SUSITNA HYDROELECTRIC PROJECT
1983 ANNUAL REPORT

BIG GAME STUDIES
VOLUME VI BLACK BEAR AND BROWN BEAR

Sterling D. Miller

ALASKA DEPARTMENT OF FISH AND GAME
Submitted to the Alaska Power Authority
April 1984

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Anchorage, AK 99502

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Results reported herein deal with portions of a continuing study and should be treated as tentative. Do not cite in technical publications without permission from author.

NOTICE

ANY QUESTIONS OR COMMENTS CONCERNING THIS REPORT SHOULD BE DIRECTED TO THE ALASKA POWER AUTHORITY SUSITNA PROJECT OFFICE

I. SUMMARY.

This report is an update of information presented in earlier reports (Miller and McAllister 1982, Miller 1983) and does not contain analyses of all the information available on the impacts of the proposed Susitna Dams on black bear (*Ursus americanus*) and brown bear (*Ursus arctos*) populations.

Following tagging operations in spring 1983, a total of 43 brown bears were radio-marked including 15 subadults. Five of these were in the downstream study area. In spring 1983 40 black bears were also radio-marked, half of these were in the downstream study area between Portage Creek and Curry.

The reproductive status of marked female brown and black bears in spring 1983 was consistent with the predicted pulse in cub production expected based on the 1981 failure of the berry crop. However, this pulse was not as large as expected largely because some females expected to produce first litters failed to do so. These observations support the hypothesis that project-related reductions in food supplies would negatively impact productivity of bear populations.

Documented losses of offspring from litters of collared female brown bears was 47% for cubs and 33% for yearlings. A limited amount of data collected in 1983 suggested these losses resulted from predation by other brown bears.

Kill locations for 351 brown bears in the study area portion of GMU 13 during the period 1961-1982 were digitized based on information recorded in ADF&G sealing documents. The sex and age composition of these harvested bears are reported. These data are presented to assist subtasks undertaking socio-economic studies in the project area. Based on hunter kills of marked bears, no less than 8%/year of the brown bear population is harvested.

Telemetry studies of six 2-year old bears (5 males and 1 female) indicated that the female and 1 male remained in or near their maternal home ranges. The other 4 males dispersed distant from their maternal home ranges. These observations validate earlier hypotheses that project-related reductions in bear numbers or productivity in the study area will impact bear populations elsewhere through reduced emigration.

Continued high use of Prairie Creek during the king salmon spawning season in 1983 supported earlier conclusions that this area is a seasonally important critical habitat area for brown bears in the study area. The area documented from which bears are attracted to Prairie Creek is 7,200 km^2 and 2,200 km^2 for males and females respectively.

The brown bear density estimate of 1/41 km^2 in an adjacent study area made by Miller and Ballard (1982) remains the best available estimate for the Su-Hydro project study area. In 1983 an independent estimate was derived based on the frequency or which radio-marked bears were seen with other marked bears and with unmarked bears during the spring 1983 breeding season. This process resulted in estimates of 11-50 km^2/bear depending on the assumptions used. These calculations lend additional credence to the density estimate of Miller and Ballard (1982).

Data collected in 1983 supported earlier conclusions that few brown bears den sites would be directly affected by the proposed impoundments. Indirect effects from increased disturbance is considered to be the main impact mechanism on brown bear denning.

Overall rates of harvest by hunters of marked black bears was 14% (19% for marked males and 10% for marked females). This rate was higher in the downstream study area (29%) than in the upstream study area (13%).

Black bear litter sizes declined over time. Mean litter size in dens was 2.5, 2.2 after exit from dens and 1.9 for litters of yearlings. Forty percent of black bear cubs have been lost from litters of radio-collared females.

Efforts to replicate the summer 1982 black bear census technique in spring 1983 were unