	0	33	38	-	-	-	-	No	-	-	-
w/2@0	114	B363	6	2375	13	291	Willow/Spruce/Alder	25	39	45	123	110	60	206	No	3	-	No
w/3@1	127	B361	9	1950	9	199	Spruce/Birch/Aspen	90	41	51	150	125	80	208	Yes	2	-	Yes
w/?@0	138*	B321	14	2225	5	190	D. Birch/Willow/Spruce	25	-	-	-	-	50**	232**	Unk.	5	No	-
w/2@0	141	B369	6	1300	-	-	Alder/Birch	40	-	-	-	-	-	-	Unk.	4	-	-
w/2@1	143	B405	18	1550	24	122	Alder/Birch/Spruce	95	36	59	190	127	66	190	No	4	-	-

(continued on next page)

Table 73. (continued)

	Den No.	Bear ID No.	Age at Exit	Elevation (feet)	Slope (Degrees)	Aspect*** (True N)	Vegetation	% Canopy Tree Coverage	ENTRANCE Ht. (cm.)	ENTRANCE Width (cm.)	CHAMBER Ln. (cm.)	CHAMBER Width (cm.)	CHAMBER Ht. (cm.)	Total Length (cm)	Previously Used? (Yes/No)	A	B	C
FEMALES w/offspring (at exit) (continued)																		
w/3@2	160*	B361	7	2440	26	330	Alder	0	-	-	-	-	-	-	No?	1	-	No
w/1@2?	174	B364	12	2145	22	326	Spruce-Birch	40	33	39	110	113	73	183	No?	2	-	Yes
w/2@0	181	B317	12	2055	32	287	Alder-Birch	20	50	59	152	133	78	152	No	3	No	-
w/3@0	186	B404	13	1975	26	214	Alder-Spruce	10	27	67	193	91	72	193	Yes	3	-	-
w/2@0	187	B402	12	1910	21	133	Alder	0	38	63	130	98	54	134	No?	3	-	-
w/2@0	188*	B377	7	1500	35	38	Alder	0	-	-	-	-	-	-	-	-	-	-
w/2@1	198*	B369	7	1100	-	-	Alder-Birch	-	-	-	-	-	-	-	-	-	-	-
w/2@0	203*	B289	14	1600	-	-	Spruce	-	-	-	-	-	-	-	-	-	-	-
FEMALES w/o offspring (at exit)																		
	34	B321	12	2125	22	184	Alder	10	29	43	99	118	79	193	No	2	No	-
	43	B317	9	2250	8	153	Dwarf Birch	0	32	36	92	89	63	150	No	2	No	-
	55	B349	5	2650	21	207	Alder/Spruce	10	39	54	56	92	55	124	No		-	No
	58	B327	7	1675	26	321	Birch/Alder	70	35	49	86	73	61	160	No	3	-	Yes
	67	B369	5	1410	21	78	Grass/Alder/Spruce	25	36	51	-	91	71	104	No	3	-	-
	80	B329	3	1725	31	28	Alder	90	24	43	102	84	53	165	No	5	-	Yes
	82	B367	5	1960	30	323	Alder/Fern	80	36	38	102	130	81	152	No	4	-	-
	99*	B363	5	2775	21	177	Alder	90	30	74	-	112**	53**	94**	No	3	-	No
	142	B411	9	1475	7	105	Alder/Birch/Spruce	100	34	57	139	117	57	220	Yes	3	-	-
MALES																		
	### 20***	B323*	3	1950	71	176	Alder/Birch/Spruce	80	166	25	217	76	36	454	Yes	3	-	Yes
	35	B304	12	1650	36	79	Birch	25	53	147	100	173	-	660	Yes	2	No	-
	38*	B343	6	1200	39	313	Birch/Alder/Spruce	60	35	62	-	-	-	-	No	?	-	-
	39	B348	10	1375	43	240	Birch/Spruce	20	57	91	116	172	183	530	Yes	1	-	-
	57	B302	10	2025	41	236	Spruce/Birch	40	55	63	94	138	101	188	Yes	2	-	Yes
	71	B365	6	900**	10**	-	Alder/Birch/Spruce	-	-	-	-	-	-	-	-			

(continued on next page)

Table 73. (continued)

	Den No.	Bear ID No.	Age at Exit	Elevation (feet)	Slope (Degrees)	Aspect*** (True N)	Vegetation	% Canopy Tree Coverage	ENTRANCE Ht. (cm.)	ENTRANCE Width (cm.)	CHAMBER Ln. (cm.)	CHAMBER Width (cm.)	CHAMBER Ht. (cm.)	Total Length (cm)	Previously Used? (Yes/No)	A	B	C
MALES (continued)																		
	116*	B387	5	3375	25	111	Alder/D. Birch	80	-	40	-	-	-	-	No	4	-	No
	126*	B359	6	2375	0	9	Spruce/D. Birch	50	-	-	-	-	-	354**	No	2	-	No
	128	B360	9	2150	14	239	Alder/Spruce	110	54	57	90	160	84	146	No	3	-	Yes
	159	B302	13	2030	29	34	Alder	0	47	77	142	111	64	200	Yes	2	-	Yes
	202*	B416	10	1700	-	-	-	-	-	-	-	-	-	-	-	-	No	-
SPECIES UNKNOWN																		
	3	-	-	2340	35	282	Dwarf birch	0	50	54	-	-	-	170	No	-	-	No
UNKNOWN CAVITY TYPE																		
MALES																		
	40	B324	7	1400**	-	-	--	-	-	-	-	-	-	-	-	-	?	-
	51###	B346	10	2370**	30	168**	Spruce/Birch	0	38	53	-	-	48	-	Yes	-	-	No
	62	B319	4	1600**	60**	118**	Spruce/Alder	-	-	-	-	-	-	-	-	-	-	-
FEMALES																		
	65*	B329	1	1900**	45**	28**	--	-	-	-	-	-	-	Yes	-			
	63*	B290	9	1850**	15**	73**	--	-	-	-	-	-	-	-	-	-	-	No
	64*	B290	9	1700**	15**	28**	--	-	-	-	-	-	-	-	-	-	-	No
w/1@0	190*	B378	9	2000	62	308	Alder	0	-	-	-	-	-	-	-	-	-	-
UNKNOWN SEX																		
	61	?	?	2400	35**	163**	Spruce/Alder/Birch	80	-	-	-	-	-	-	No	4	-	No

(continued on next page)

Table 73. (continued)

* Actual den site not found or too difficult to enter or collapsed.
** Approximate value.
A Subjective characterization of quality, 1 = highest and 5 = lowest.
B Will be flooded by Devil's Canyon impoundment?
C Will be flooded by Watana impoundment?
*** Den not located first year known but thought to be the same location as subsequently found den. Den No. 158=171.
**** Mag. N+28° = True N. of hillside.
\# Used by the same bear two consecutive winters.
\## Used by the offspring during natal winter and subsequent winter.
\### Used by different radio-collared bear during subsequent winter.

Dens No. 8, 19, 6, 7, 9 10, 13, 18, 2, 4, 11, 12, 21, 20, 62, 63, 64 used during winter of 1980/1981.

Dens No. 32, 33, 50, 34, 43, 55, 58, 35, 38, 39, 57, 40, 49, 51, 61, 65, 7, 9, 10, 4, 21, used during winter of 1981/1982.

Dens No. 73, 88, 92, 93, 85, 51, 66, 95, 96, 98, 100, 72, 68, 69, 70, 74, 75, 81, 83, 84, 90, 91, 97, 67, 80, 82, 99, 71, 10, 7, 9, 19 used during winter 1982/1983.

Dens No. 113, 129, 20, 115, 144, 49, 146, 154, 145, 114, 127, 138, 141, 143, 142, 116, 126, 128, 140, 152, 156, 147, 9, 51, 88, 92, and 73 used during winter 1983/84.

Dens No. 168, 169, 172, 180, 184, (158), 185, 191, 167, 173, 160, 174, 181, 186, 187, 188, 198, 203, (159), 202, 190, (85), (49), (74), used during winter 1984/85.

Table 74. (Continued)

		1982/83			1983/84			1984/85		
Bear No.	Sex	Cavity Type	Den#	Assoc**	Cavity Type	Den#	Assoc**	Cavity Type	Den#	Assoc**
376	F	Dug	91	w/3@0	Natural	144	w/o	Nat.	85	w/o?
377	F	Natural	85	w/o	Tree	146	w/?@0?	Dug	188	w/2@0
378	F	Dug	90	w/2@0	Tree	154	w/2@1	Nat.	190	w/1@0
379	F	Natural	19	w/3@0	Dead----------					
387	M				Dug	116	w/o	Nat.	167	--
401	M				Natural	157	w/o	Nat.	49	--
402	F				Tree	145	w/o	Dug	187	w/2c
404	F				Natural	92	w/o	Dug	186	w/3@0
405	F				Dug	143	w/2@1	Nat.	185	w/o
408	M				Natural	157	w/o	Unk.	201	w/o
411	F				Dug	142	w/2@0	Nat.	184	w/2@1
416	M							Dug	202	--
364	F							Dug	174	w/1@2?

** Associations are at time of emergence

*** Den 158 was capture site of B289 (mother of B329) in spring 1980. Den not flagged until winter 84/85, assumed was 79/80 den of B289

Table 74. History of den use by individual radio-marked black bears, 1980/81 - 1984/85.

		1980/81			1981/82			1982/83			1983/84			1984/85		
Bear No	Sex	Cavity Type	Den#	Assoc**	Cavity Type	Den#	Assoc**	Cavity Type	Den#	Assoc**	Cavity Type	Den#	Assoc**	Cavity Type	Den#	Assoc**
287	M	Natural	7	w/o	Natural	7	w/o	Dead----------------			------------------			------------------		
289	F	Dug	4	w/3@0	Dug	4	w/2@1	Dug	81	w/2@0	Natural	129	w/1@1	dug	203	w/2@0
290	F	-	63,64	w/o	Released----------											
301	F	Dug	2	w/2@0	Dug	50	w/2@1	Dug	70	w/2@0	Shed------------------			Dead		
302	M	Dug	57	w/o	Shed----------									dug	#159	--
303	M	Natural	10	w/o	Natural	10	w/o	Natural	10	w/o	Dead----------					
304	M	Natural	13	w/o	Dug	35	w/o	Shed----------								
317	F	Dug	11	w/2@1	Dug	43	w/o	Dug	69	w/2@0	Natural	20	w/1@1	dug	181	w/2@0
318	F	Dug	12	w/1@1	Natural	33	w/o	Dug	68	w/2@0	Shed----------					
319	M	-	62	w/o	Dead----------											
321	F	Natural	8	w/2@0	Dug	34	w/o	Natural	7	w/o	Dug	138	w/1@0	Nat.	172	w/1@1
322	M	Natural	18	w/o	Shed & Dead----------											
323	M	Natural	20	w/o	Natural	49	w/o	Natural	51	w/o	Dead----------					
324	M	Natural	9	w/o	Dug	40	w/o	Natural	9	w/o	Natural	9	w/o	Missing----------		
325	F	Natural	6	w/o	Natural	9	w/o	Shed----------								
327	F	Dug	21	w/2@1	Dug	58	w/o	Natural	73	w/2@0	Dead------------------			----------------		
328	F	Natural	19	w/2@0	Natural	32	w/1@1	Shed----------------------			Recaptured 5/84			Nat.	180	w/3@0
329	F	Dug	21	w/mom & sibling	Dug	65,21	w/o	Dug	80	w/o	Natural	73	w/1@1	Nat.	#158***	w/2@0
330	M	Dug	12	w/o	Dead----------											
343	M				Dug	38	w/o	Natural	66	w/o	unk	--	--	Dead------------		
346	M				Natural	51	w/o	Natural	96	w/o	Natural	51	w/o	Dead------------		
348	M				Dug	39	w/o	Dead----------								
349	F				Dug	55	w/o	Dug	74	w/2@0	Shed in '83 recaptured '84			Dug-----	74	w/2@0
354	F							Dug	97	w/1@1	Natural	113	w/2@0	Nat.	169	w/2@1
358	M							Natural	100	w/o	Natural	115	w/o	Dead------------		
359	M							Natural	98	w/o	Dug	126	w/o	Nat.	173	w/o
360	M							Natural	95	w/o	Dug	128	w/o	Shed------------		
361	F							Dug	75	w/4@0	Dug	127	w/3@1	Dug	160	w/3@2
363	F							Dug	99	w/o	Dug	114	w/2@0	Nat.	168	w/2@1
365	M							Dug	71	w/o	Dead----------					
367	F							Dug	82	w/o	Dead----------					
369	F							Dug	67	w/o	Dug	141	w/2@0	Dug	198	w/2@1
370	F							Dug	83	W/2@0	Missing----------					
372	F							Dug	84	w/3@0	Missing----------					
374	F							Natural	92	w/3@0	Dead----------					
375	F							Natural	88	w/2@0	Natural	88	w/2@1	Natural	191	w/o

(continued)

Table 75. History of use of individual black bear dens by radio-marked black bears, 1980/81 - 1984/85 (blanks indicate no data available, den not revisited and no radio-marked bear there). "Flooded" means would be inundated by impoundment.

Den No.	Den Type	Flooded	Location***	80/81	81/82	82/83	83/84	84/85
158	Dug	Yes	W	[B289 in 79/80 spring w/2@1]	Unk. 80/81, 81/82	--	--	B329 female
2	Dug	Yes	W	B301 female w/2@0	Vacant	Vacant	Vacant	
4	Dug	Yes	W	B289 female w/3@0	B289 female w/2@1	Vacant	Vacant	Vacant
6	Nat	No	D	B325 female w/o				
7	Nat	No	D	B287 male	B287 male	B321 female w/o		
8	Nat	No	D	B321 female w/2@0				
9**	Nat	No	D	B324 male	B325 female w/o	B324 male	B324 male	Vacant
10	Nat	No	D	B303 male	B303 male	B303 male	Vacant	
11	Dug	No	D	B317 female w/2@1	----------------------			
12	Dug	No	D	B318 female w/1@1 (B330 male)	Collapsed---------	-------------------		
13	Nat	No	D	B304 male				
18	Nat	Yes	W	B322 male				
19	Nat	No	D	B328 female w/2@0		B379 female w/3@0		
20	Nat	Yes	W	B323 male		------------------	B317 female w/1@1	Vacant
21	Dug	Yes	W	B327 female w/B329@1	B329 female w/o	Collapsed---------	-----	
32	Nat	No	D		B328 female w/1@1	Vacant		Vacant
33	Nat	No	D		B318 female w/o			
34	Dug	No	D		B321 female w/o			
35	Dug	No	D		B304 male	Vacant-----------		
38	Dug	No	DS		B343 male	Collapsed---------	----------	
39	Dug	No	DS		B348 male	Vacant		
40	-	Yes	D		B324 male			
43	Dug	No	D		B317 female w/o			
49	Nat	Yes	W		B323 male(?)			B401 male
51*	Nat	No	W		B346 male	B323 male	B346 male	
50	Dug	No	W		B301 female w/2@1	Vacant	Vacant	
55	Dug	No	W		B349 female w/o			
57	Dug	Yes	W		B302 male	Vacant	Vacant	Vacant
58	Dug	Yes	W		B327 female w/o	Vacant		
61	Dug	No	W	-	Unmarked BKB			
62	-	No	D	B319 male				
63	-	No	D	B390 female w/o				
64	-	No	D	B390 female w/o				
65	-	Yes	W		B329 female w/o			
66	Nat	No	D			B343 male		
67	Dug	No	DS			B369 female w/o	-------	
68	Dug	No	D			B318 female w/2@0	Collapsed----	
69	Dug	No	D			B317 female w/2@0		
70	Dug	No	W			B301 female w/2@0	Vacant	Vacant
71	Dug	No	DS			B365 male		

(continued on next page)

Table 75. (Continued)

Den No.	Den Type	Flooded	Location***	80/81-81/82	82/83	83/84	84/85
72	Nat	No	W		Unmarked BKB		
73	Nat	Yes	W		B327 female w/2@0	B329 Female w/1@1	Vacant
74	Dug	No	W		B349 female w/2@0		B349
75	Dug	No	W		B361 female w/4@0		
80	Dug	Yes	W		B329 female w/o		
81	Dug	Yes	W		B389 female w/2@0	Vacant	
82	Dug	No	DS		B367 female w/o		
83	Dug	No	DS		B370 female w/2@0		
84	Dug	No	DS		B372 female w/3@0		
85	Nat	No	DS		B377 female w/o		B376
88	Nat	No	DS		B375 female w/2@0	B375 female w/2@1	
90	Dug	No	DS		B378 female w/2@0		
91	Dug	No	DS		B376 female w/3@0		
92	Nat	No	DS		B374 female w/3@0	B404 female w/o	
93 spring	Nat	No	DS		B374 female w/3@0		
95	Nat	Yes	W		B360 male	Vacant	
96	Nat	Yes	W		B346 male		
97	Dug	No	W		B354 female w/1@1	Collapsed-------------------------------	
98	Nat	Yes	W		B359 male	Vacant	Vacant
99	Dug	No	W		B363 female w/o	Collapsed-------------------------------	
100	Nat	No	W		B358 male	Collapsed-------------------------------	
113	Nat	No	W			B354 female w/2@0	
114	Dug	No	W			B363 female w/2@0	Vacant
115	Nat	No	W			B358 female w/o	
116	Dug	No	W			B387 male	Collapsed-----------
126	Dug	No	W			B359 male	Collapsed-----------
127	Dug	Yes	W			B361 female w/3@1	Vacant
128	Dug	Yes	W			B360 male	
129	Nat	Yes	W			B289 female w/1@1	Vacant
157	Nat	Yes	W			B401 male	
138	Dug	No	D			B321 female w/?@0	Collapsed-----------
140	-	No	DS			B406 female w/2@1	
141	Dug	No	DS			B369 female w/2@0	
142	Dug	No	DS			B411 female w/o	
143	Dug	No	DS			B405 female w/2@1	
144	Nat	No	DS			B376 female w/o	
145	Tree	No	DS			B402 female w/o	Vacant

(continued on next page)

Table 75. (Continued)

Den No.	Den Type	Flooded	Location***	80/81 - 82/83	83/84	84/85
146	Tree	No	DS		B377 female w/?@0	Vacant
147	-	-	D		B343 male	
152	-	No	DS		B409 female w/o	
154	Tree	No	DS		B378 female w/2@1	
156	Nat	No	DS		B408 male	

* Attempted initial denning location for B323, B346, & B360 in 1982/1983. B346 & B360 subsequently moved.
** Attempted denning location for B324 & B325 in 1981/1982. B324 subsequently moved.
*** W= Watana, D= Devils Canyon, DS= Downstream of impoundment zone.

SUMMARY OF TABLE:
103 dens identified to date throughout entire study area (reused dens counted only once).
51(49.5%) dug dens, 40(38.8%) natural cavity dens, 9(8.7%) unknown cavity type. 3(2.9%) tree dens.

Watana dens (N=44)		Devils Canyon dens (N=30)		Downstream dens (N=29)	
				Tree	3(10.3%)
Dug	24(54.5%)	Dug	10(33.3%)	Dug	17(58.6%)
Natural	18(40.9%)	Natural	13(43.3%)	Natural	9(31.0%)
Unknown	2(4.5%)	Unknown	7(23.3%)		
Flooded	24(54.5%)	Flooded	1(3.3%)	Flooded	0(0.0%)
Not flooded	20(45.5%)	Not flooded	28(93.3%)	Not flooded	29(100.0%)
		Unknown	1(3.3%)		

Table 76. Daily search effort for each quadrat for the spring 1985 bear population estimate of the Su-Hydro study area. Commuting and circling time not included.

			For each day: Search time (minutes) /Spotter Plane Number*										
Quadrat No.	Mi^2	Km^2	6/1	6/2	6/3	6/4	6/5**	6/9	6/10	6/11	Total Minutes	Total Min/mi^2	Total Min/km^2
1	56.52	146.38	(19)/2	132/2	93/2	100/2	233/1	(209)/1	(17)/1	156/2	959	17.0	6.6
2	63.64	142.89	--	253/1	183/1	121/1	172/2	(90)/2	(72)/2	(93)/3	984	15.4	6.9
3	38.62	100.02	120/3	131/3	82/2	--	175/2,3	--	110/1	85/2	703	18.2	7.0
4	49.30	127.67	106/1	89/1	96/1	120/1	168/3	(4)/1	157/2	116/1	856	17.4	6.7
5	55.17	142.89	49/1	167/3	138/2	120/3	--	121/1	103/1	(10)/1	708	12.8	5.0
6	33.76	87.42	148/2	79/2	93/1	149/2	(16)/2	(12)/2	180/3	(107)/1	784	23.2	9.0
8	64.72	167.62	214/3,2	(62)/3	173/1,3	174/3	--	166/1	210/2	169/1	1168	18.1	7.0
9	83.29	215.71	118/2	104/1	--	151/1	--	211/2	(166)/1,3	(61)/3	811	9.7	3.8
10	75.10	194.50	96/1	(50)/2	(77)/2	148/2	(7)/2	120/2	217/1	--	715	9.5	3.7
Total	520.12	1325.10	870	1,067	935	1,083	771	933	1,232	797	7,688	14.8	5.8
			14.5 h	17.8 h	15.6 h	18.1 h	12.9 h	15.6 h	20.5 h	13.3 h	128.1 h		

* Spotter Pilot # 1 = McMahan, #2 = Lee, # 3 = Deering
** Bad weather on 6/5/85 and on the 3 days following
( ) = partially done

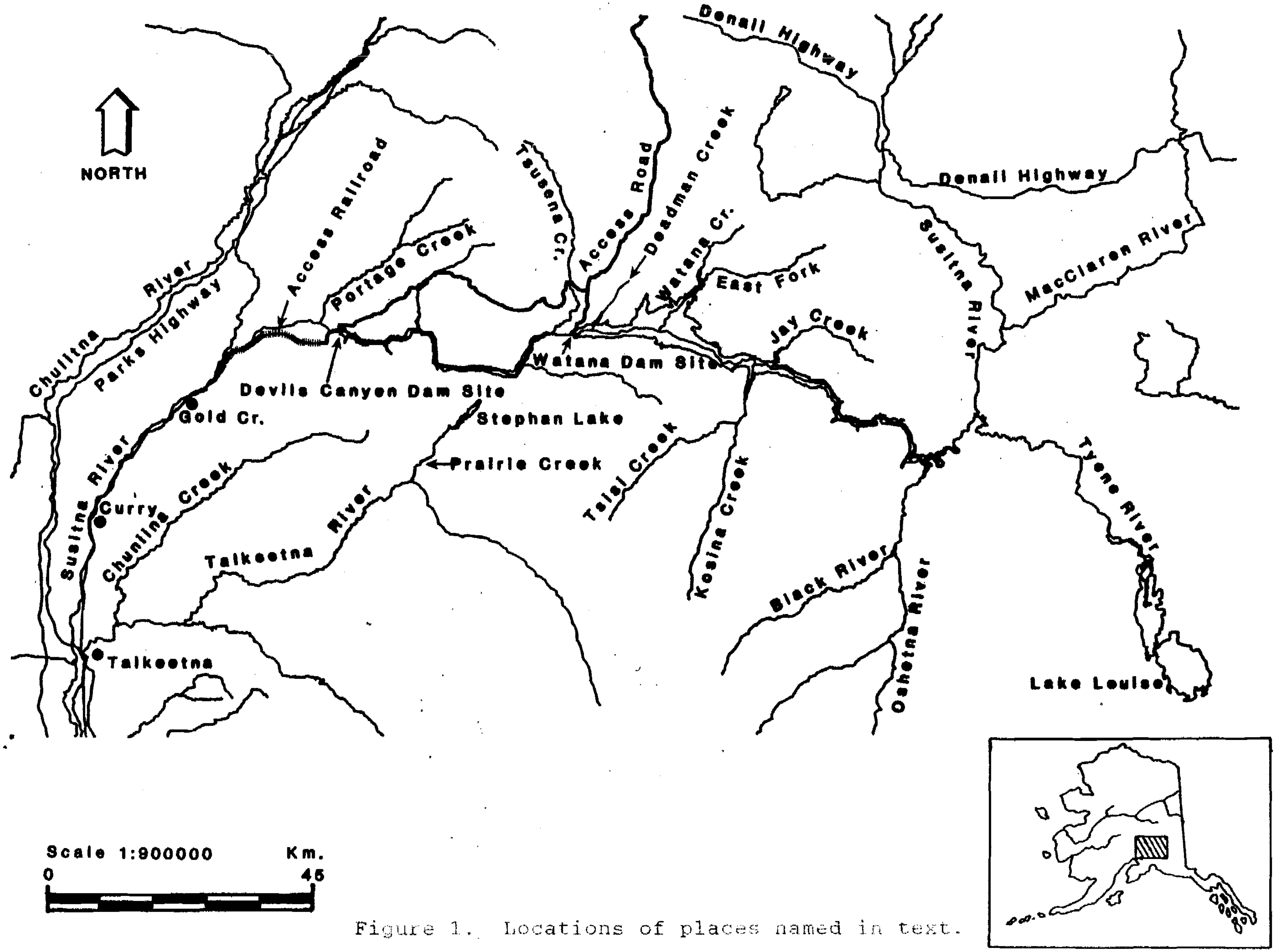


Figure 1. Locations of places named in text.

Figure 2. Capture locations for 53 brown bears radio-collared in the upstream study area. Polygon incorporates an area of 2,169 km², females are indicated with a hexagon, males with an asterisk.

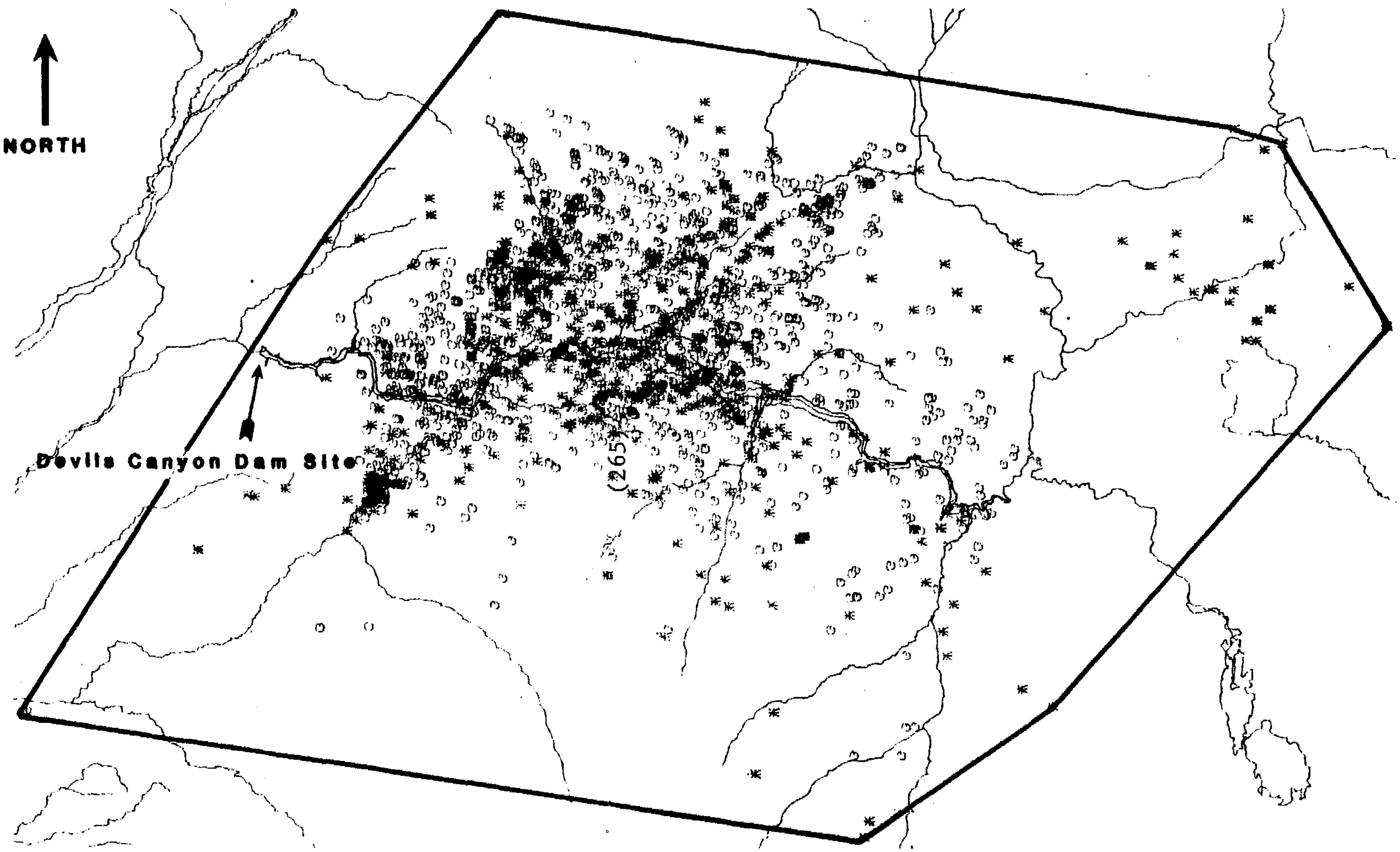


Figure 3. Point locations (N = 2,296) for radio-marked brown bears captured in the downstream study area, 1980-1984. Polygon incorporates an area of 13,912 km², females indicated with a hexagon, males with an asterisk, 1 cm = 9 km. Bears excluded are: 400, 342a, 386 (in 1983), 379, 403, and 407.

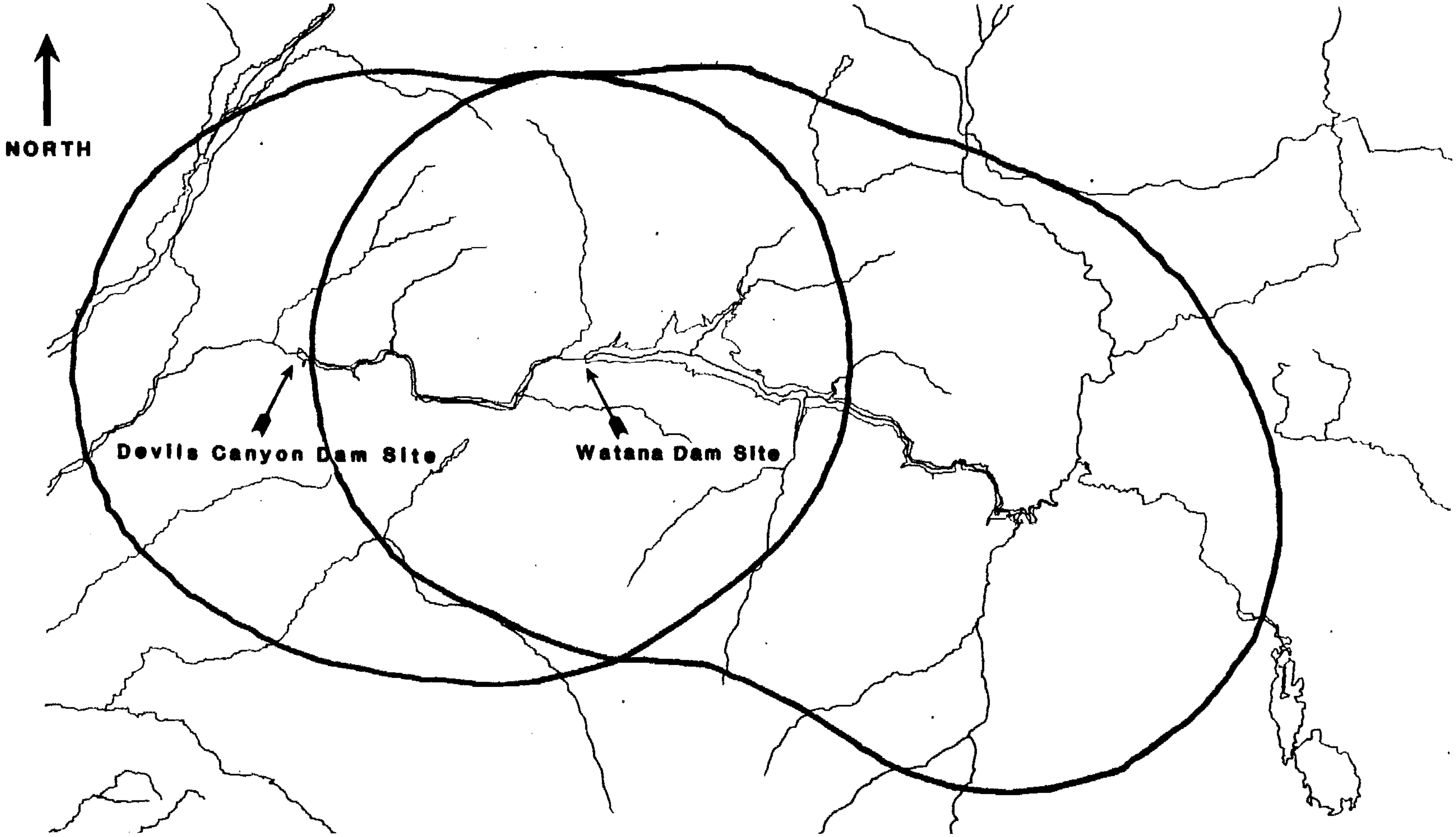
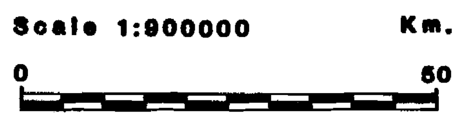


Figure 4. Brown bear study area. Illustrated polygons are 1 mean home range diameter (37.5 km = midpoint between average male and average female home range diameter) around impoundment zones. Defined impoundment zone is between Devils Canyon and confluence of Oshetna and Susitna Rivers. Total area of impoundment zone = 12,127 km^2 (7,120 km^2 for Devils Canyon alone, 9,452 km^2 for Watana alone, and 4,425 km^2 in zone of overlap). Portion of each polygon that is above 5,000 feet elevation (defined as not brown bear habitat) is: 26.12 km^2 for area exclusive to Devils Canyon, 135.39 km^2 for area exclusive to Watana, and 281.14 km^2 for overlap zone between impoundments. Total brown bear habitat in impoundment impact zone is 11,704 km^2 (9,056 km^2 for just Watana and 6,833 km^2 for just Devils Canyon).



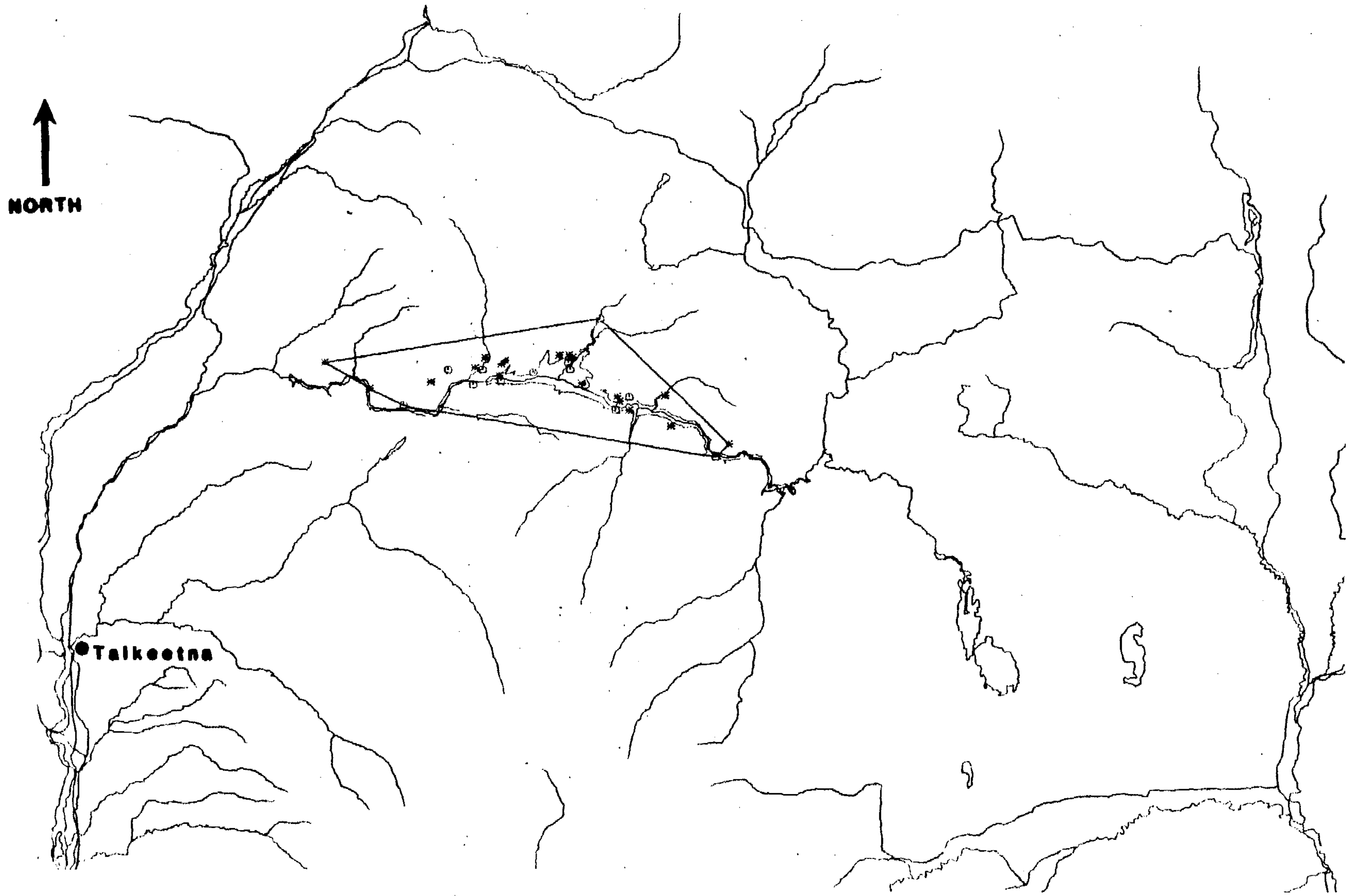


Figure 5. Point locations (N = 2,195) for radio-marked brown bears captured in the downstream study area, 1980-1984. Polygon incorporates an area of 2,946 km², females indicated with a hexagon, males with an asterisk.

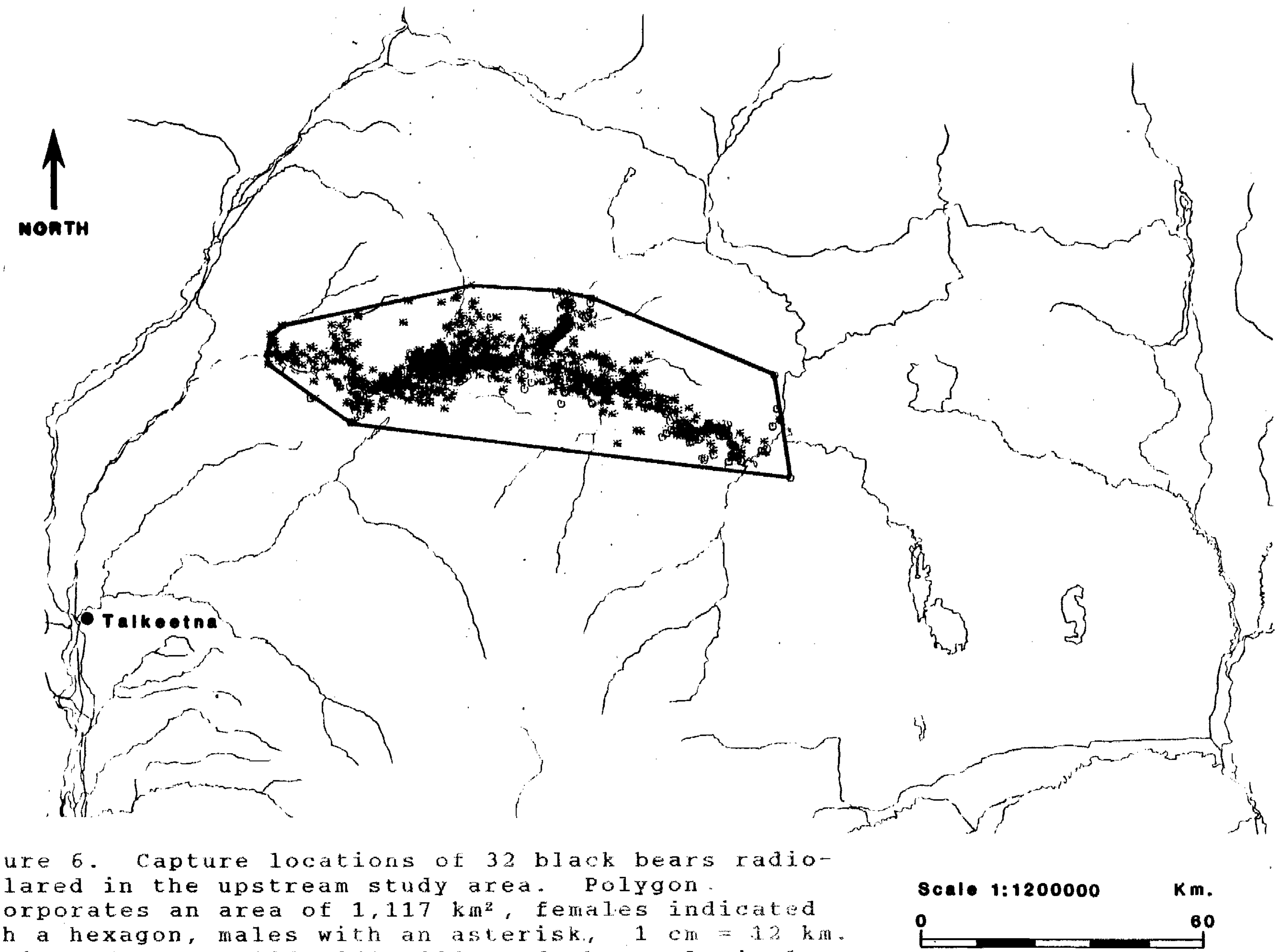


Figure 6. Capture locations of 32 black bears radio-collared in the upstream study area. Polygon incorporates an area of 1,117 km², females indicated with a hexagon, males with an asterisk, 1 cm = 12 km. Not included are: 324, 343, 320, and the exclusively downstream black bears.

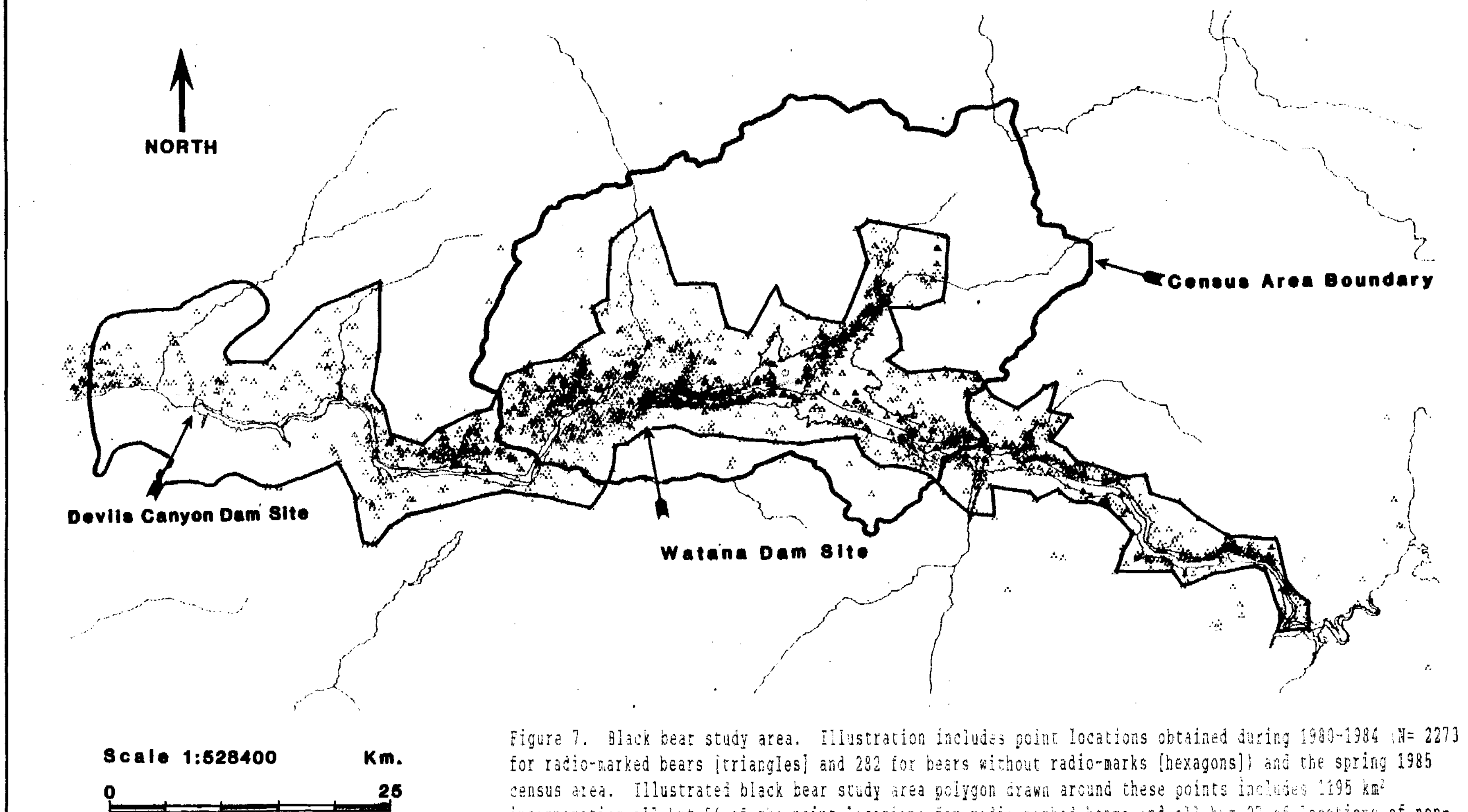


Figure 7. Black bear study area. Illustration includes point locations obtained during 1980-1984 (N= 2273 for radio-marked bears [triangles] and 282 for bears without radio-marks [hexagons]) and the spring 1985 census area. Illustrated black bear study area polygon drawn around these points includes 1195 km² incorporating all but 54 of the point locations for radio-marked bears and all but 27 of locations of non-radio-marked bears.

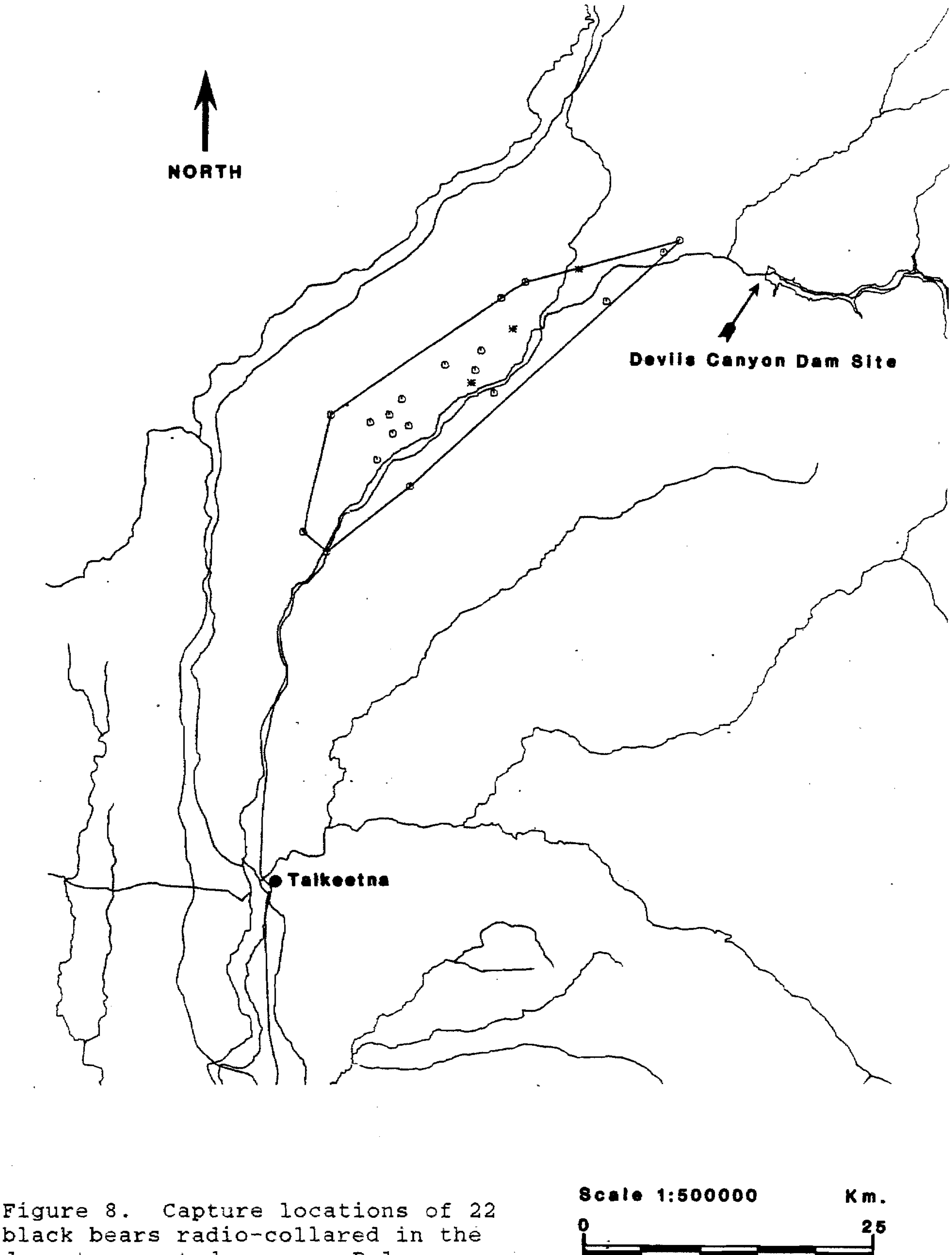


Figure 8. Capture locations of 22 black bears radio-collared in the downstream study area. Polygon incorporates an area of 250 km^2, females indicated with a hexagon, males with an asterisk.

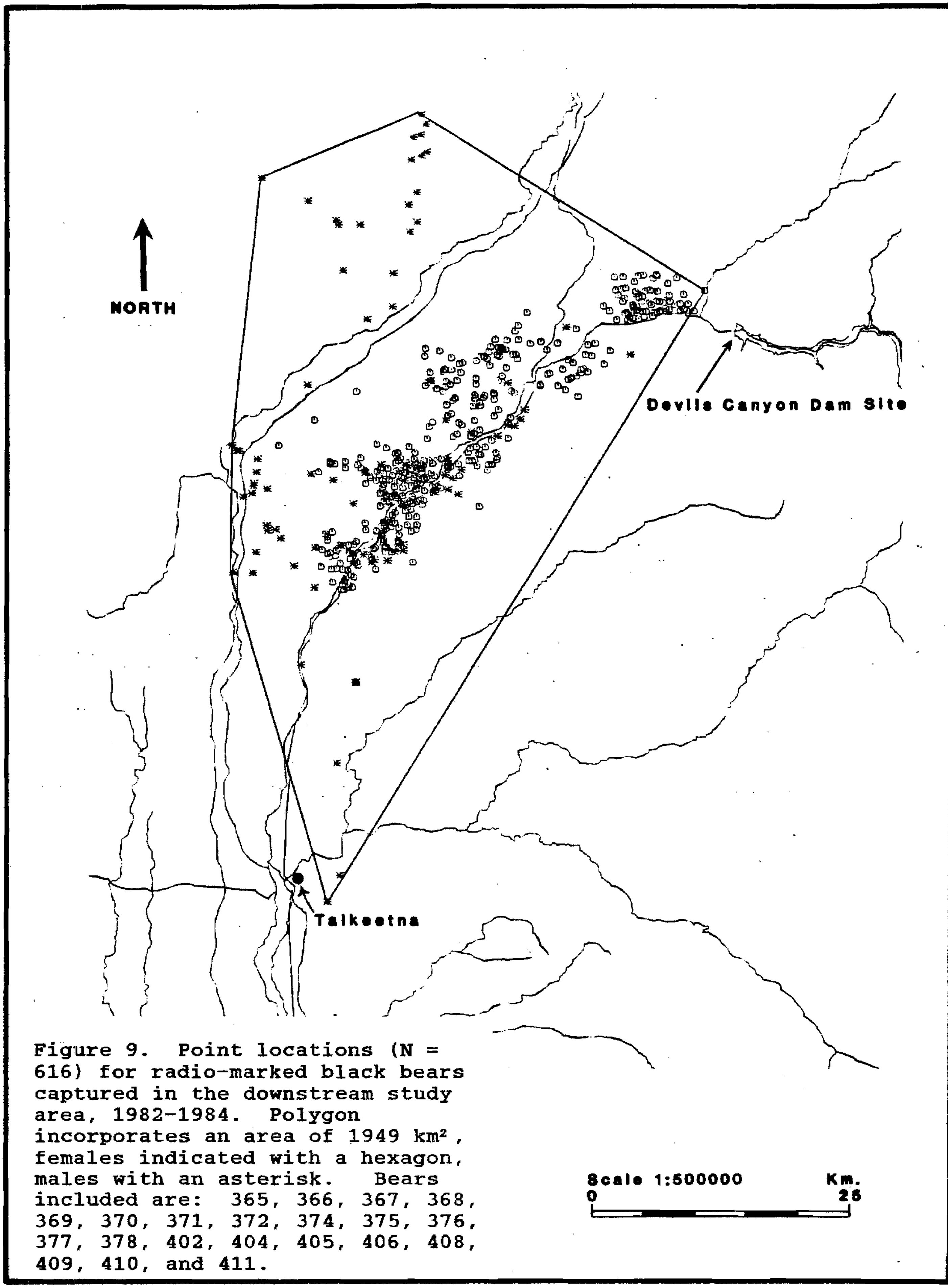


Figure 9. Point locations (N = 616) for radio-marked black bears captured in the downstream study area, 1982-1984. Polygon incorporates an area of 1949 km², females indicated with a hexagon, males with an asterisk. Bears included are: 365, 366, 367, 368, 369, 370, 371, 372, 374, 375, 376, 377, 378, 402, 404, 405, 406, 408, 409, 410, and 411.

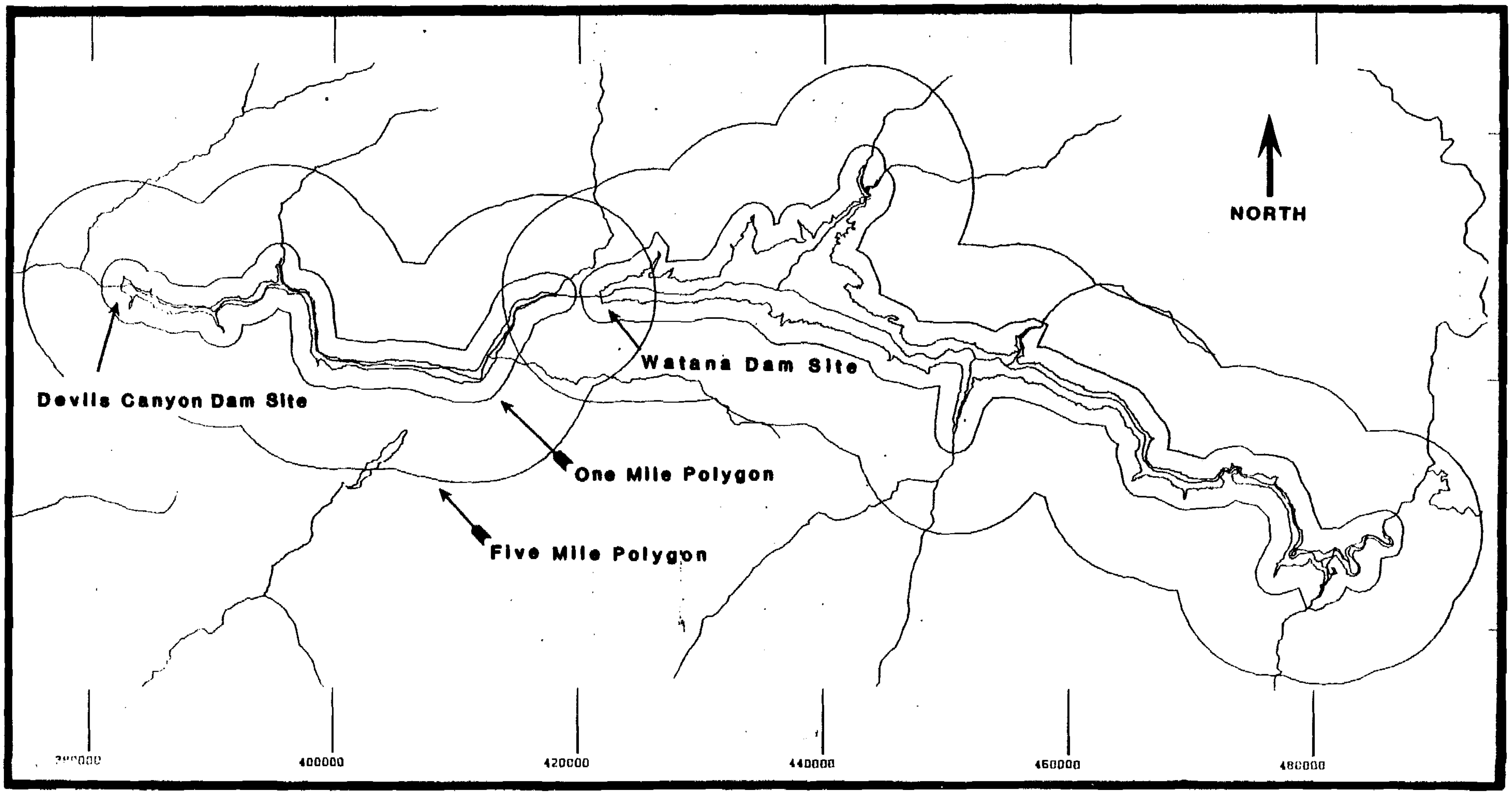


Figure 10. Illustration of proximity polygons that are 1 mile and 5 miles from the shoreline of proposed Watana and Devils Canyon Impoundments.

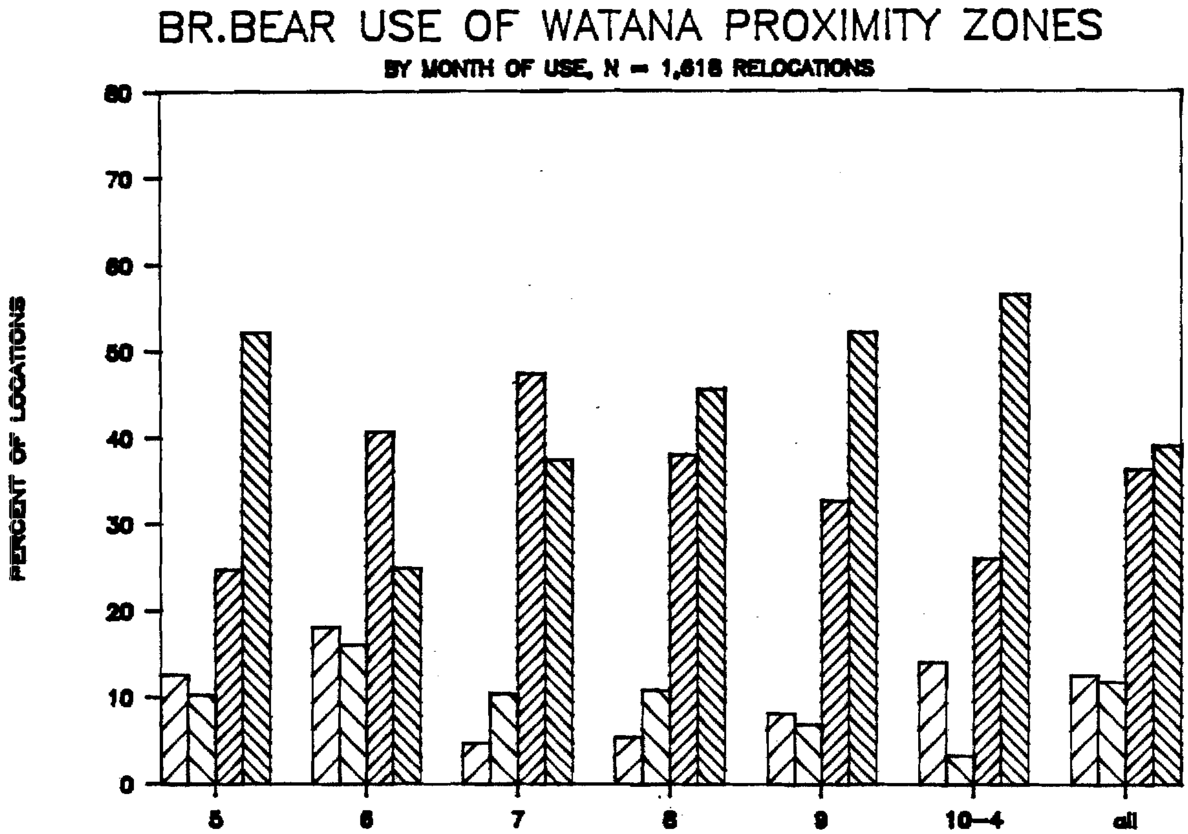
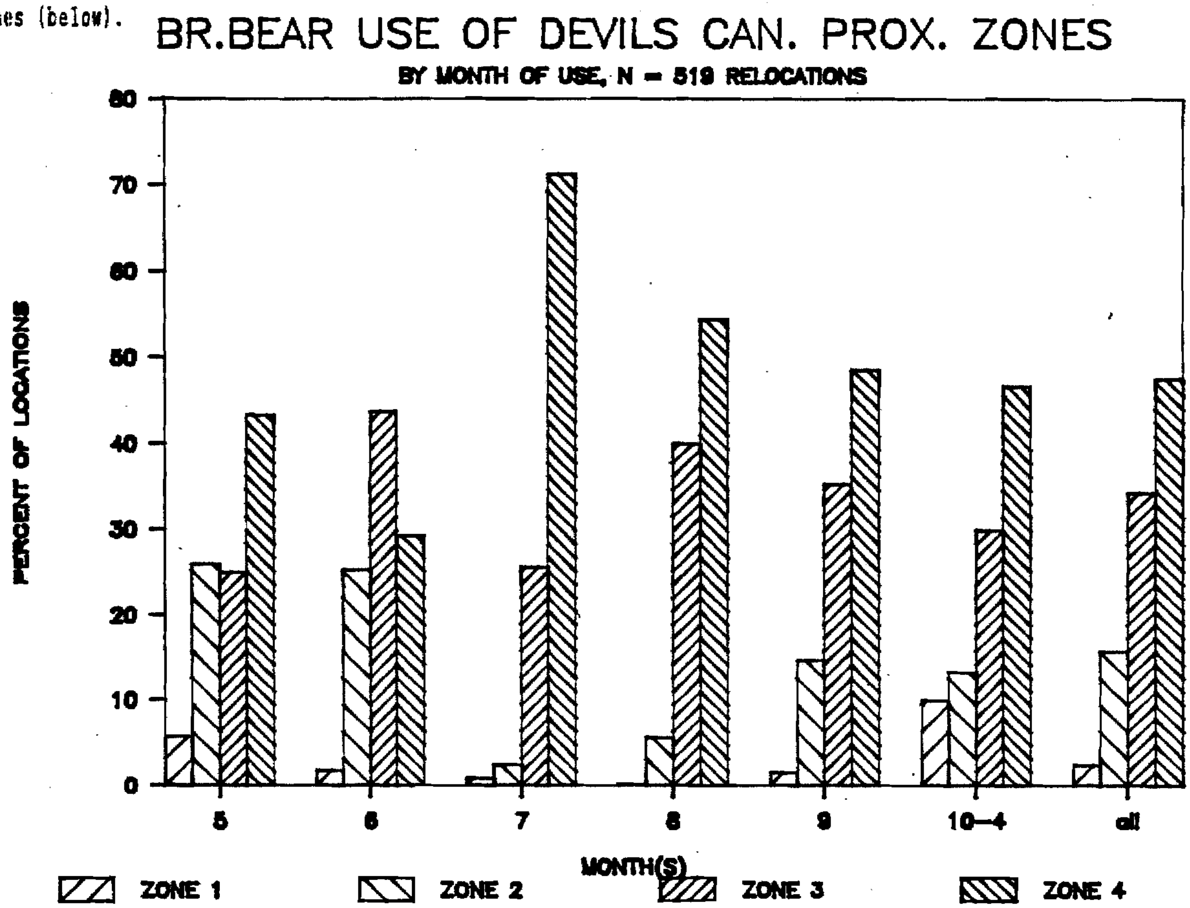


Figure 11. Percent of brown bear point locations in each of 4 impoundment proximity zones, by month. All radio-locations in 1980-1984 are included except for den site locations. Number of point locations for months 5 (May), 6 (June), 7 (July), 8 (August), 9 (September), and 10-4 (October through April) are, respectively: 339, 633, 211, 184, 159, and 92 for Watana Impoundment zones (above), and 104, 174, 125, 90, 68, and 30 for Devils Canyon Impoundment zones (below).



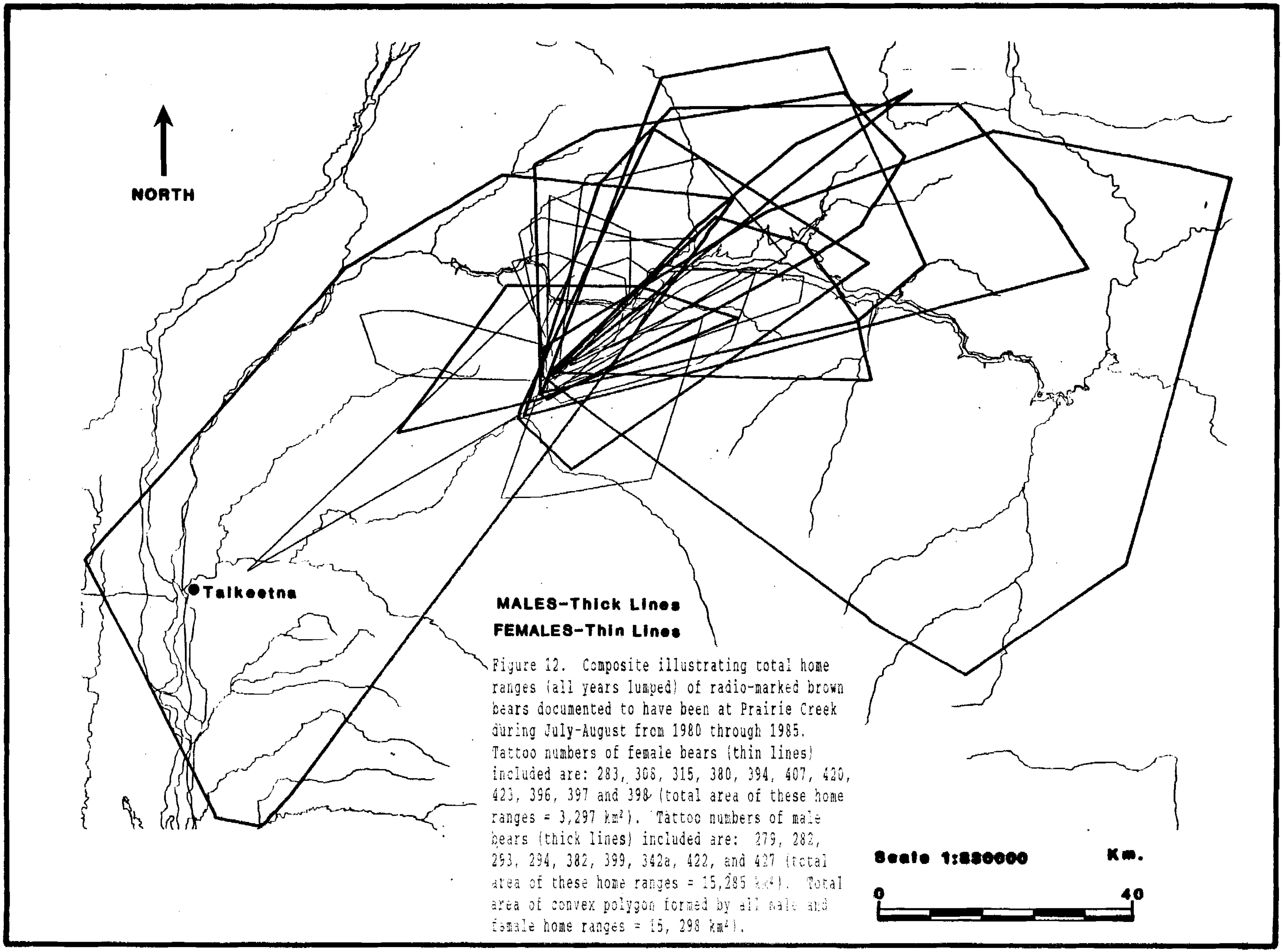


Figure 12. Composite illustrating total home ranges (all years lumped) of radio-marked brown bears documented to have been at Prairie Creek during July-August from 1980 through 1985. Tattoo numbers of female bears (thin lines) included are: 283, 308, 315, 380, 394, 407, 420, 423, 396, 397 and 398 (total area of these home ranges = 3,297 km^2). Tattoo numbers of male bears (thick lines) included are: 279, 282, 293, 294, 382, 399, 342a, 422, and 427 (total area of these home ranges = 15,285 km^2). Total area of convex polygon formed by all male and female home ranges = 15, 298 km^2).

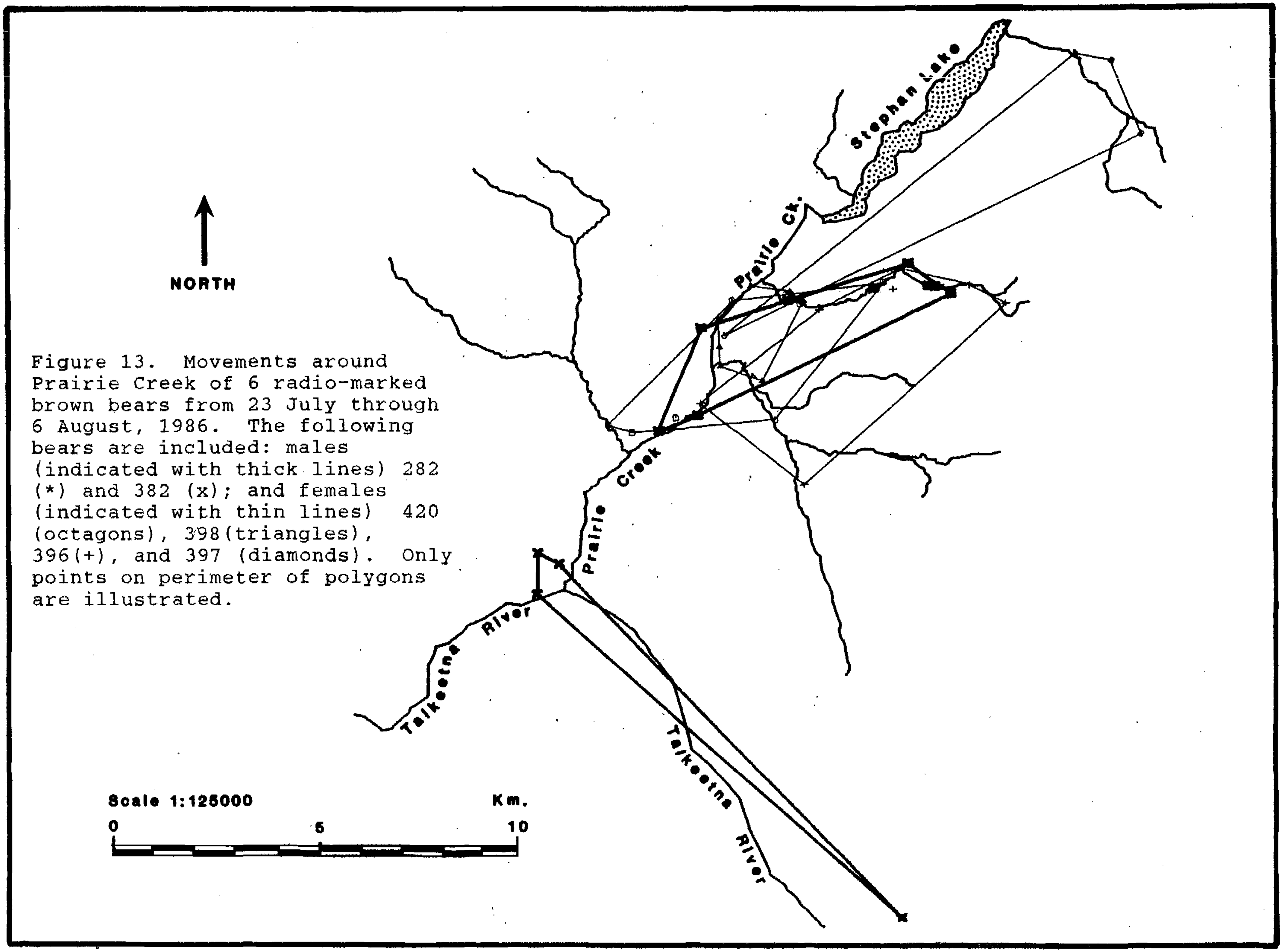


Figure 13. Movements around Prairie Creek of 6 radio-marked brown bears from 23 July through 6 August, 1986. The following bears are included: males (indicated with thick lines) 282 (*) and 382 (x); and females (indicated with thin lines) 420 (octagons), 398 (triangles), 396 (+), and 397 (diamonds). Only points on perimeter of polygons are illustrated.

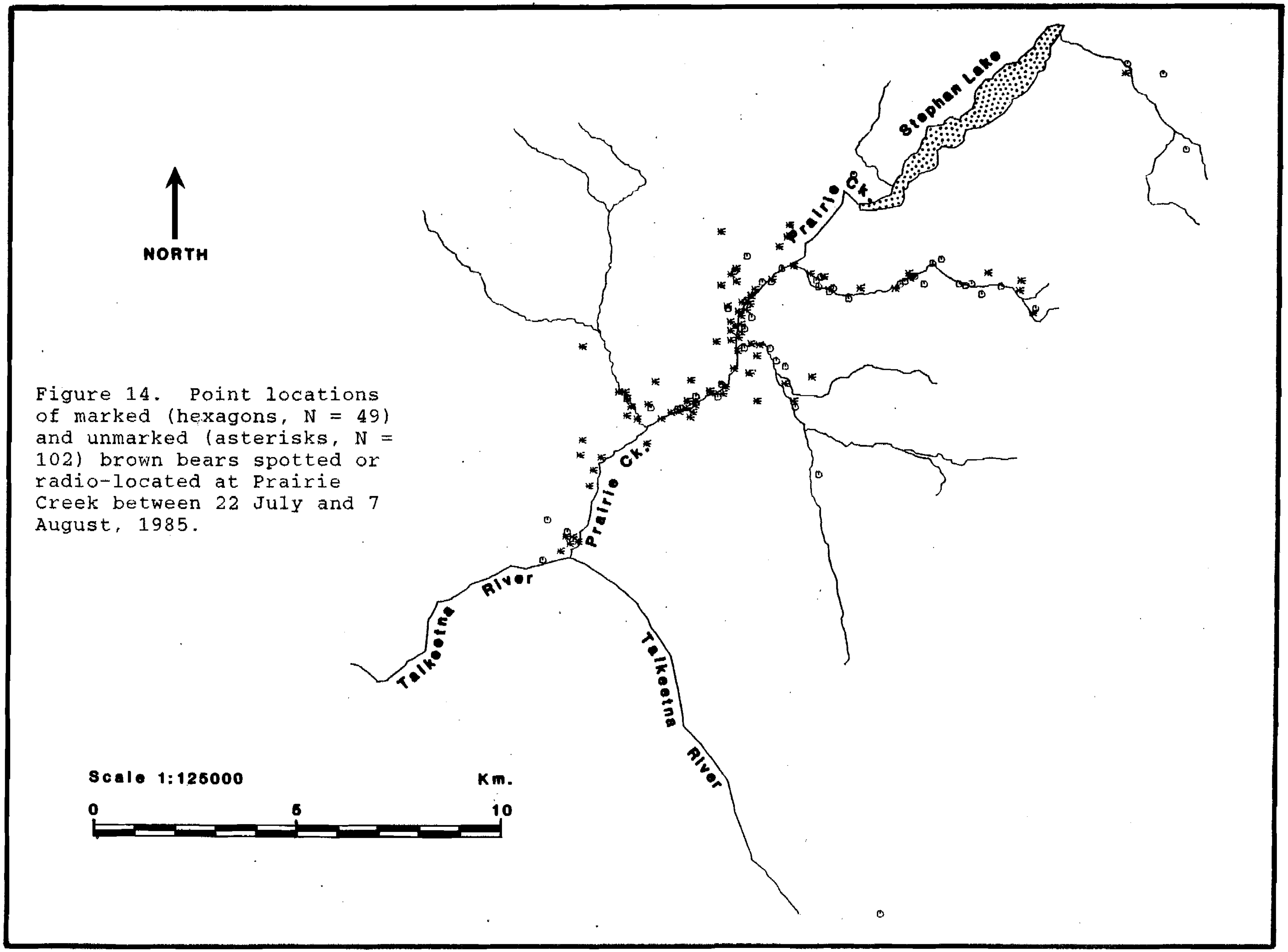


Figure 14. Point locations of marked (hexagons, N = 49) and unmarked (asterisks, N = 102) brown bears spotted or radio-located at Prairie Creek between 22 July and 7 August, 1985.

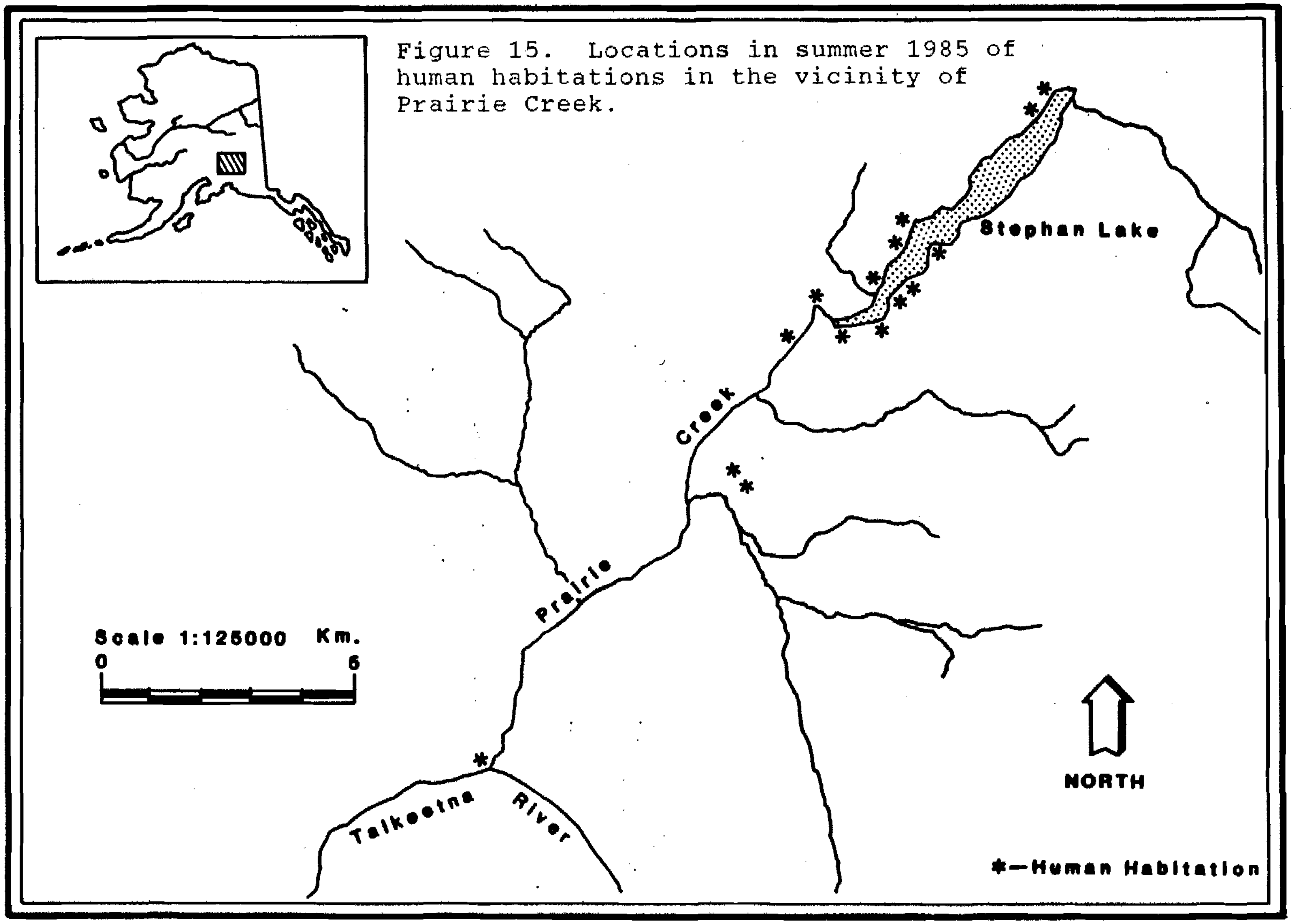


Figure 15. Locations in summer 1985 of human habitations in the vicinity of Prairie Creek.

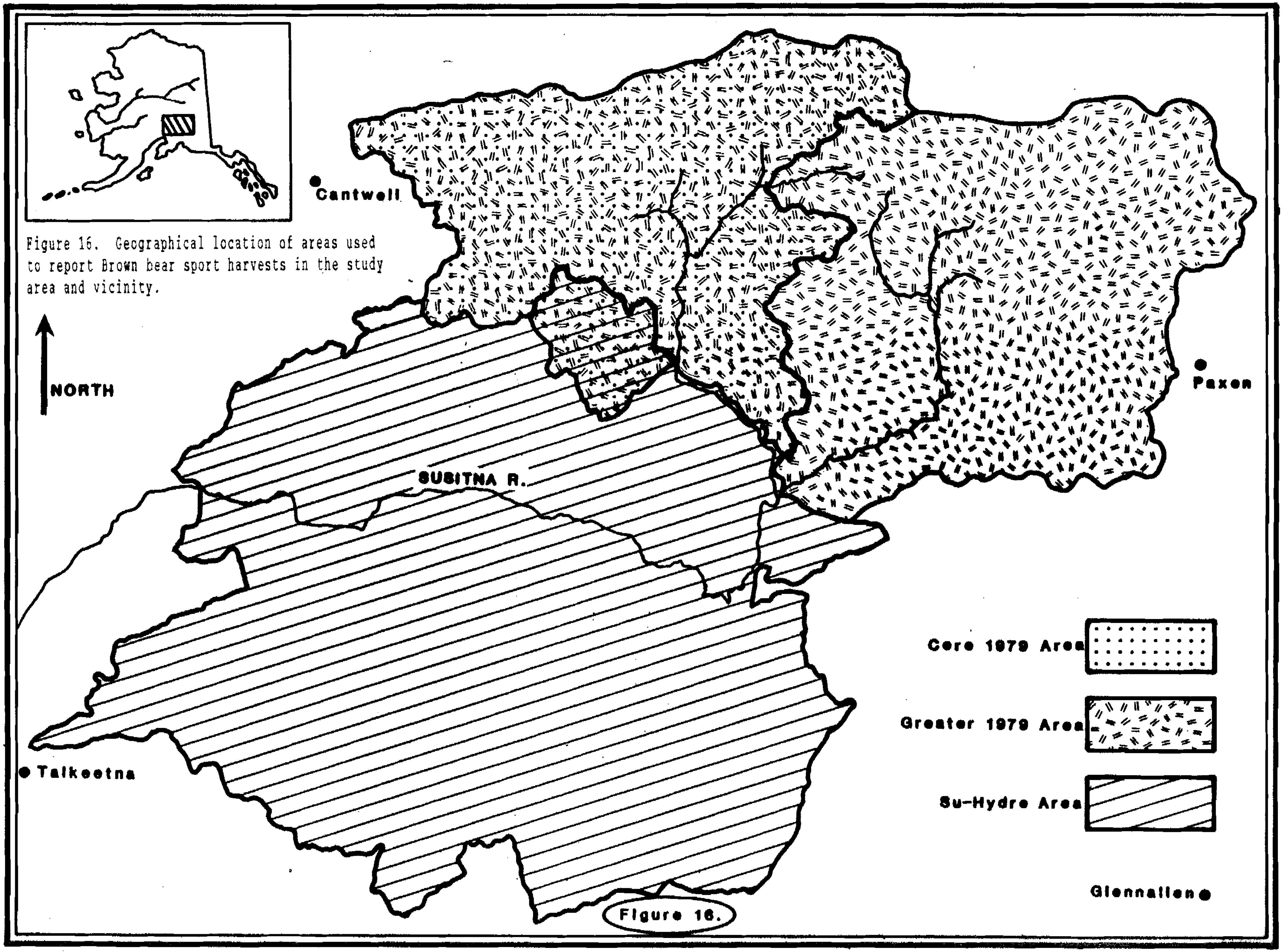


Figure 16. Geographical location of areas used to report Brown bear sport harvests in the study area and vicinity.

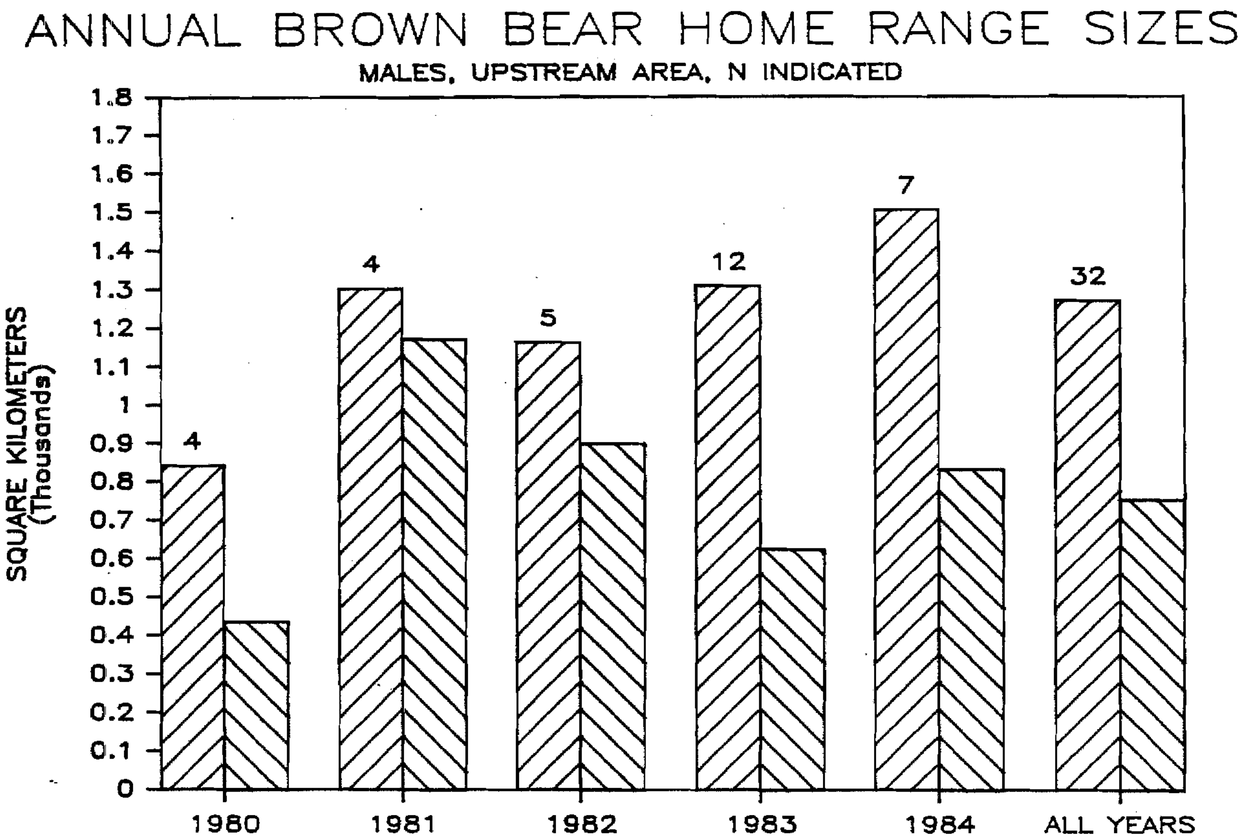
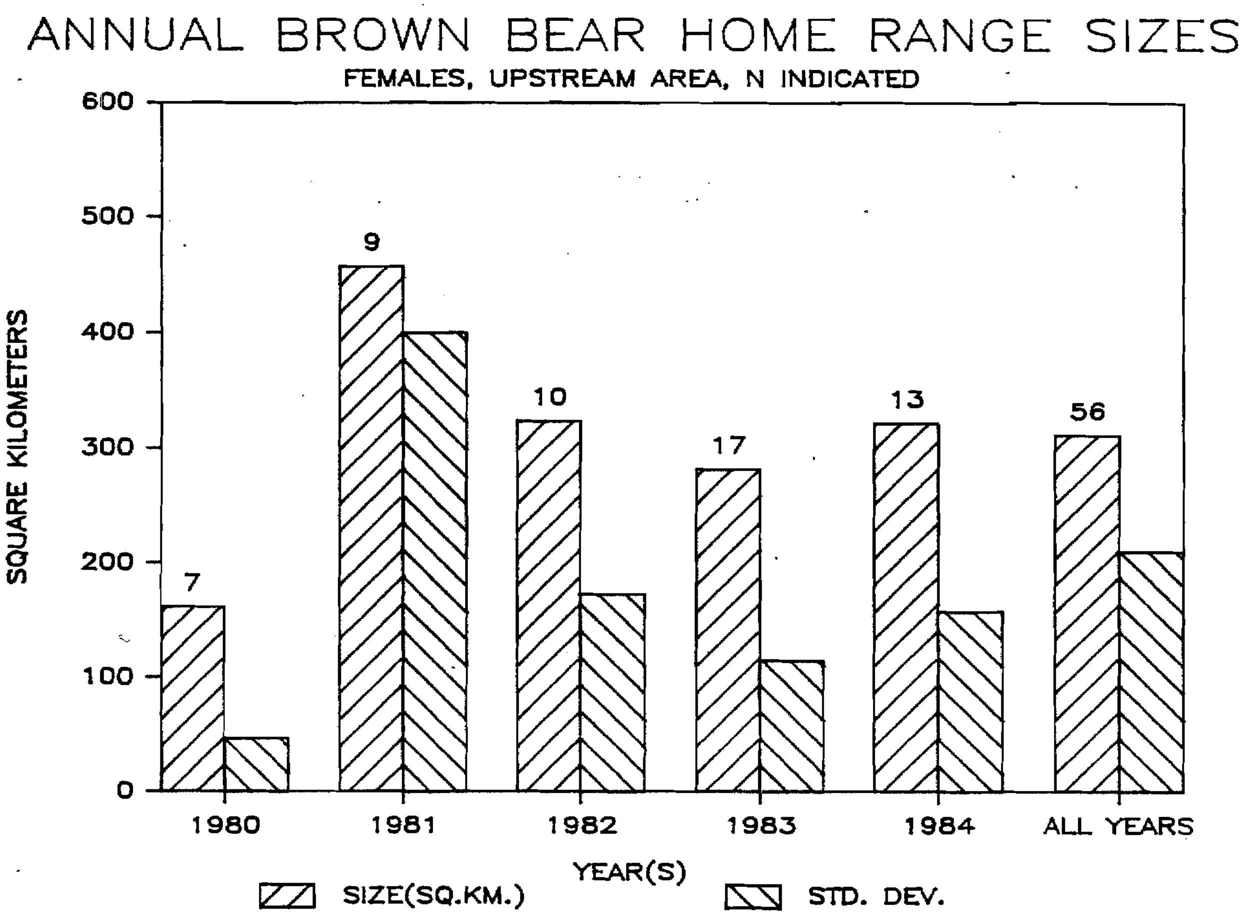


Figure 17. Annual variation in mean home range size of radio-marked black bear males and females (only females without newborn cubs included). Number indicates sample size used in calculation of mean and standard deviation.



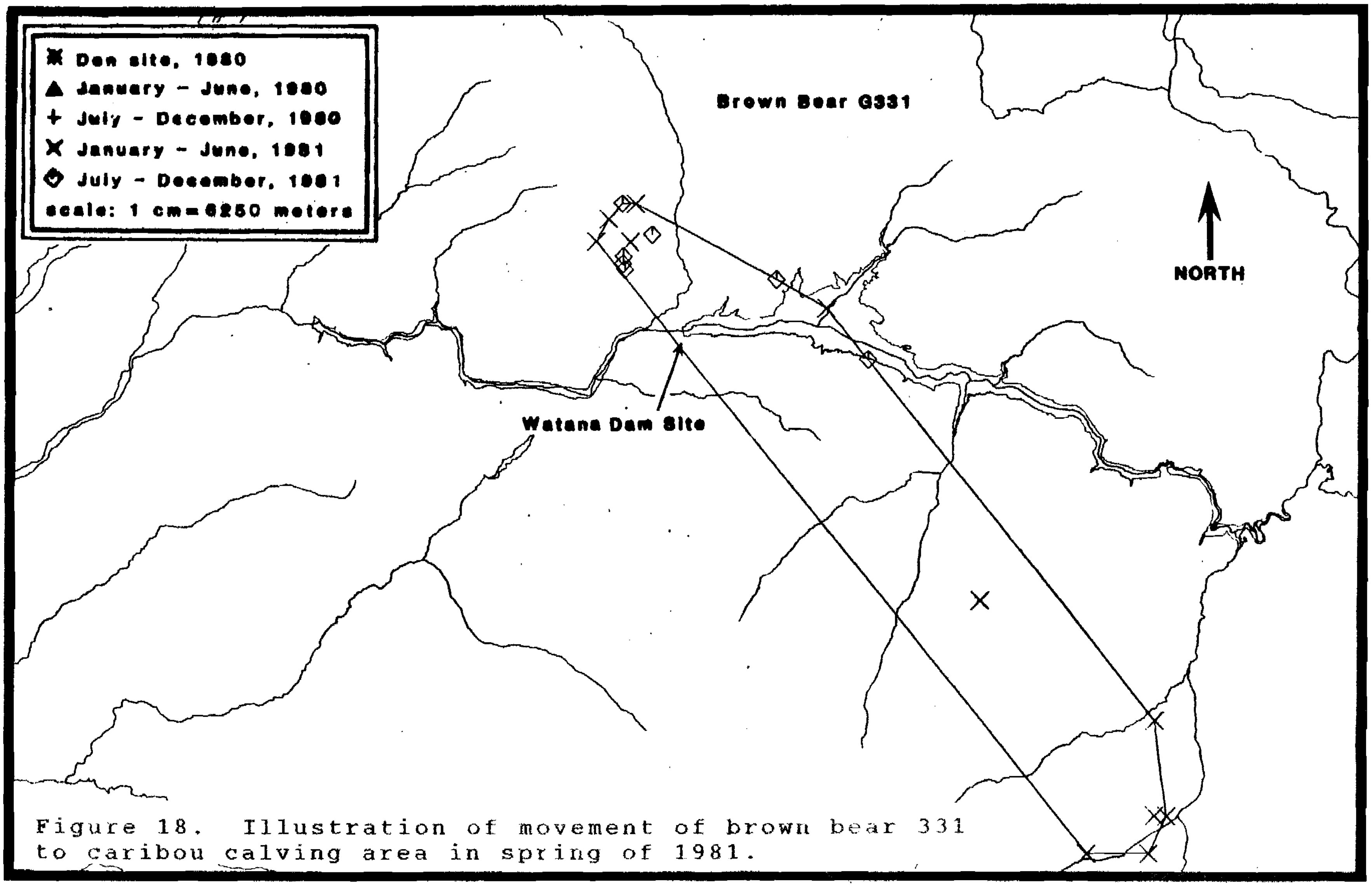


Figure 18. Illustration of movement of brown bear 331 to caribou calving area in spring of 1981.

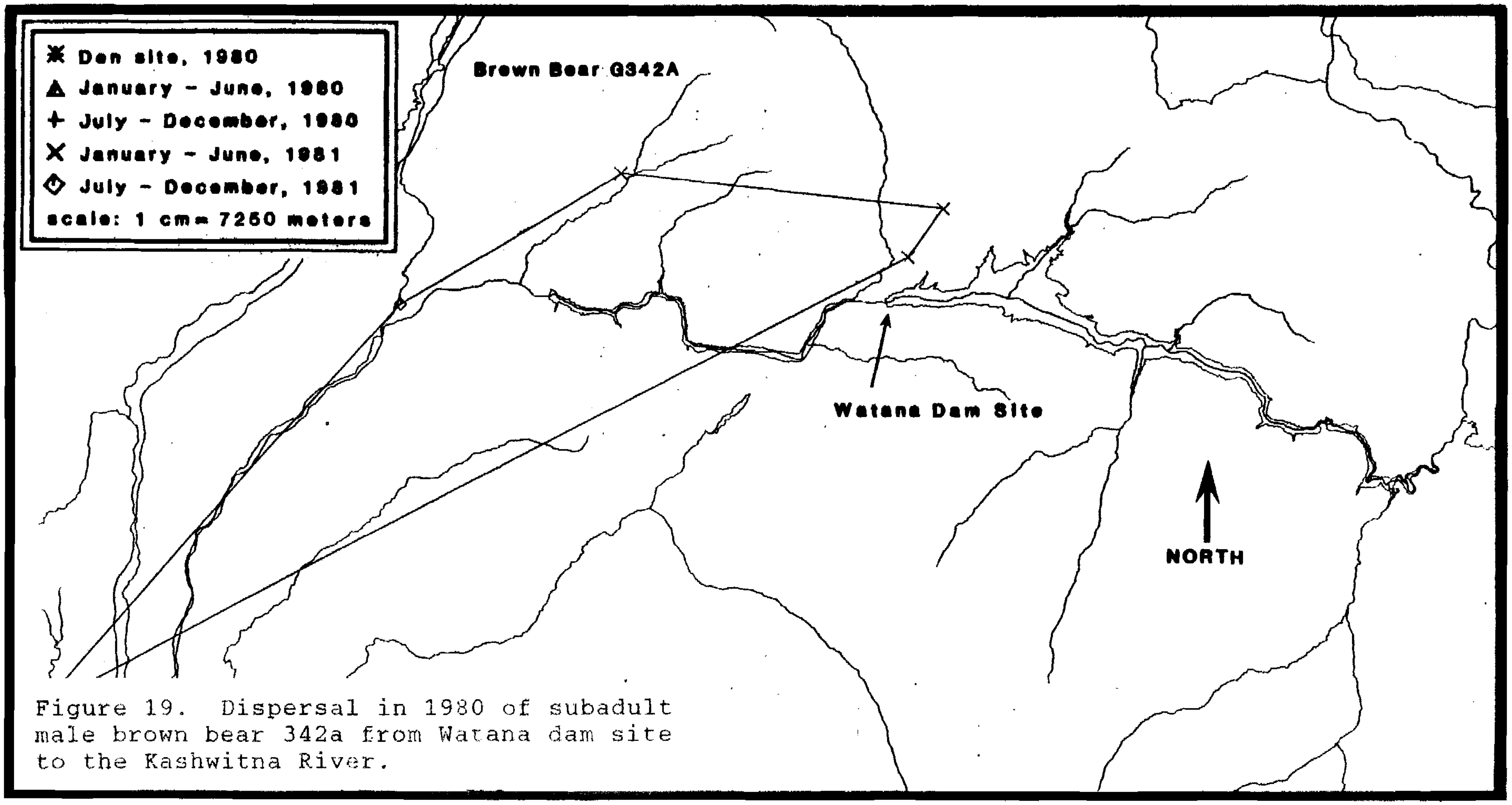


Figure 19. Dispersal in 1980 of subadult male brown bear 342a from Watana dam site to the Kashwitna River.

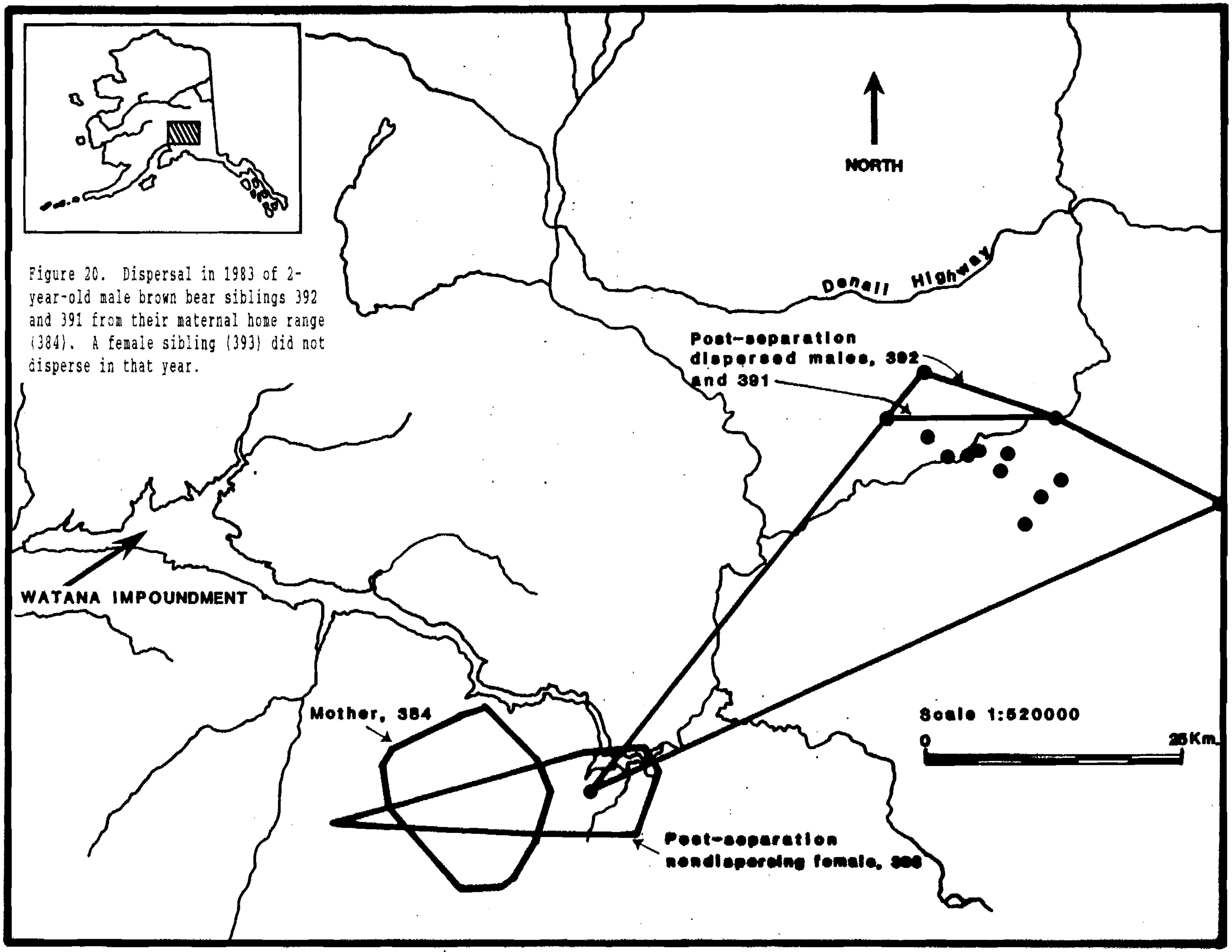


Figure 20. Dispersal in 1983 of 2-year-old male brown bear siblings 392 and 391 from their maternal home range (384). A female sibling (393) did not disperse in that year.

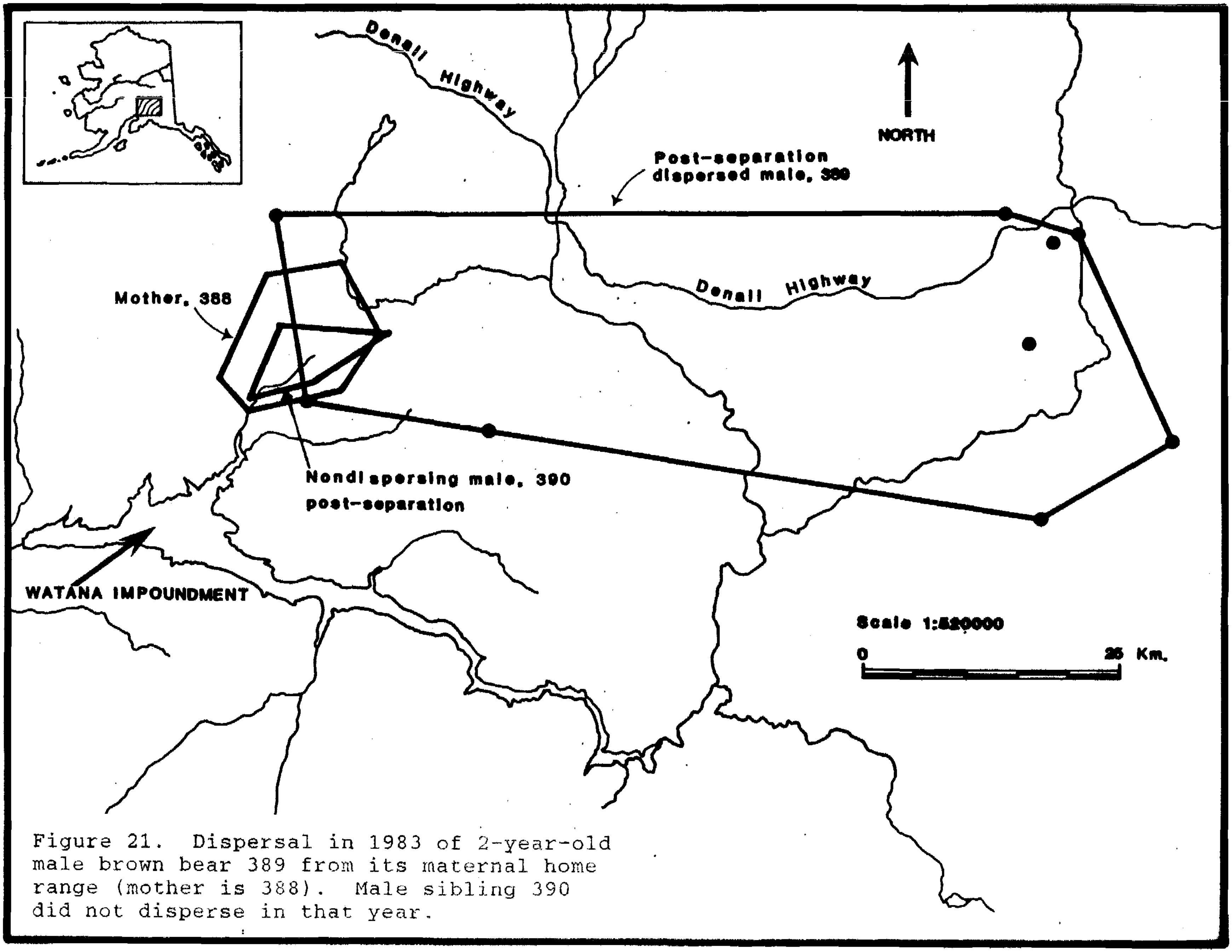


Figure 21. Dispersal in 1983 of 2-year-old male brown bear 389 from its maternal home range (mother is 388). Male sibling 390 did not disperse in that year.

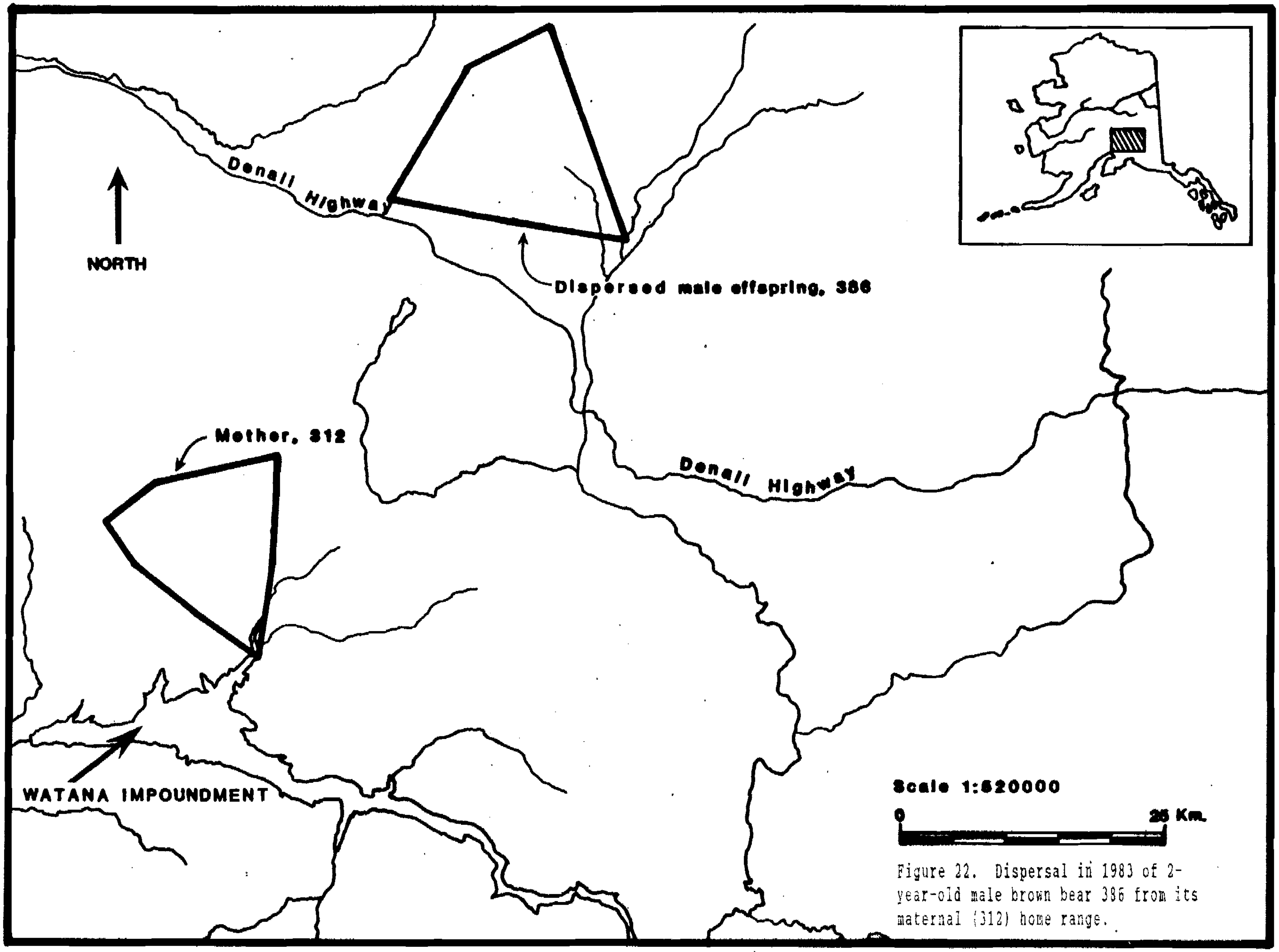


Figure 22. Dispersal in 1983 of 2-year-old male brown bear 386 from its maternal (312) home range.

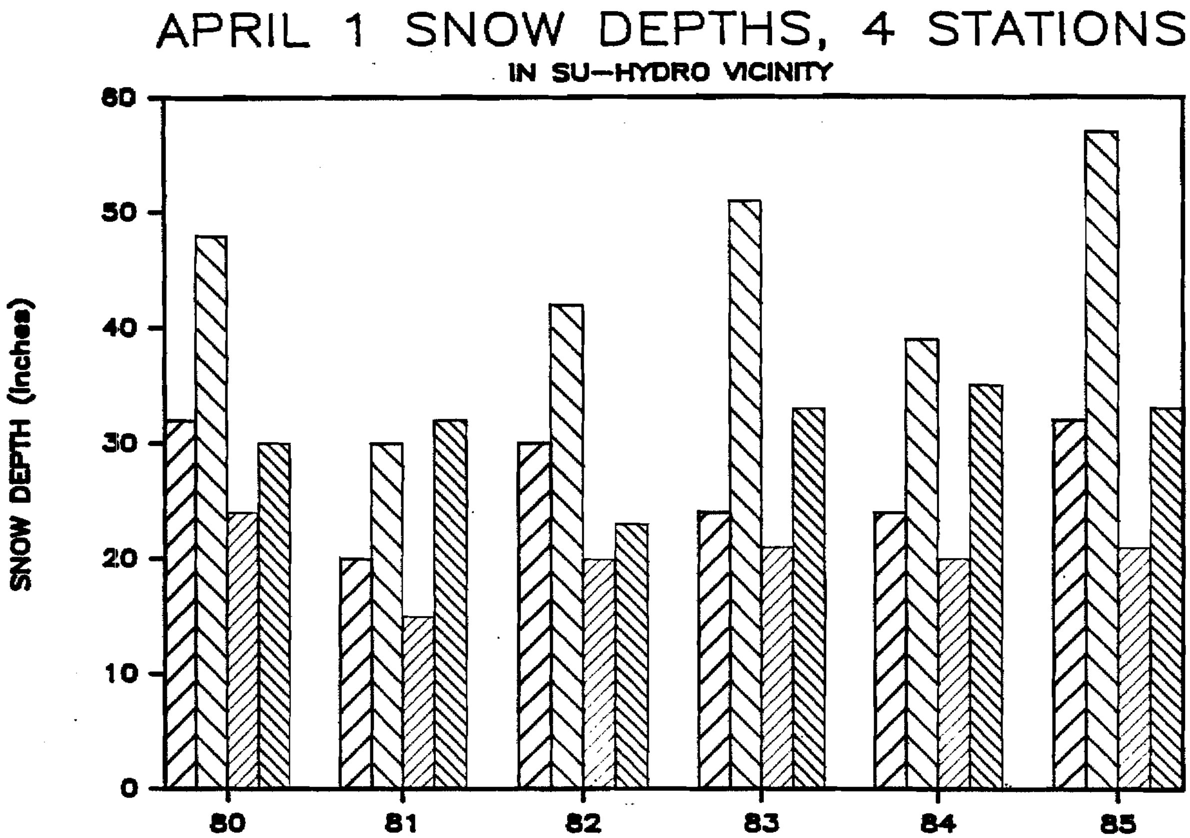
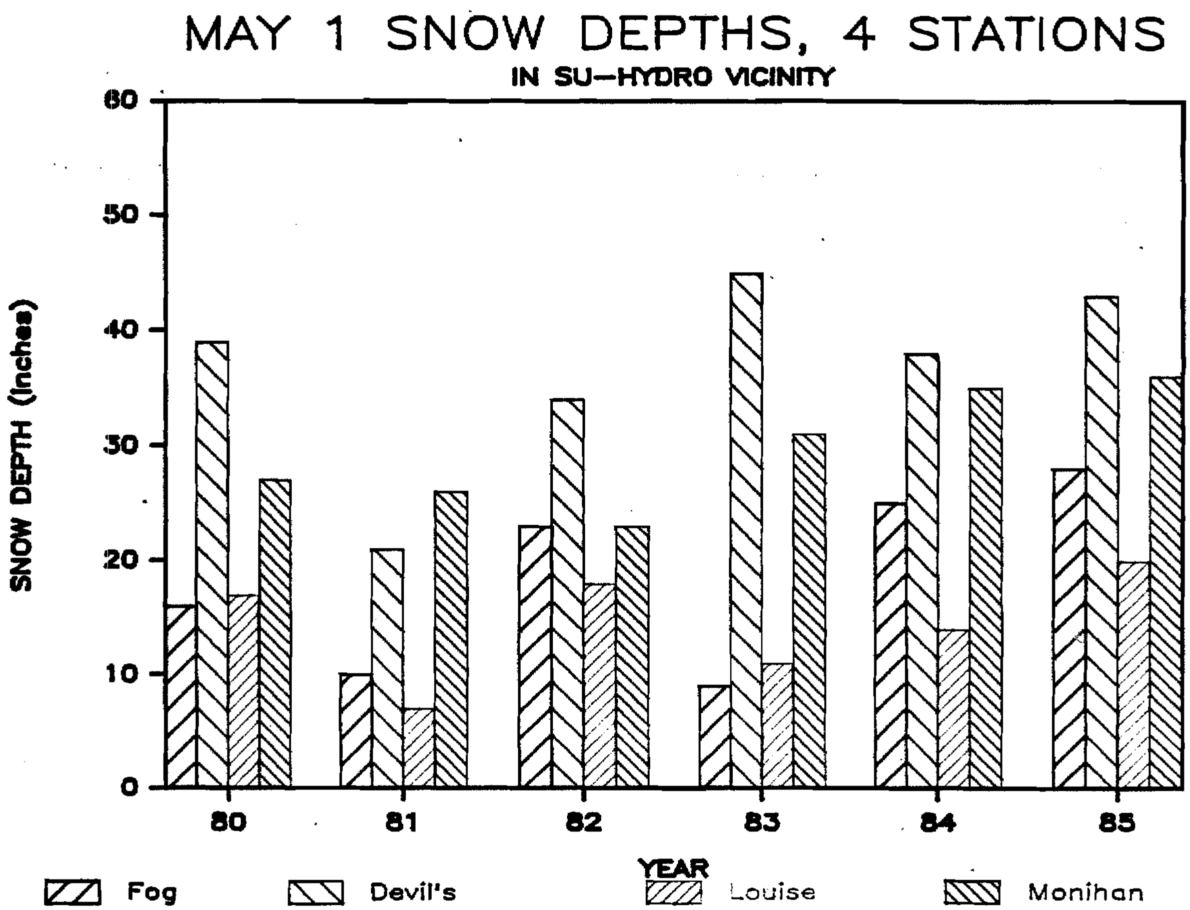


Figure 23. Annual snow depths on 1 April and 1 May during 1980 through 1985 at 4 snow survey stations in the vicinity of the proposed impoundments. Data provided by U.S. Soil Conservation Service, Snow Survey.



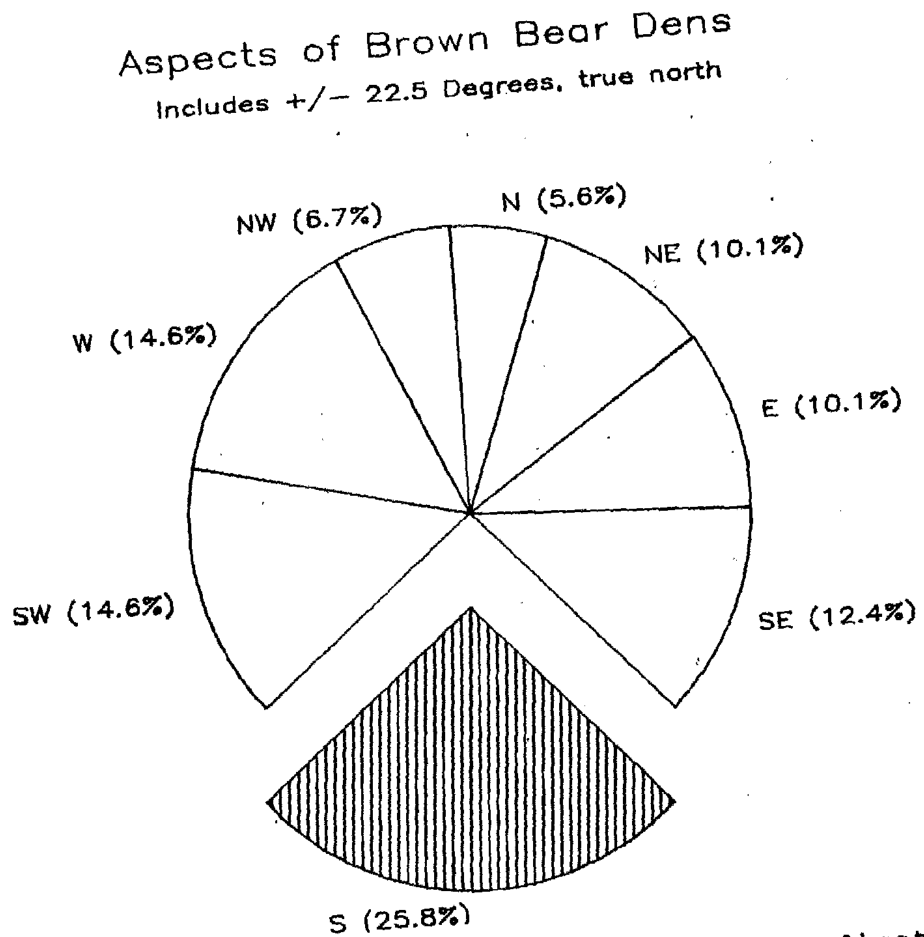


Figure 24. Aspects of 89 brown bear dens. Indicated direction includes arc of ±22.5 degrees on either side. Aspects corrected for magnetic deviation from true north.

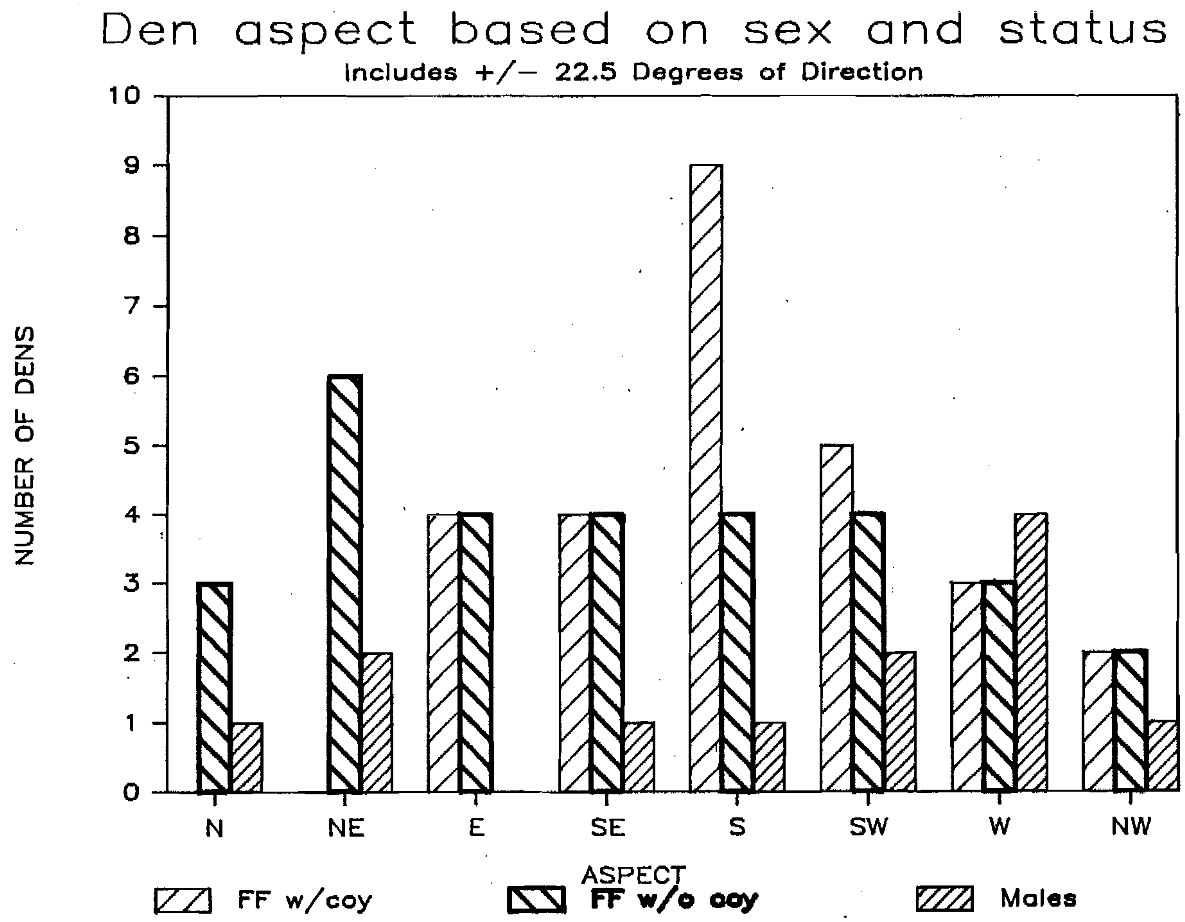


Figure 25. Aspects of brown bear dens based on reproductive status of 27 females with newborn cubs (COY) at exit from den cavities, 30 females without newborn cubs at exit, and 12 males. Dens for 20 brown bears of unknown sex or reproductive status are not included. Indicated direction includes arc of $\pm$22.5 degrees on either side. Aspects corrected for magnetic deviation from true north.

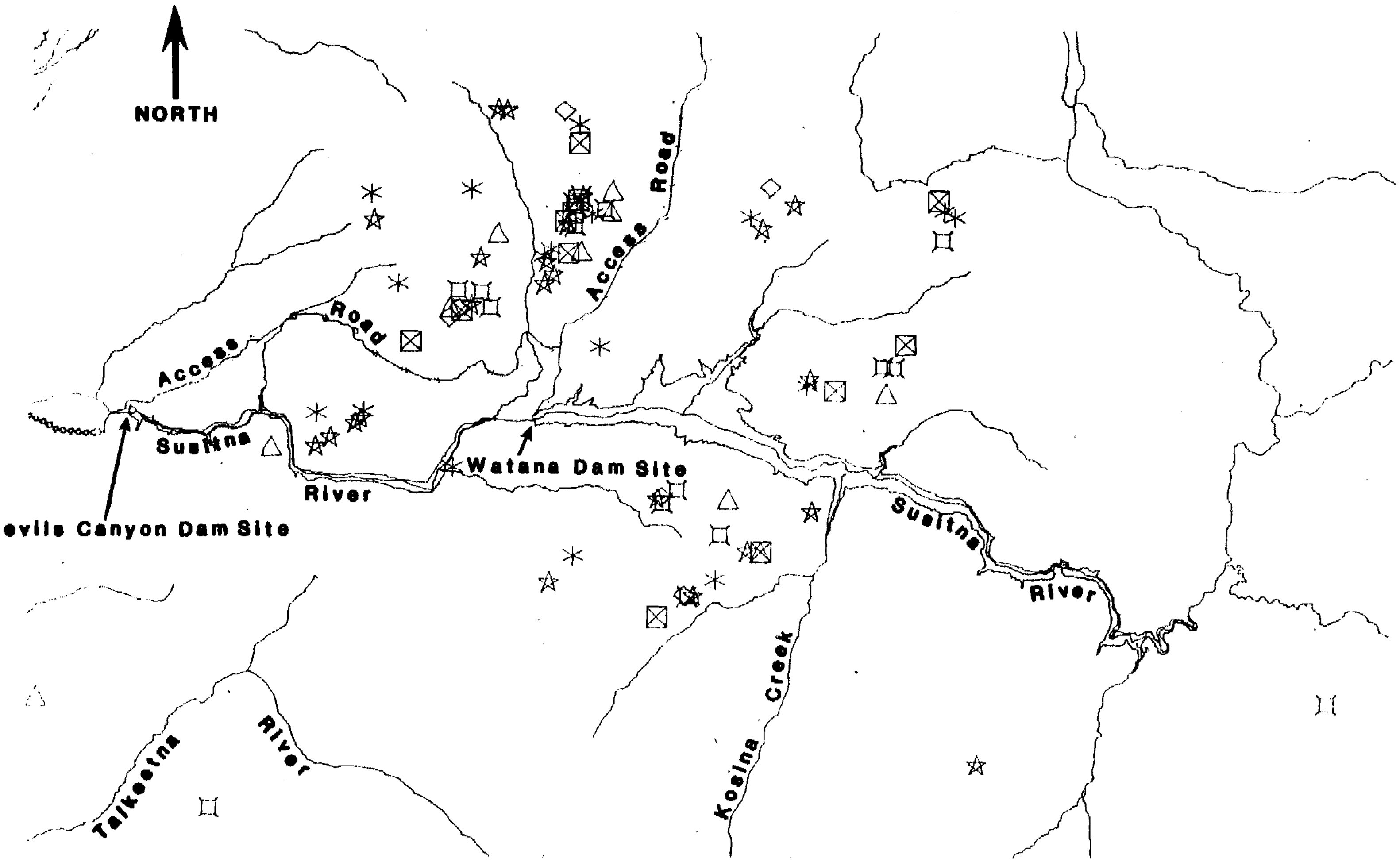
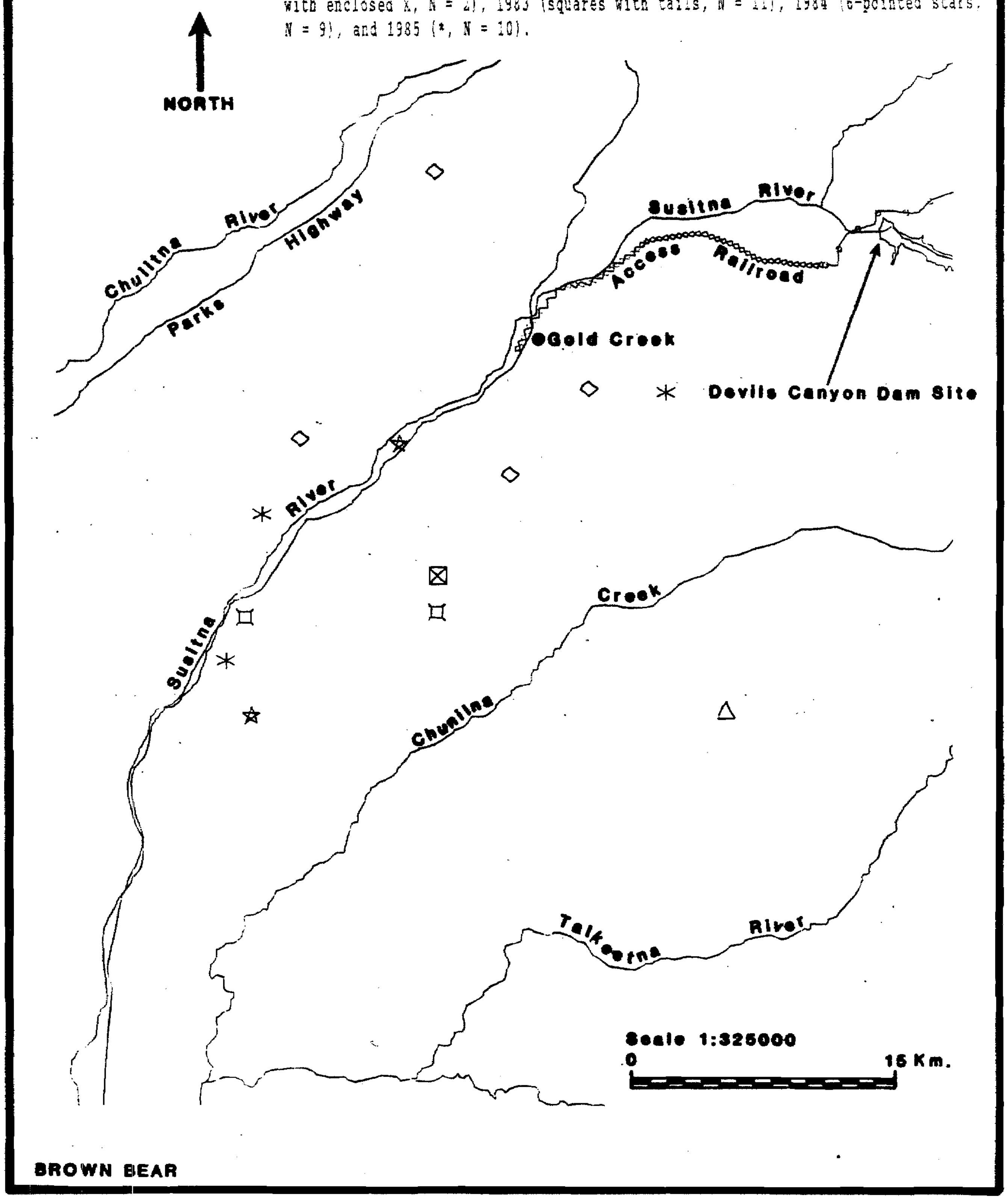


Figure 26. Location of den sites for radio-marked brown bears in the Su-Hydro study area upstream from the Devils Canyon dam site in springs of 1981 (triangles, N = 9), 1982 (squares with X, N = 12), 1983 (squares with tails, N = 18), 1984 (6-pointed stars, N = 25), and 1985 (*, N = 19). Diamonds are for den sites of unmarked bears (N = 8).

Scale 1:600000
0 25 Km.

Figure 27. Location of den sites for radio-marked brown bears in the Su-hydro study area downstream from the Devils Canyon dam site in springs of 1982 (squares with enclosed X, N = 2), 1983 (squares with tails, N = 11), 1984 (6-pointed stars, N = 9), and 1985 (*, N = 10).



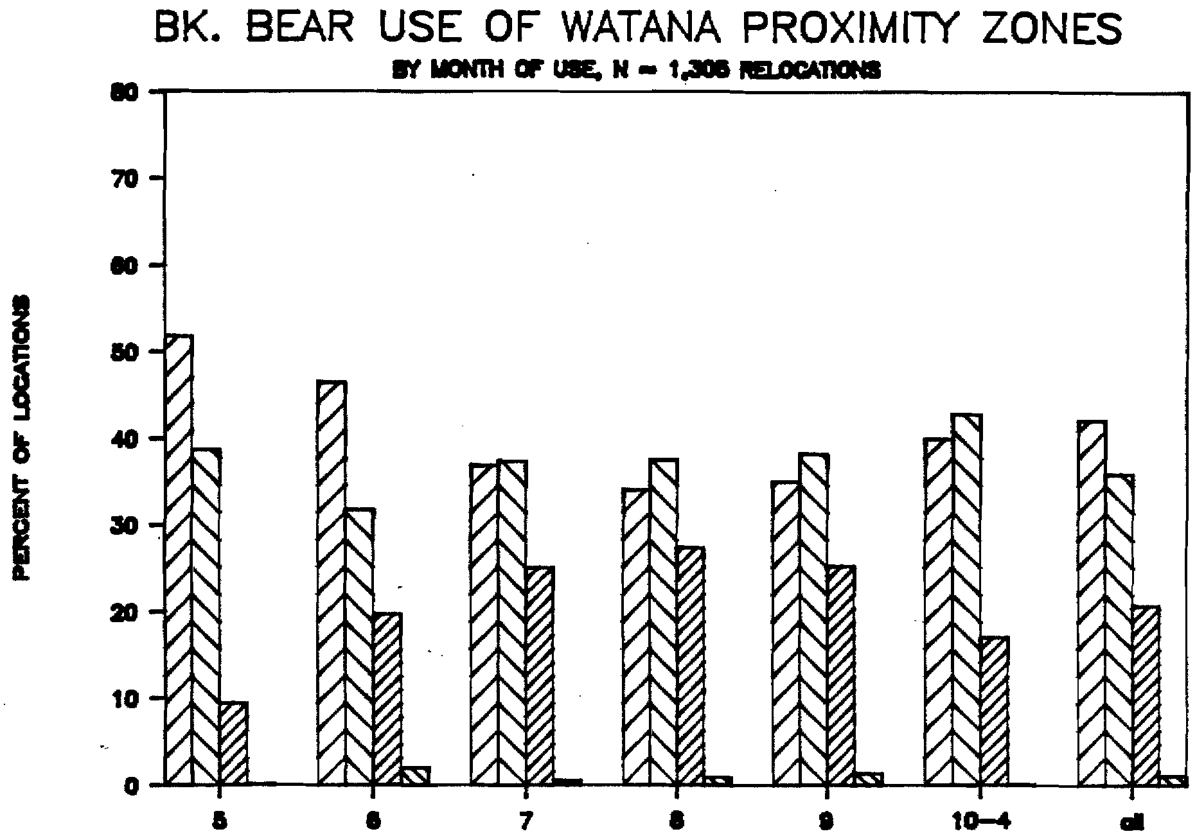
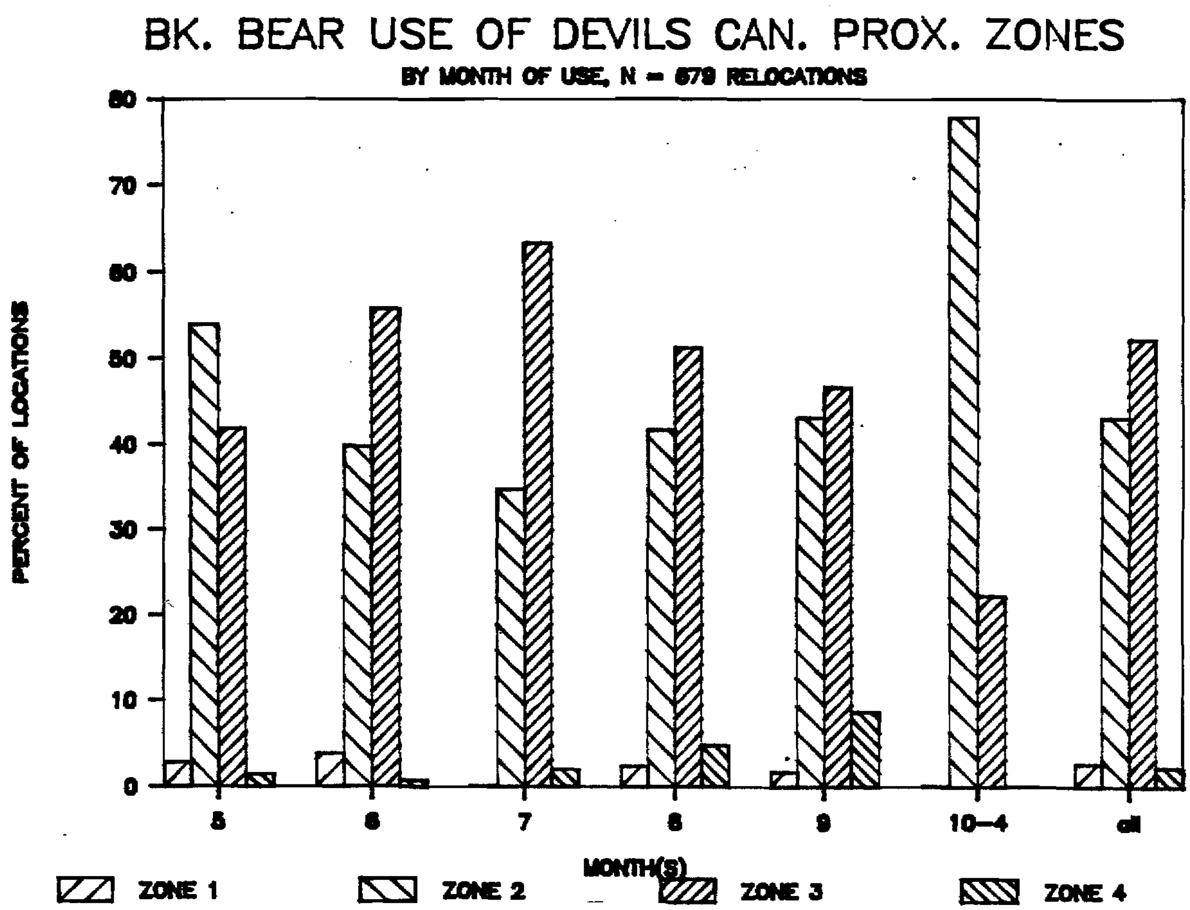


Figure 28. Percent of black bear point locations in each of 4 Watana Dam impoundment proximity zones, by month. All radio-locations in 1980-1984 are included except for den site locations. Number of point locations for months 5 (May), 6 (June), 7 (July), 8 (August), 9 (September), and 10-4 (October-April) are, respectively: 222, 465, 203, 226, 154, and 35 for Watana impoundment zones and 141, 289, 98, 84, 58, and 9 for Devils Canyon impoundment zones.



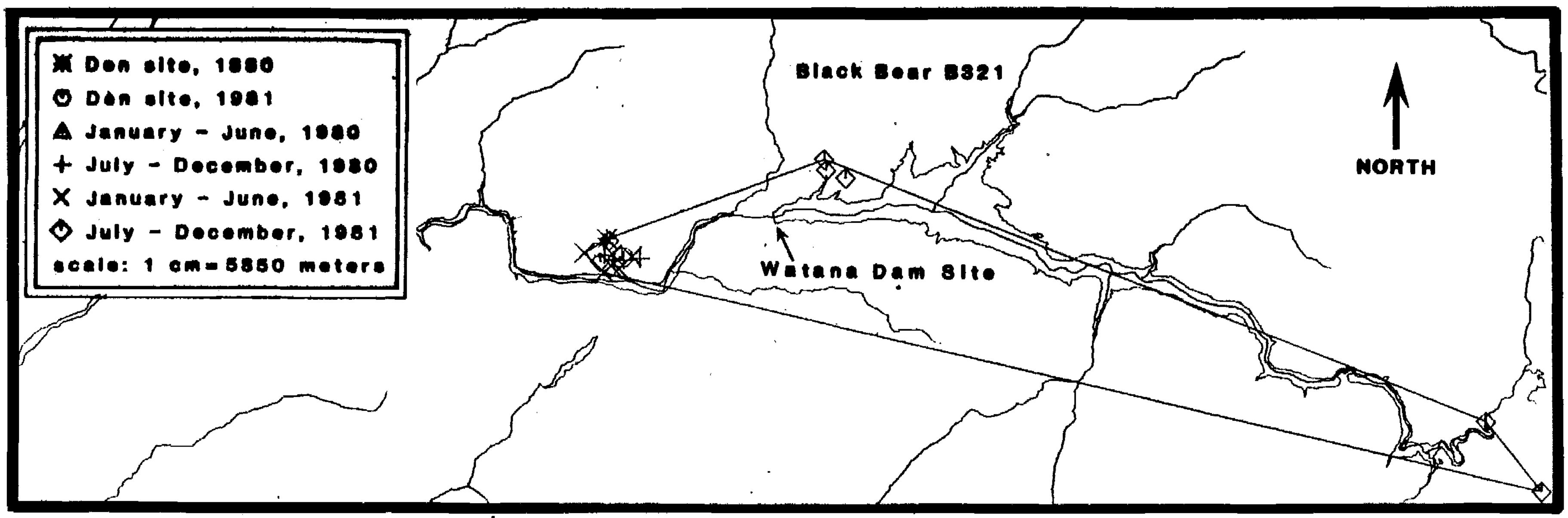


Figure 29 . Upstream movement of black bear 321 during poor berry summer of 1981.

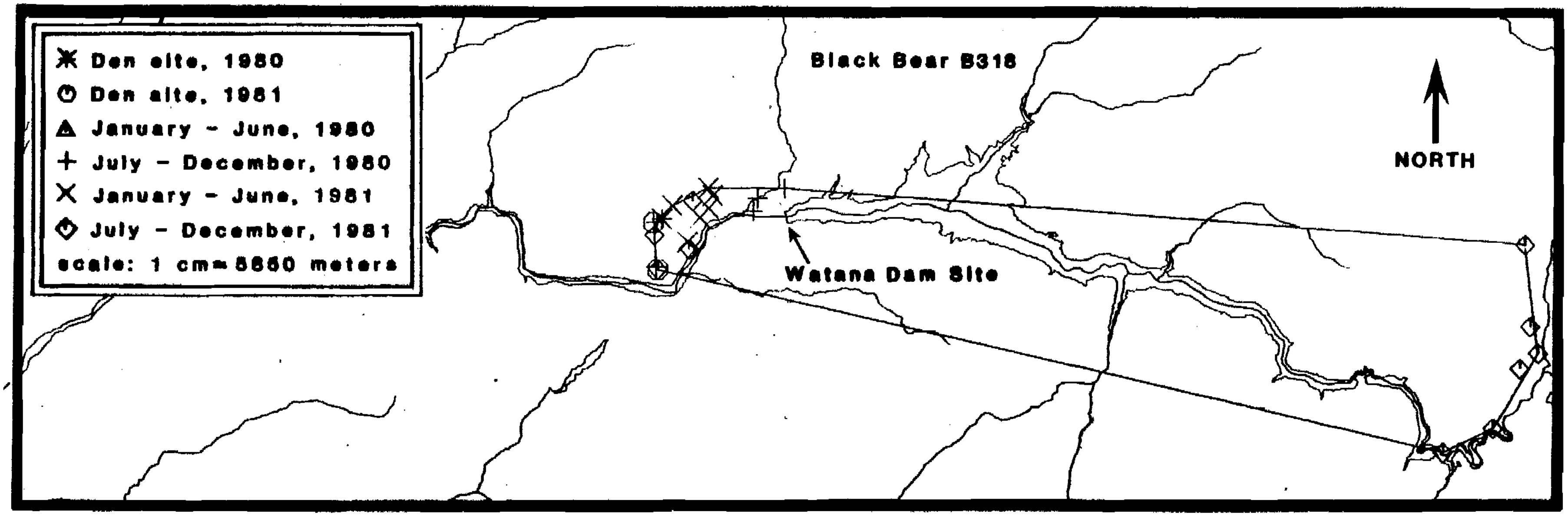


Figure 30. Upstream movement of black bear 318 during poor berry summer of 1981.

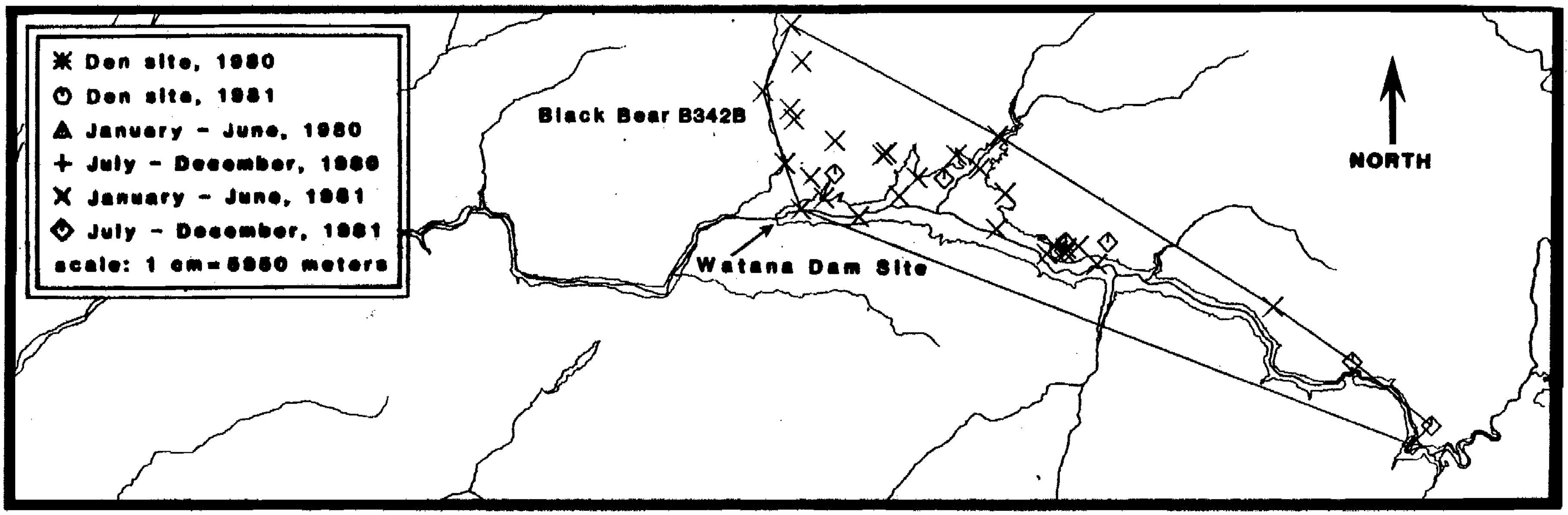


Figure 31 . Upstream movement of black bear 342b during poor berry summer of 1981.

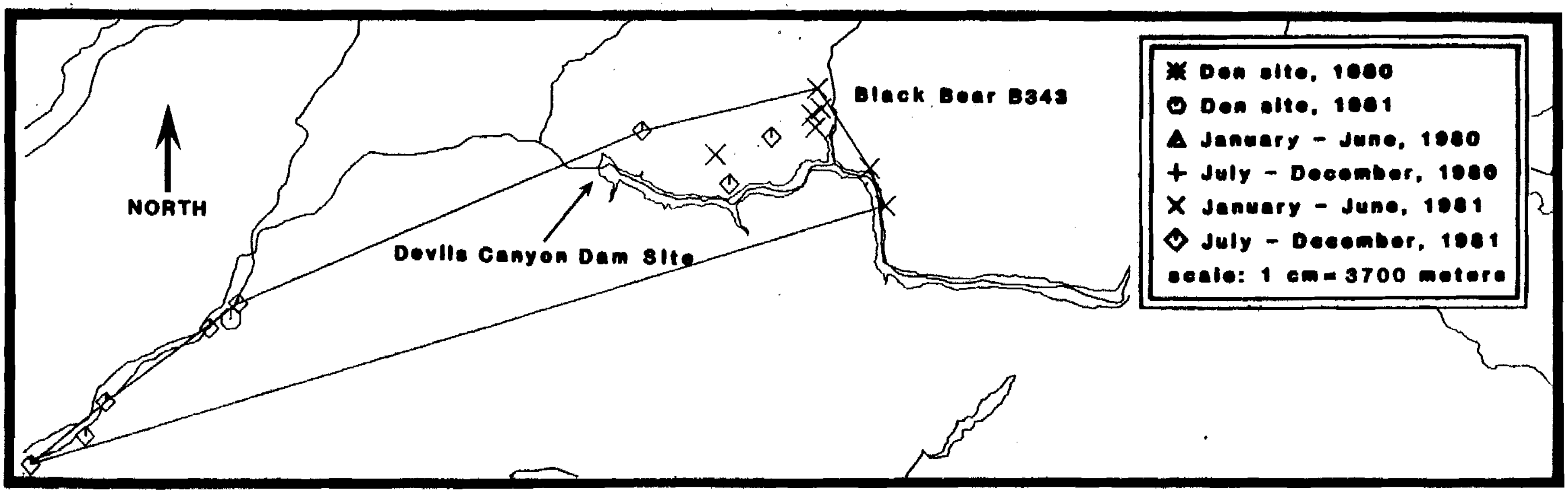


Figure 32. Downstream movement of black bear 343 during poor berry summer of 1981.

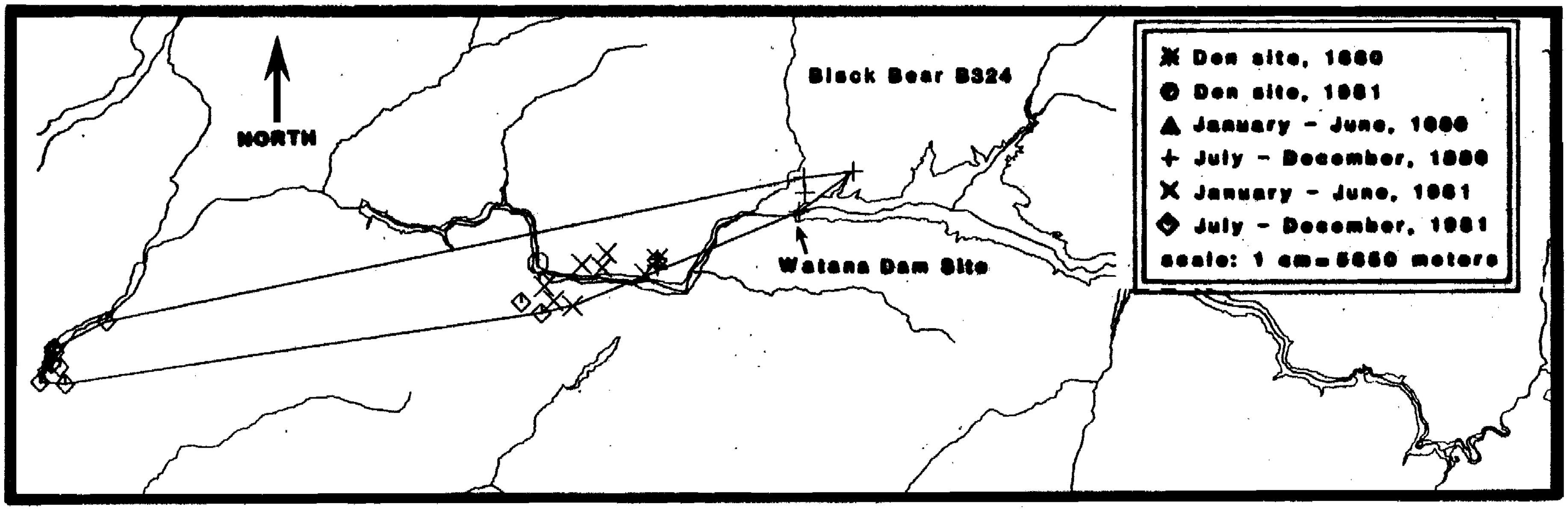


Figure 33. Downstream movement of black bear 324 during poor berry summer of 1981.

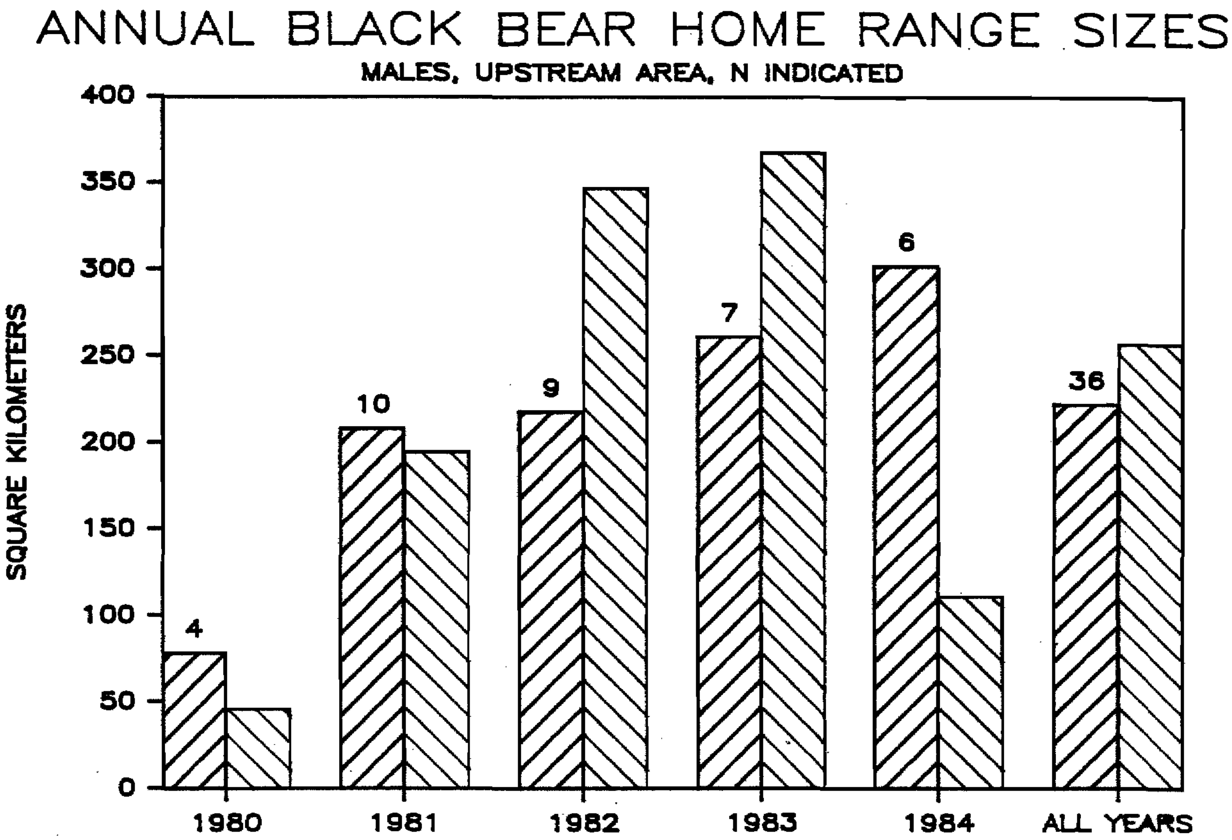
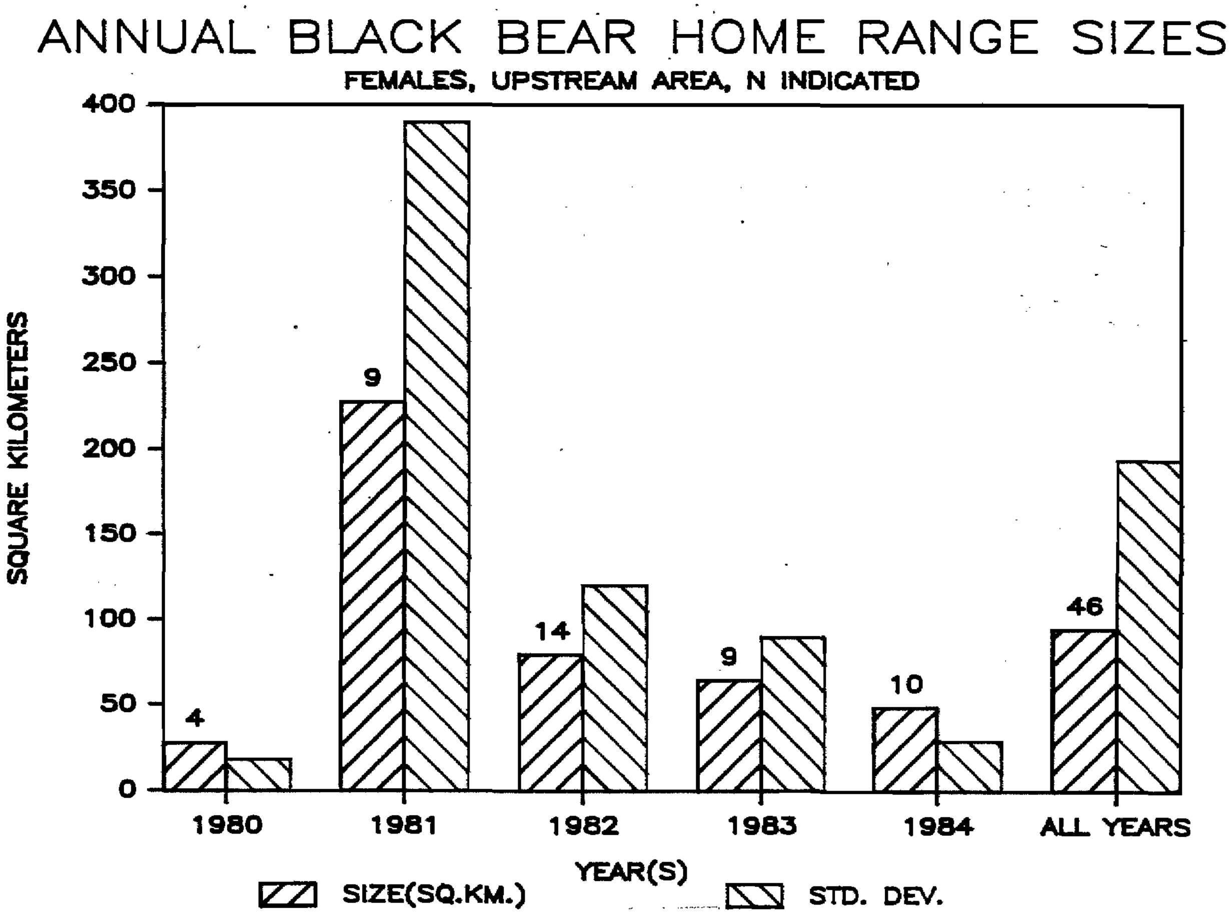


Figure 34. Annual variation in mean home range size of radio-marked brown bear males and females (only females without newborn cubs included). Number indicates sample size used in calculation of mean and standard deviation.



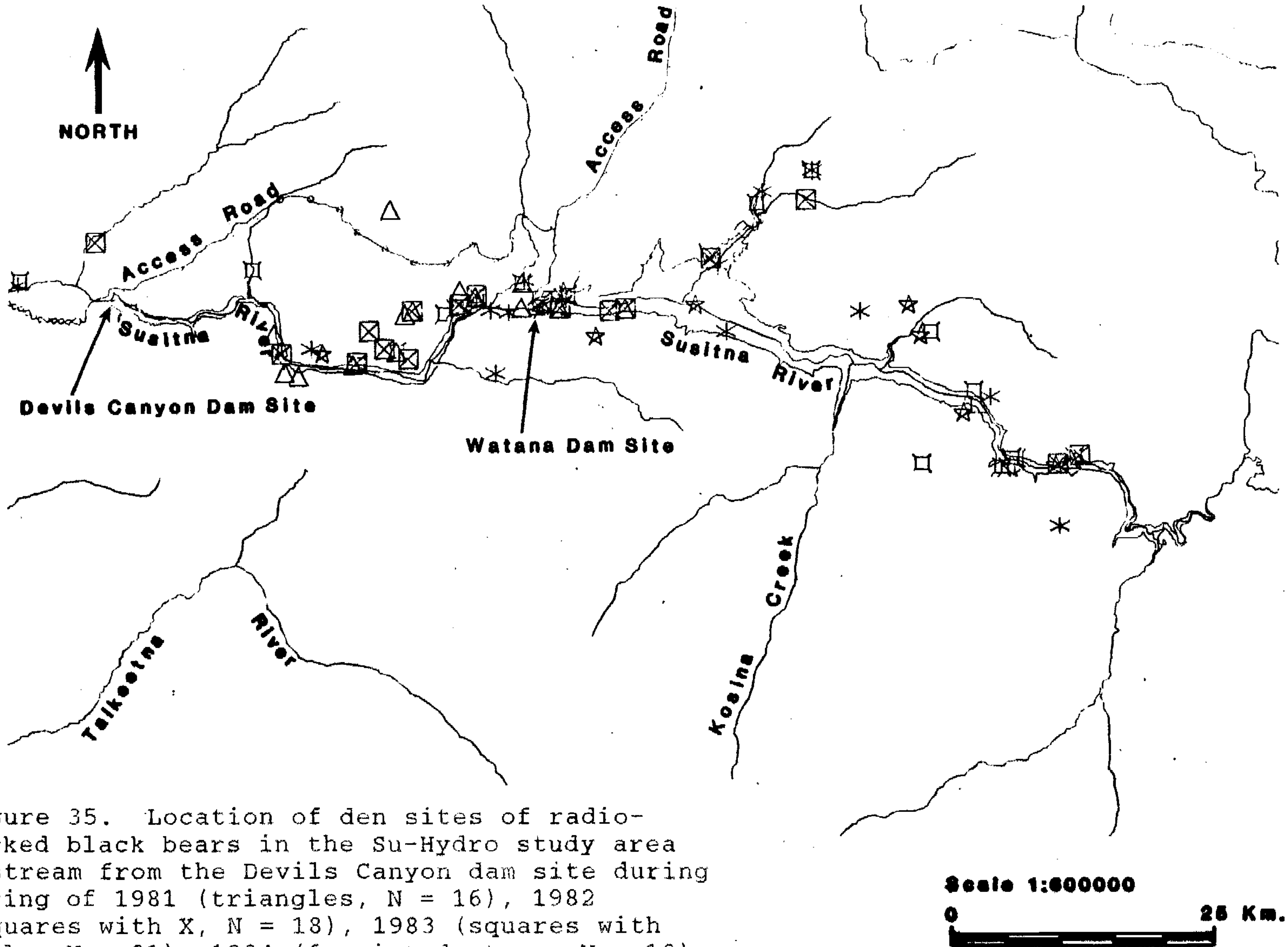
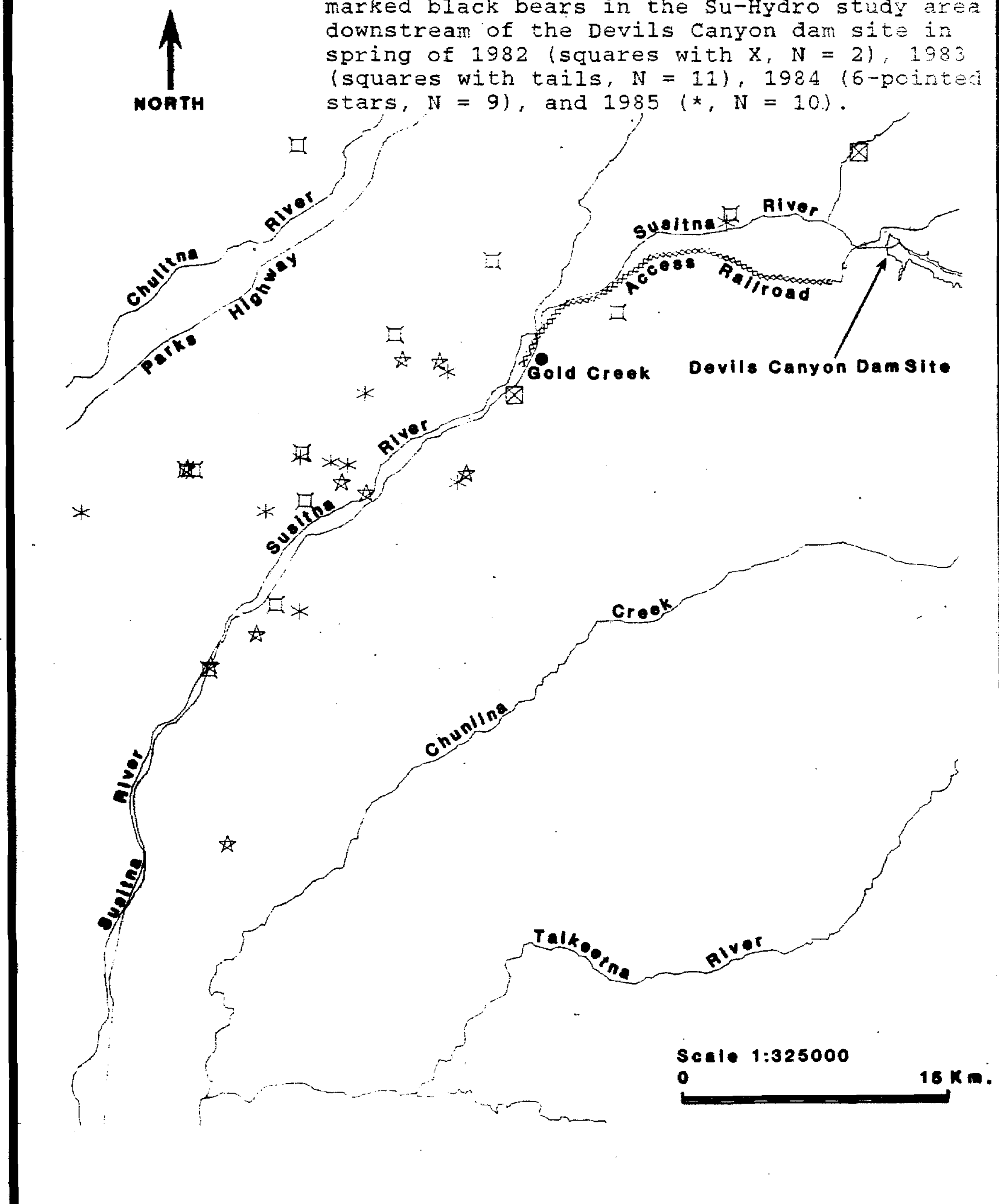


Figure 35. Location of den sites of radio-marked black bears in the Su-Hydro study area upstream from the Devils Canyon dam site during spring of 1981 (triangles, N = 16), 1982 (squares with X, N = 18), 1983 (squares with tails, N = 21), 1984 (6-pointed stars, N = 12), and 1985 (*, N = 15). Diamonds are for den sites of unmarked bears (N = 3).

Figure 36. Location of den sites for radio-marked black bears in the Su-Hydro study area downstream of the Devils Canyon dam site in spring of 1982 (squares with X, N = 2), 1983 (squares with tails, N = 11), 1984 (6-pointed stars, N = 9), and 1985 (*, N = 10).



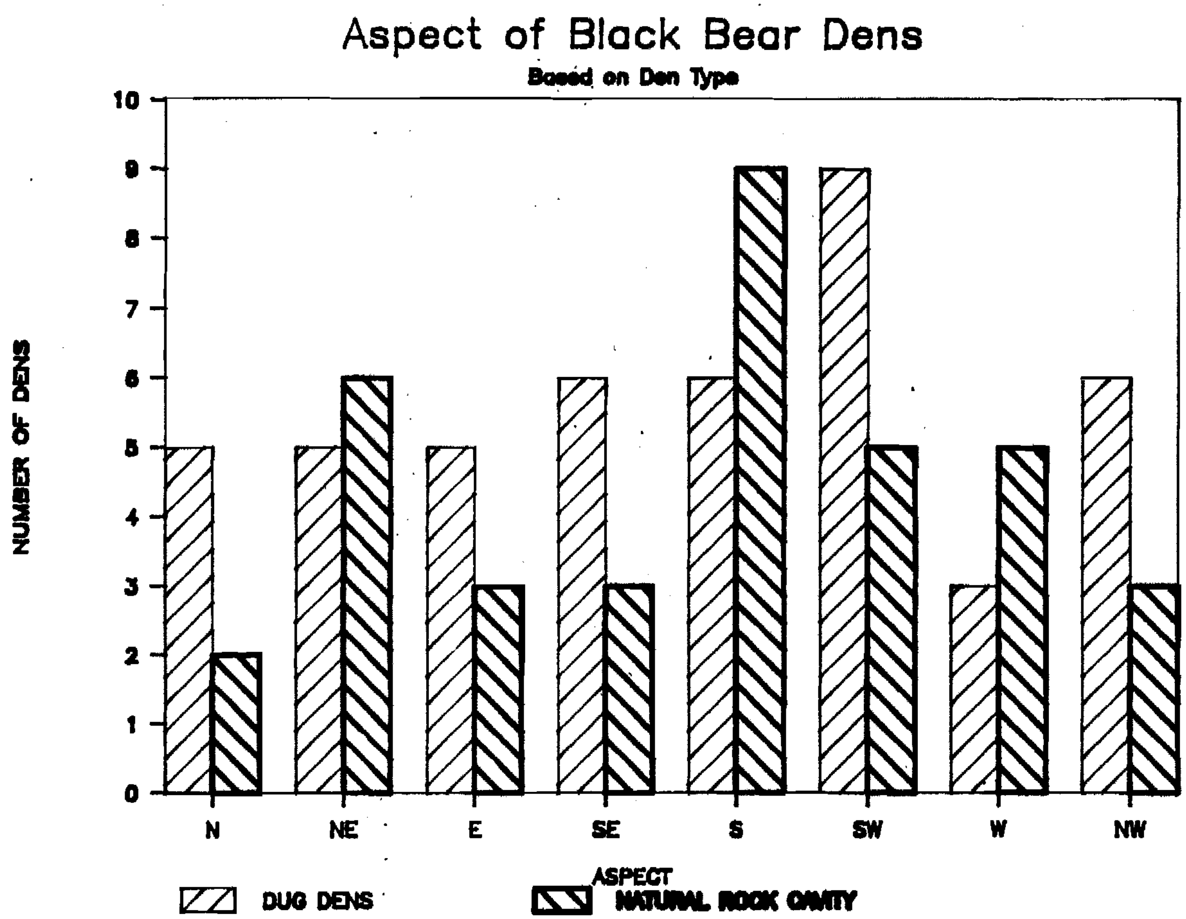


Figure 37a. Aspects of black bear dens in 45 dug cavities and 36 natural rock cavities. Indicated direction includes arc of ±22.5 degrees on either side. Aspects corrected for magnetic deviation from true north.

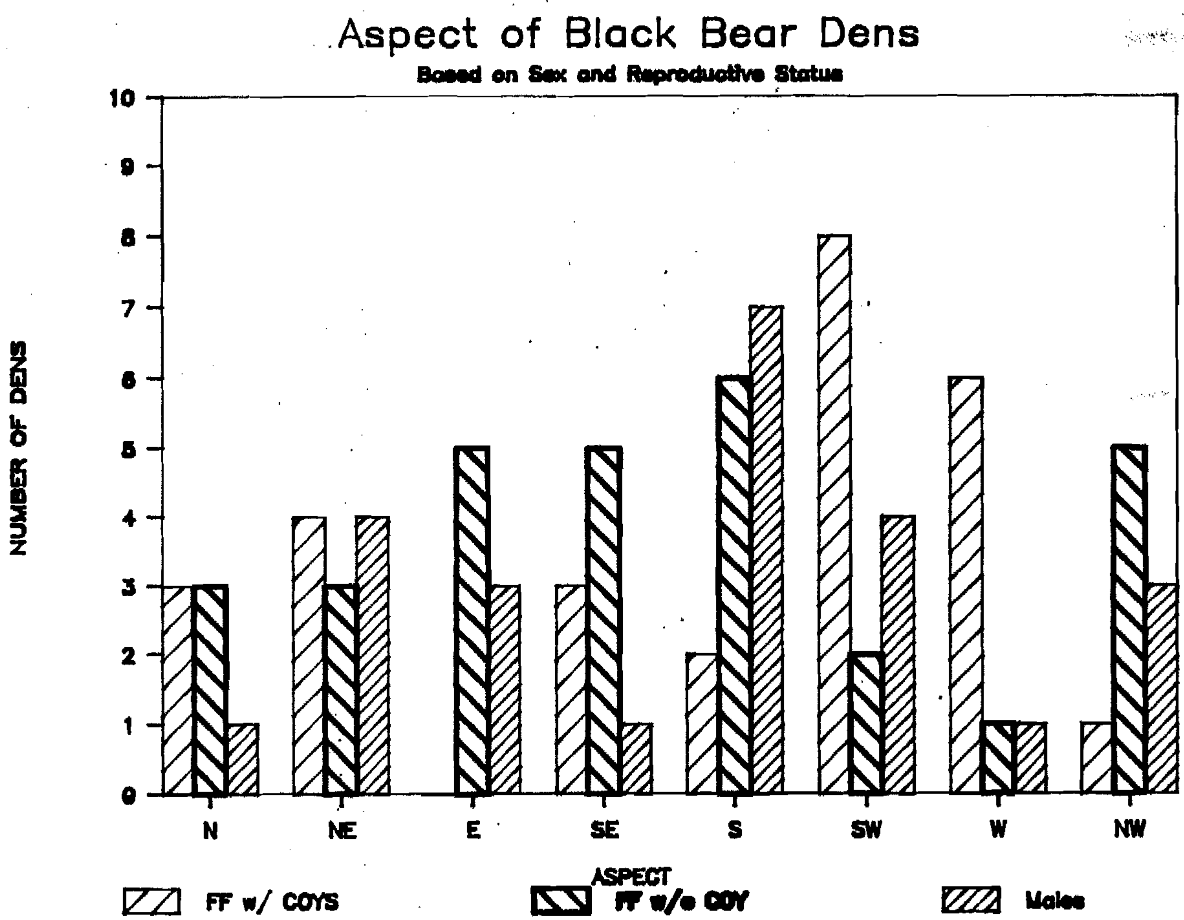


Figure 37b. Aspects of black bear dens for 27 females with newborn cubs (COY) at exit from den cavities, 30 females without newborn cubs at exit, and 24 males. Indicated direction includes arc of ± 22.5 degrees on either side. Aspects corrected for magnetic deviation from true north.

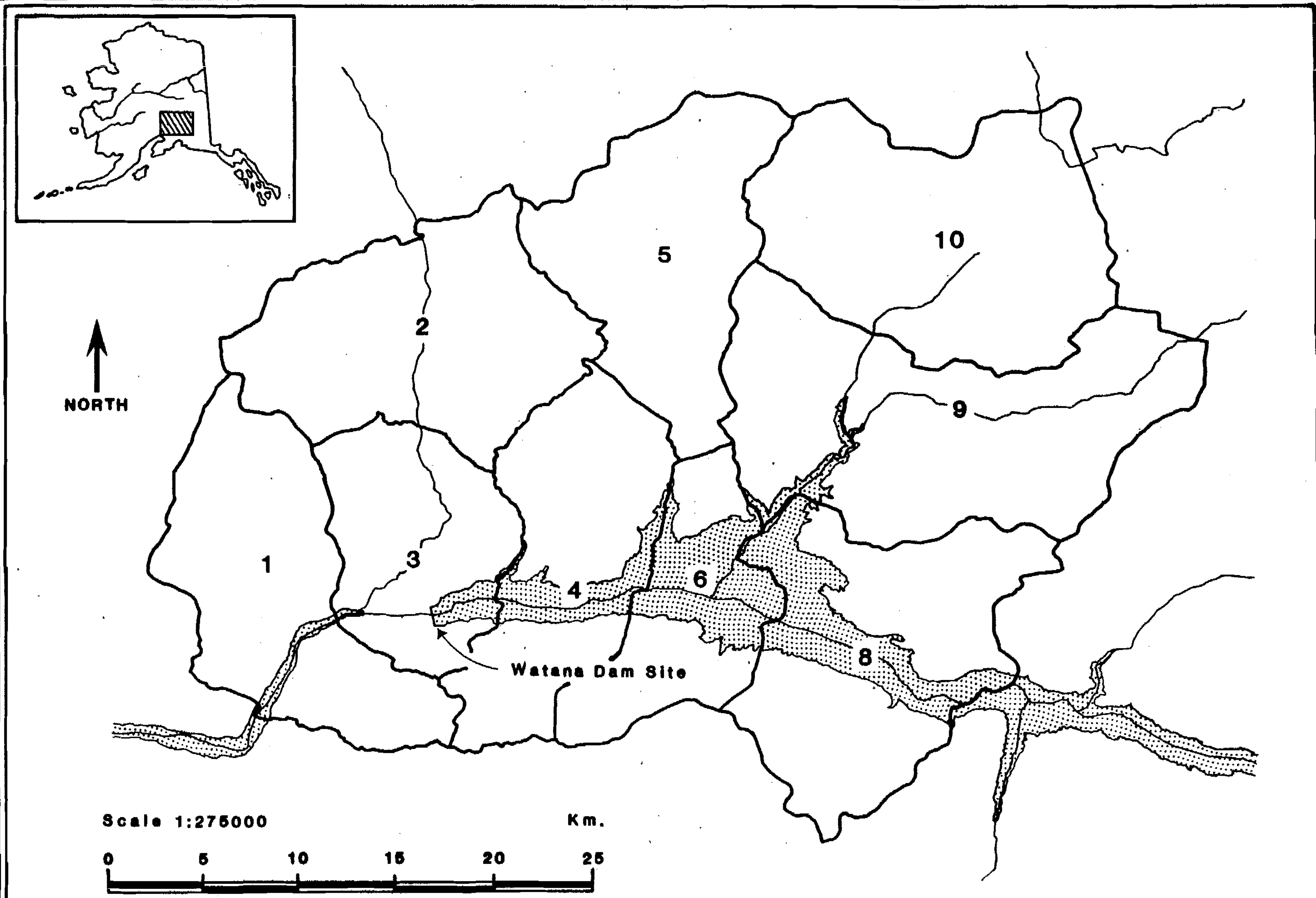


Figure 38. Search area quadrats used for spring 1985 bear density estimation.

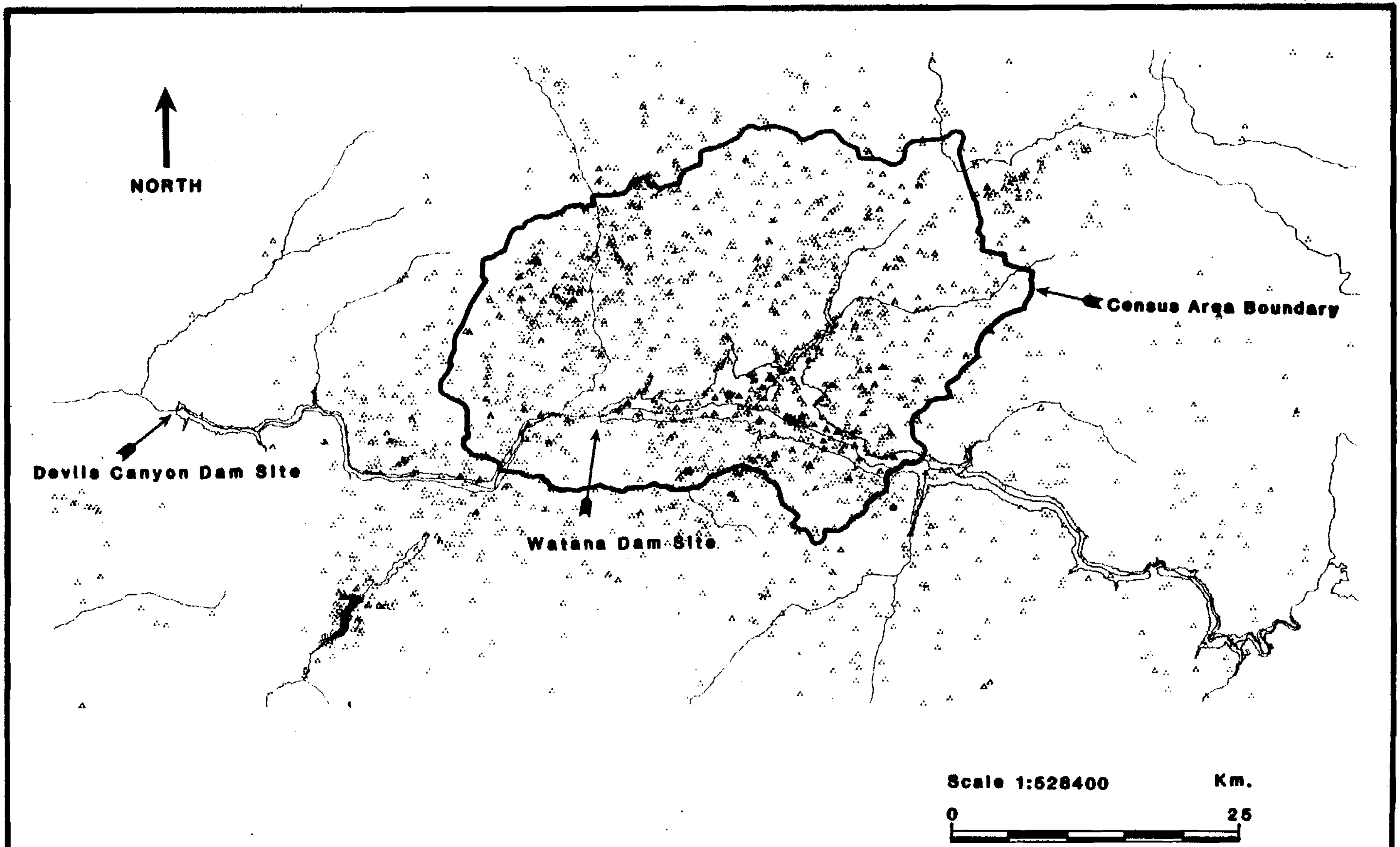


Figure 39. Distribution of brown bears during 1980-1984 relative to the spring 1985 density-estimation study area (3,389 point-locations are illustrated [203 of these for unmarked bears]).

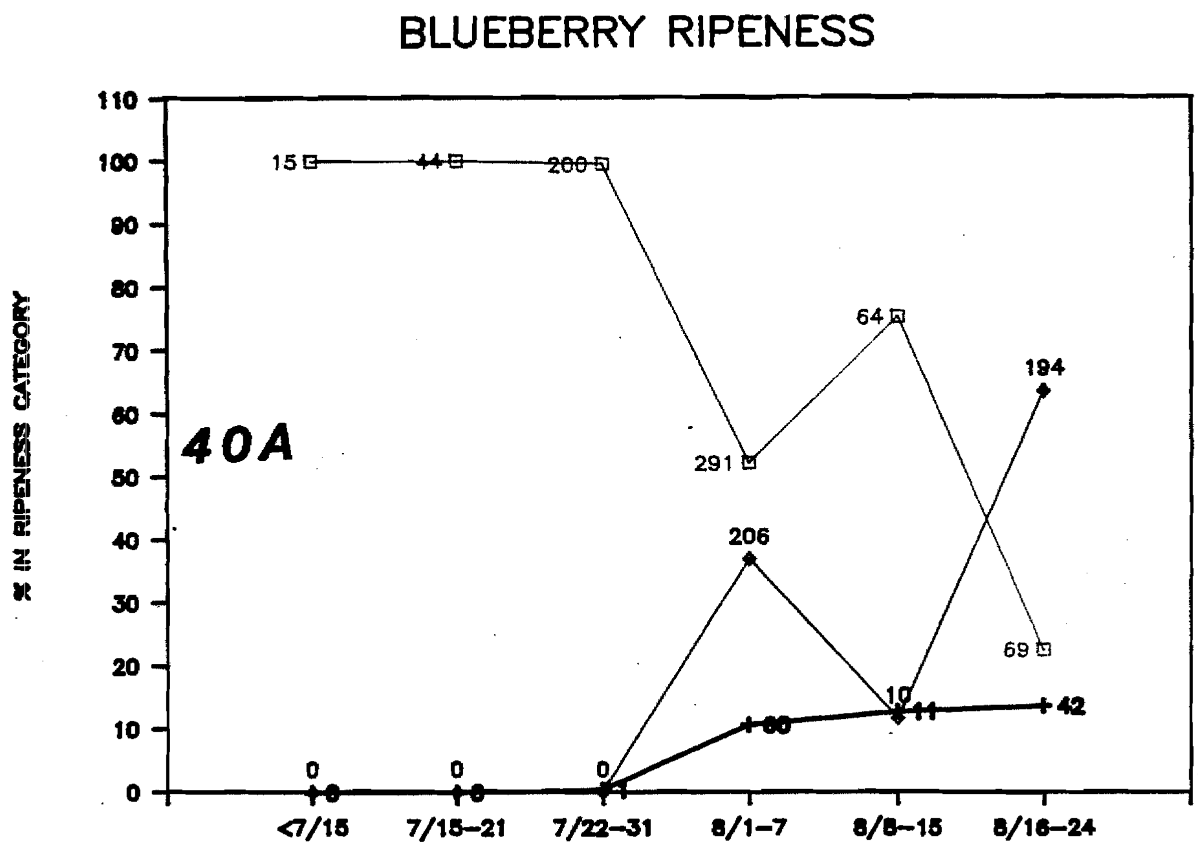
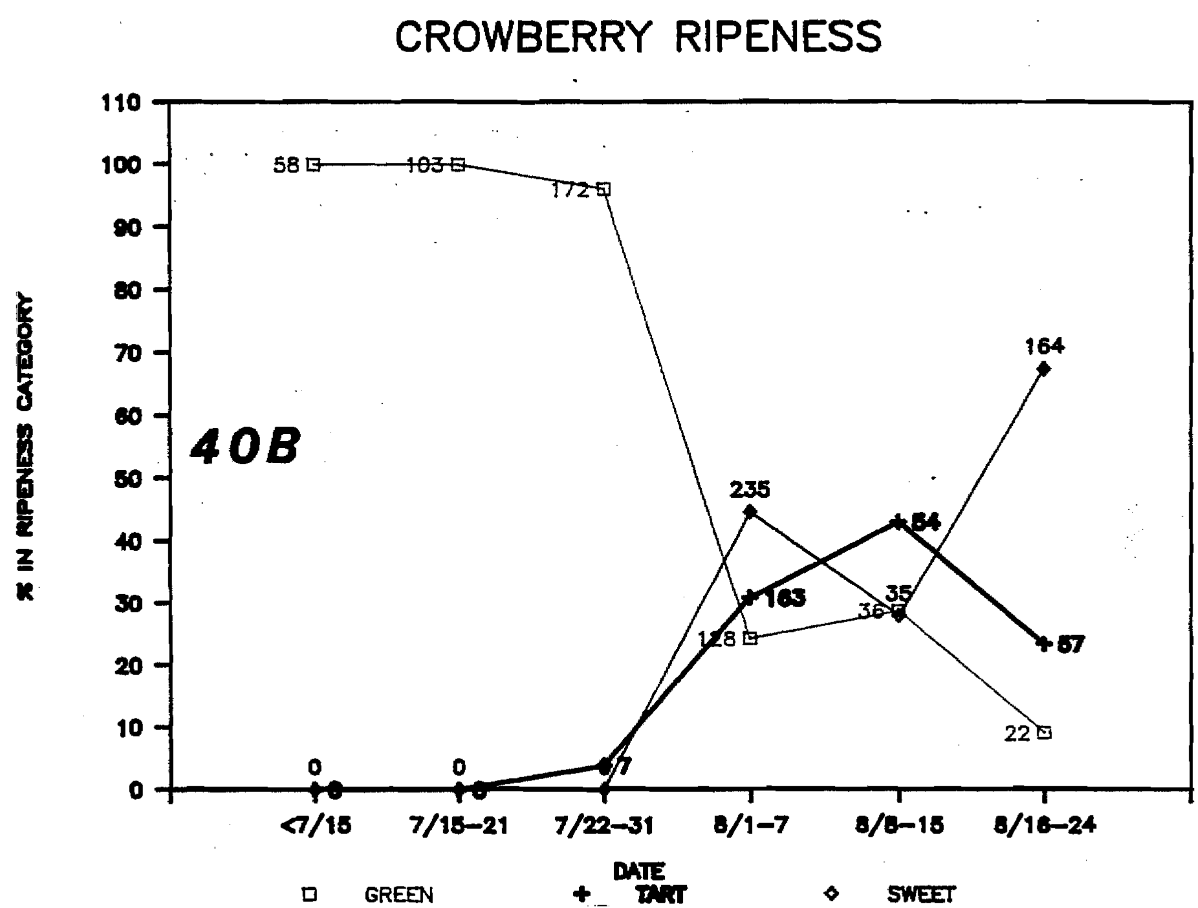


Figure 40. Ripeness phenology (% of all plots read during period with berries in that category) for blueberry (Fig. 40a), crowberry (Fig. 40b), and highbush cranberry (Fig. 40c). Sample sizes indicated on left of point for green berries, on right of point for tart berries, and above point for ripe berries.



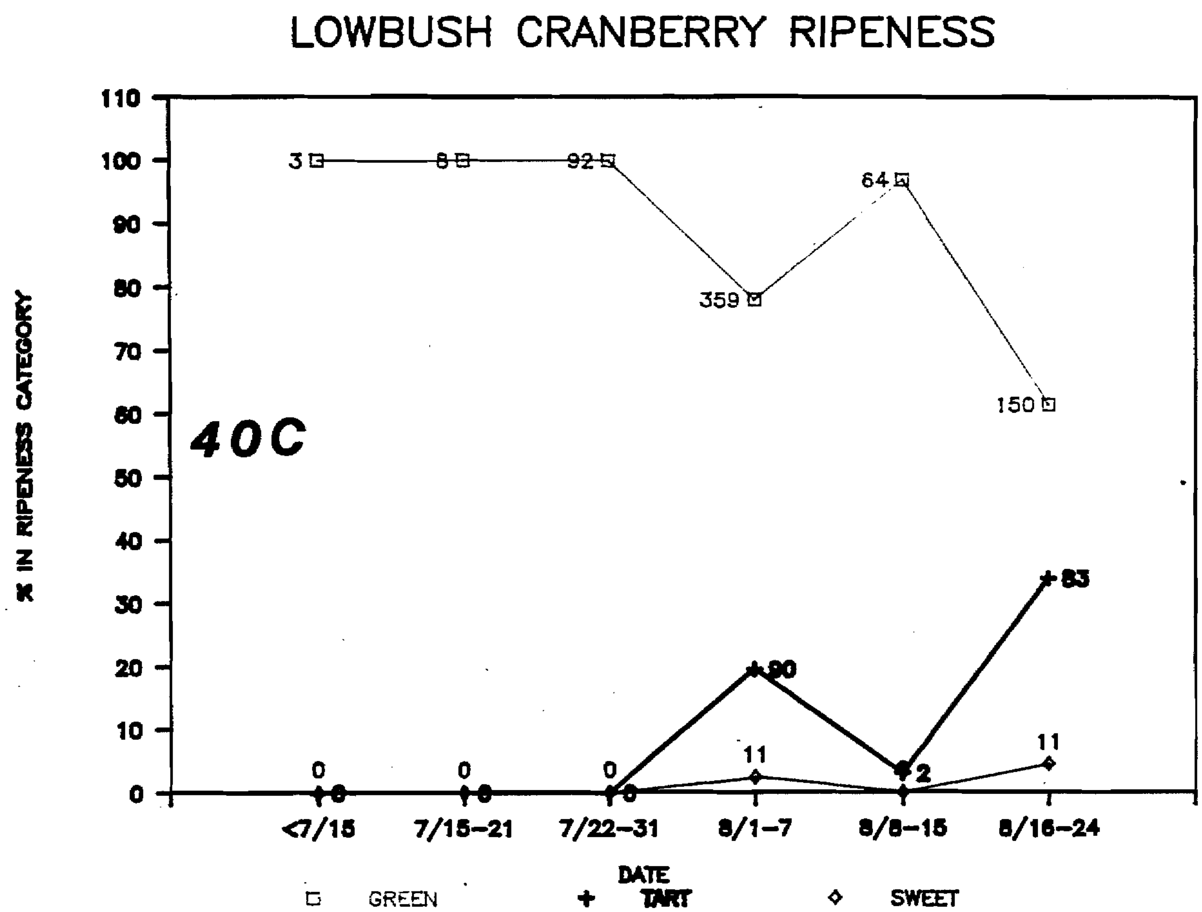


Figure 40. Ripeness phenology (% of all plots read during period with berries in that category) for blueberry (Fig. 40a), crowberry (Fig. 40b), and highbush cranberry (Fig. 40c). Sample sizes indicated on left of point for green berries, on right of point for tart berries, and above point for ripe berries.

Figure 41. Canopy coverage for blueberries in each impoundment zone and above 2200 feet elevation. Chi square analysis was based on estimated proportion in each class times the number of transects. Last two classes were lumped.

Coverage Class	Devils Canyon POPULATION D Est. Prop.	SE w/cov	Watana POPULATION A Est. Prop.	SE w/cov	>2200 feet elev. POPULATION B Est. Prop.	SE w/cov
None	0.228	0.0481	0.244	0.0190	0.253	0.0205
<5%	0.238	0.0390	0.223	0.0124	0.145	0.0131
5-25%	0.272	0.0330	0.292	0.0111	0.263	0.0194
26-50%	0.179	0.0292	0.147	0.0113	0.197	0.0165
51-75%	0.052	0.0120	0.067	0.0087	0.100	0.0122
>75%	0.031	0.0117	0.027	0.0050	0.042	0.0084
No. transects		43		165		126

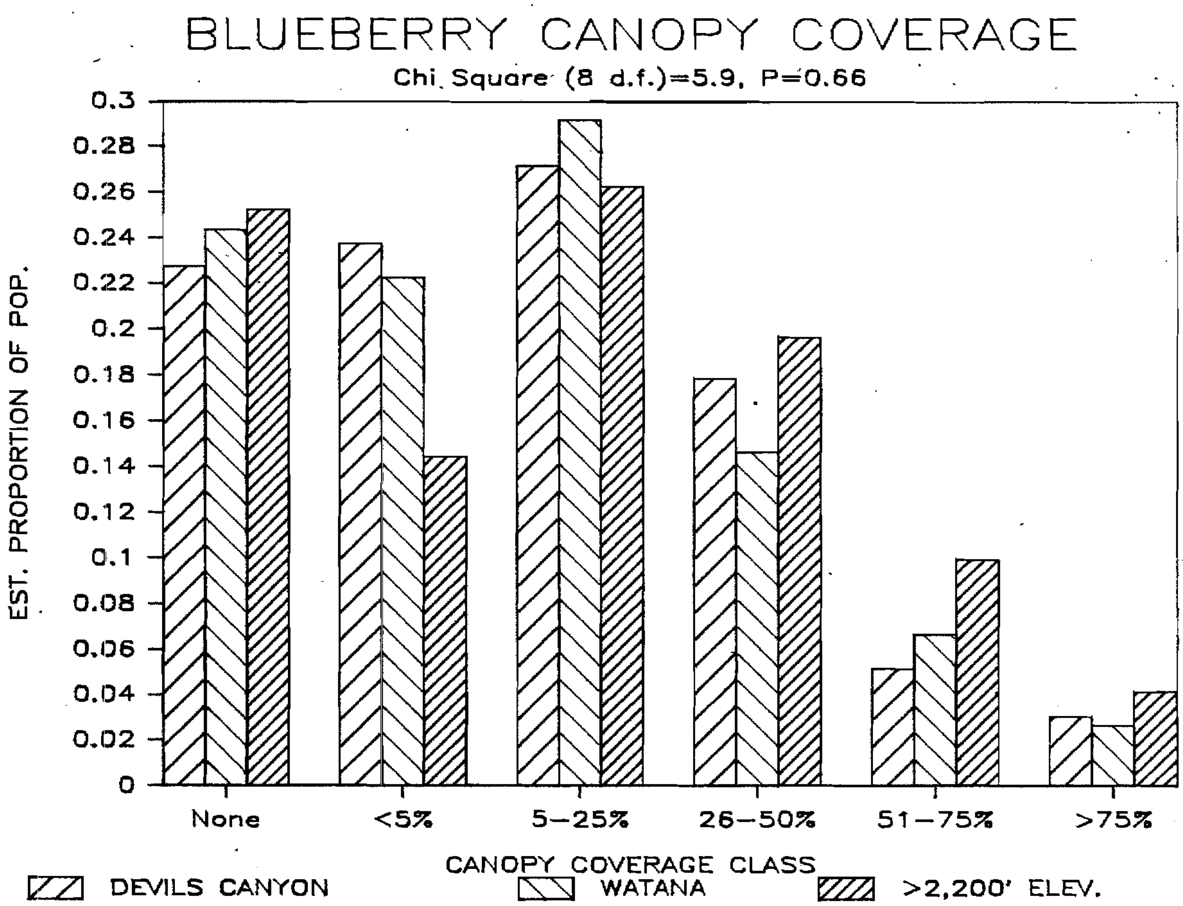


Figure 42. Canopy coverage for crowberries in each impoundment zone and above 2200 feet elevation. Chi square analysis was based on estimated proportion in each class times the number of transects. Last three classes were lumped.

Coverage Class	Devils Canyon POPULATION D Est. Prop.	SE w/cov	Watana POPULATION A Est. Prop.	SE w/cov	>2200 feet elev. POPULATION B Est. Prop.	SE w/cov
None	0.379	0.0639	0.376	0.0210	0.611	0.0257
<5%	0.256	0.0439	0.140	0.0127	0.178	0.0175
5-25%	0.181	0.0225	0.224	0.0138	0.143	0.0160
26-50%	0.131	0.0251	0.148	0.0106	0.059	0.0110
51-75%	0.036	0.0119	0.085	0.0104	0.010	0.0029
>75%	0.016	0.0117	0.028	0.0061	0.000	0.0000
No. transects		43.00		165.00		126.00

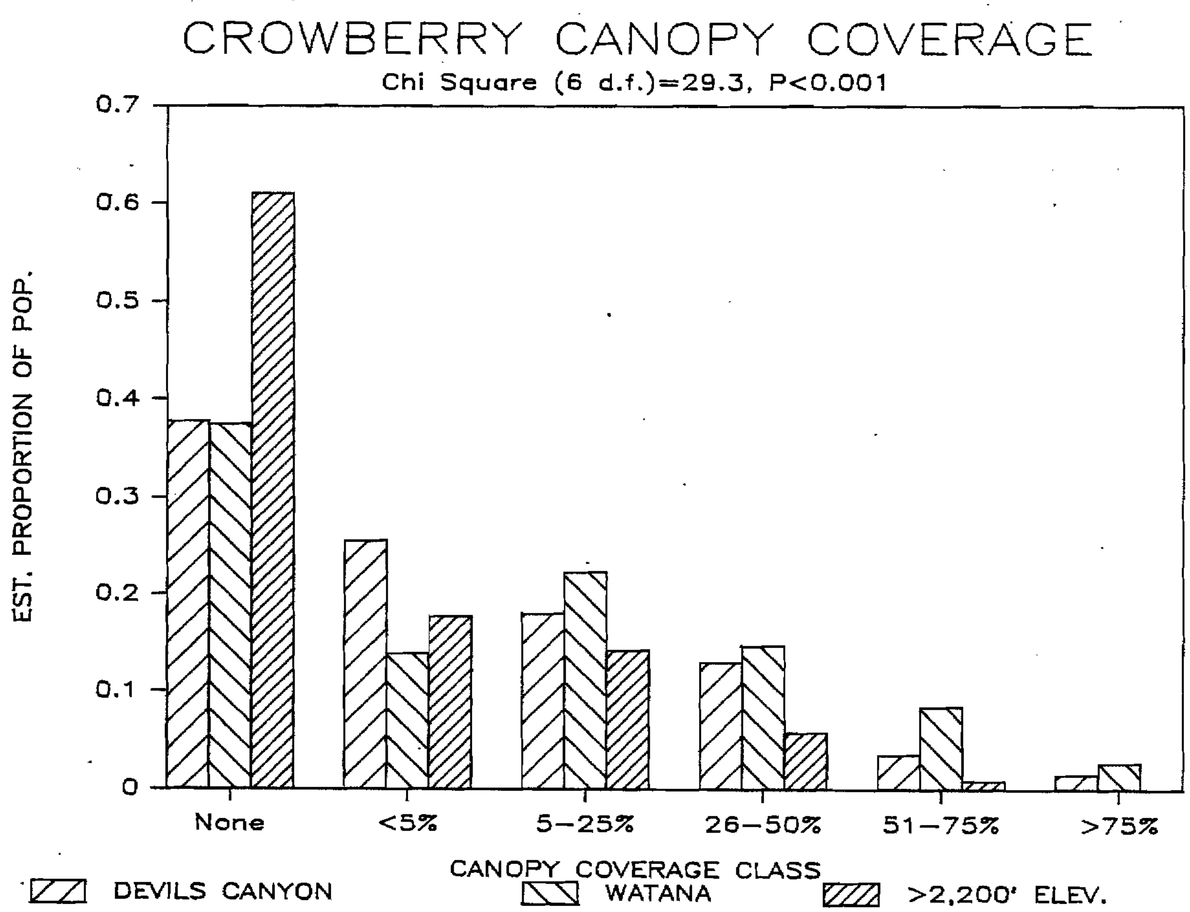


Figure 43. Canopy coverage for lowbush cranberries in each impoundment zone and above 2200 feet elevation. Chi square analysis was based on estimated proportion in each class times the number of transects. Last three classes were lumped.

Coverage Class	Devils Canyon POPULATION D Est. Prop.	SE w/cov	Watana POPULATION A Est. Prop.	SE w/cov	>2200 feet elev. POPULATION B Est. Prop.	SE w/cov
None	0.171	0.0483	0.262	0.0187	0.188	0.0182
<5%	0.409	0.0459	0.454	0.0138	0.306	0.0218
5-25%	0.289	0.0385	0.214	0.0128	0.330	0.0204
26-50%	0.097	0.0193	0.055	0.0084	0.138	0.0150
51-75%	0.031	0.0118	0.012	0.0033	0.033	0.0067
>75%	0.003	0.0026	0.004	0.0020	0.006	0.0031
No. transects		43		165		125

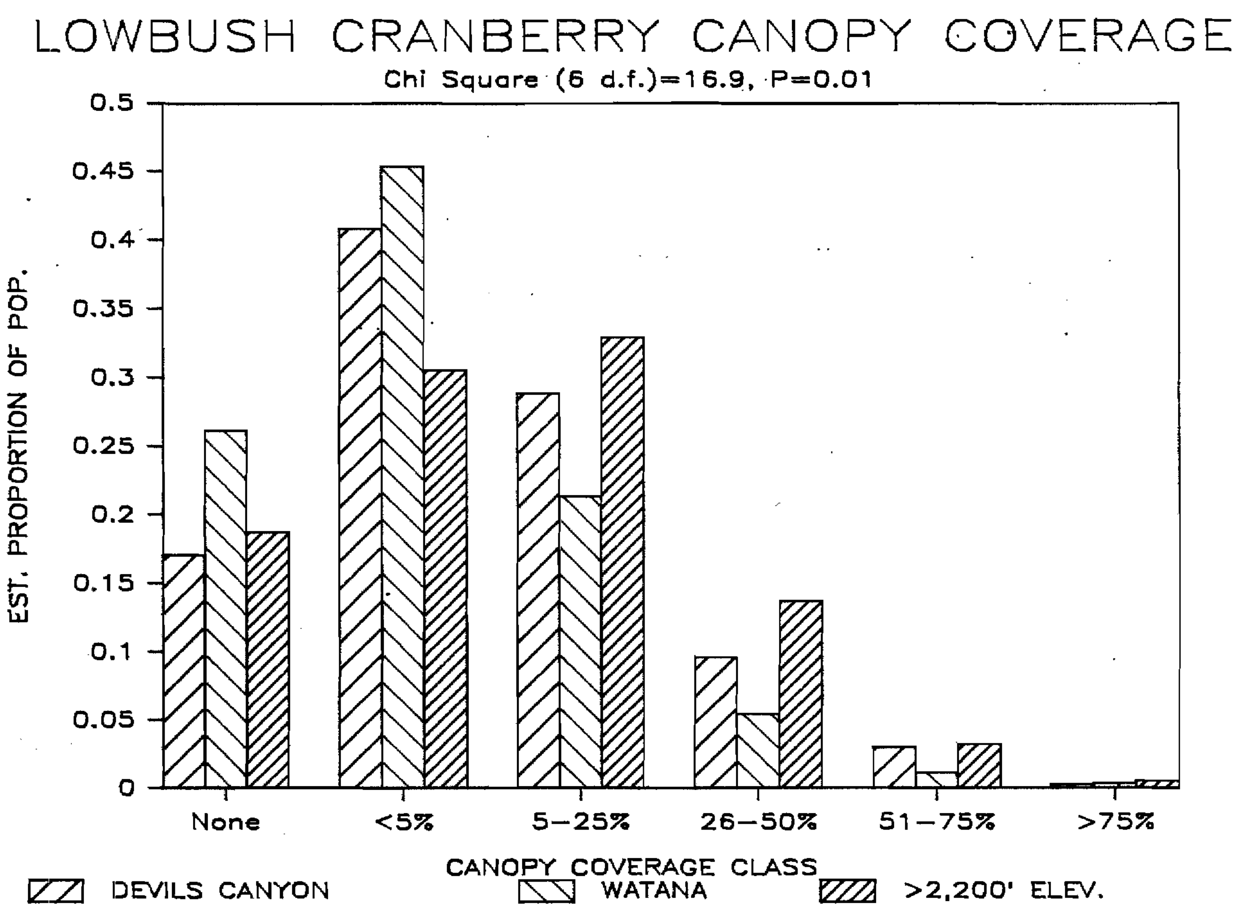


Figure 44. Canopy coverage for Equisetum in each impoundment zone and above 2200 feet elevation. Chi square analysis was based on estimated proportion in each class times the number of transects. Last four classes were lumped.

Coverage Class	Devils Canyon POPULATION D Est. Prop	Devils Canyon POPULATION D SE w/cov	Watana POPULATION A Est. Prop.	Watana POPULATION A SE w/cov	>2200 feet elev. POPULATION B Est. Prop.	>2200 feet elev. POPULATION B SE w/cov
None	0.503	0.0651	0.692	0.0120	0.568	0.0265
<5%	0.361	0.0627	0.178	0.0208	0.218	0.0186
5-25%	0.075	0.0172	0.074	0.0090	0.122	0.0150
26-50%	0.035	0.0120	0.029	0.0058	0.046	0.0083
51-75%	0.012	0.0119	0.016	0.0034	0.028	0.0060
>75%	0.014	0.0086	0.011	0.0032	0.019	0.0059
No. transects		43		165		126

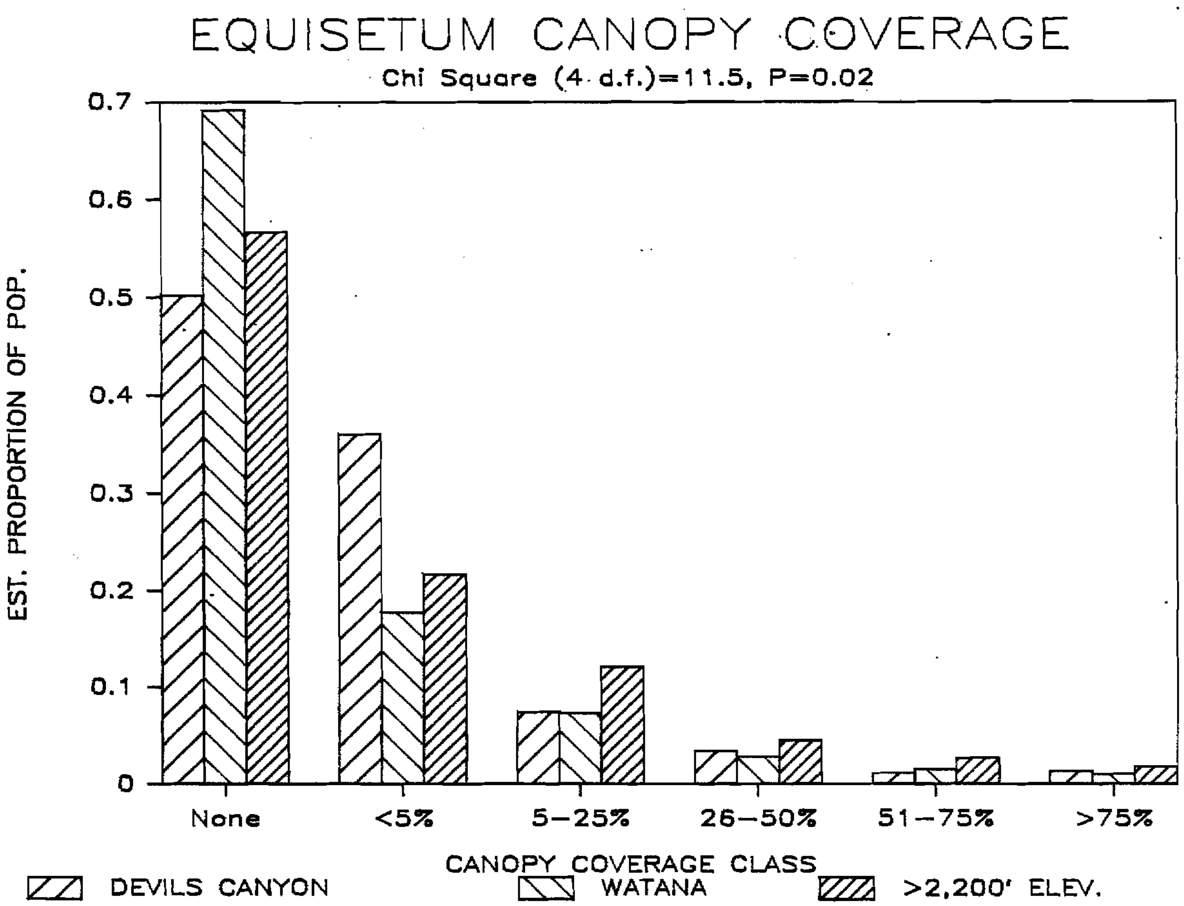


Figure 45. Abundance data for blueberries in each impoundment zone and above 2200 feet elevation. Chi square analysis was based on estimated proportion in each class times the number of transects. Last two classes were lumped.

Abundance Class	Devils Canyon POPULATION D Est. Prop.	SE w/cov	Watana POPULATION A Est. Prop.	SE w/cov	>2200 feet elev. POPULATION B Est. Prop.	SE w/cov
None	0.764	0.0421	0.796	0.0171	0.681	0.0210
1-4	0.110	0.0244	0.117	0.0119	0.156	0.0163
5-20	0.086	0.0181	0.065	0.0074	0.123	0.0118
>20	0.040	0.0136	0.021	0.0060	0.041	0.0081
No. transects		43		165		126

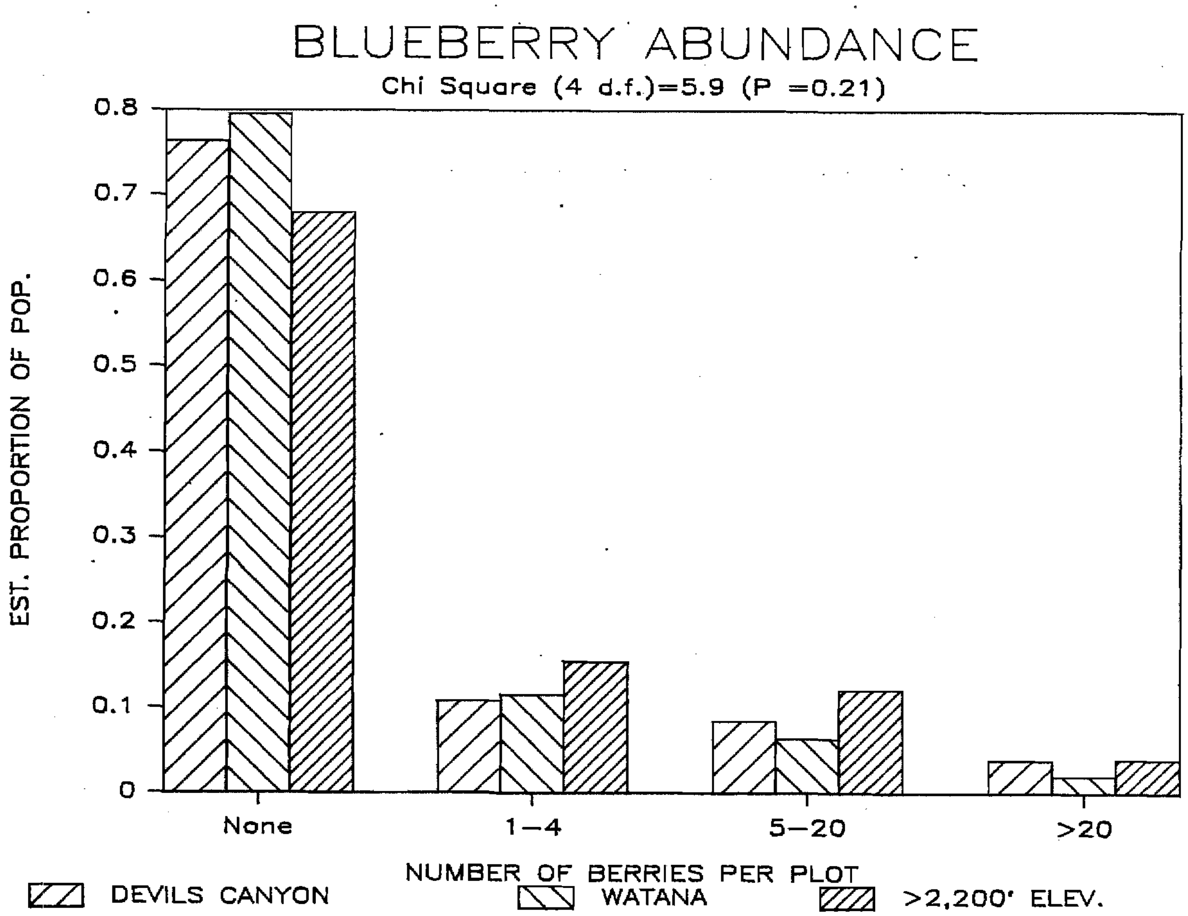


Figure 46. Abundance of crowberries in each impoundment zone and above 2200 feet elevation. Chi square analysis was based on estimated proportion in each class times the number of transects. Last three classes were lumped.

Abundance Class	Devils Canyon POPULATION D EST. PROP.	SE w/cov	Watana POPULATION A EST. PROP.	SE w/cov	>2200 feet elev. POPULATION B EST. PROP.	SE w/cov
None	0.758	0.0391	0.618	0.0144	0.875	0.0153
1-4	0.102	0.0241	0.102	0.0080	0.052	0.0100
5-20	0.073	0.0141	0.126	0.0105	0.048	0.0073
>20	0.067	0.0241	0.153	0.0134	0.026	0.0056
No. transects		43		165		126

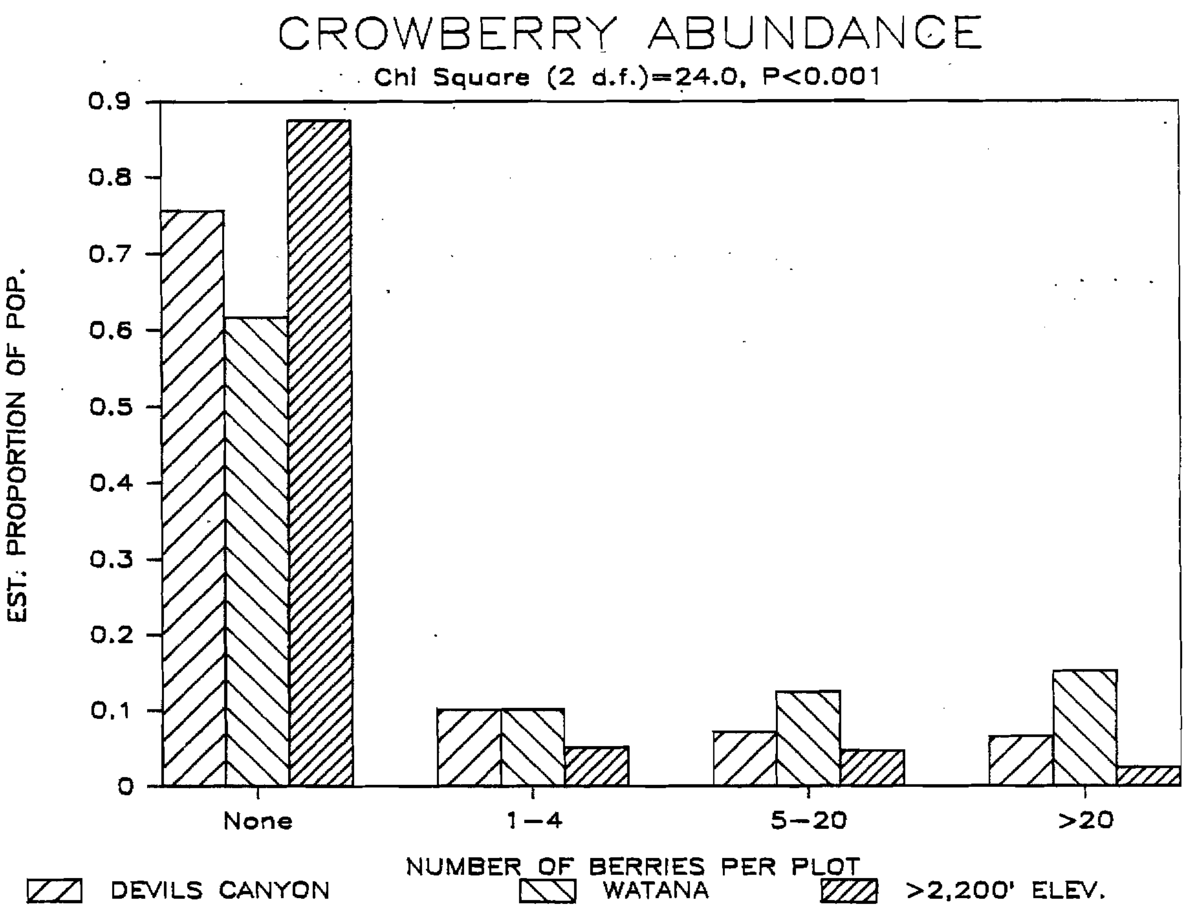


Figure 47. Abundance of lowbush cranberry berries in each impoundment zone and above 2200 feet elevation. Chi square analysis was based on estimated proportion in each class times the number of transects. Last three classes were lumped.

Abundance Class	Devils Canyon POPULATION D Est. Prop.	SE w/cov	Watana POPULATION A Est. Prop.	SE w/cov	>2200 feet elev. POPULATION B Est. Prop.	SE w/cov
None	0.845	0.0315	0.873	0.0136	0.744	0.0206
1-4	0.101	0.0288	0.038	0.0064	0.068	0.0103
5-20	0.040	0.0128	0.047	0.0074	0.119	0.0134
>20	0.014	0.0075	0.042	0.0074	0.069	0.0110
No. transects		43		165		126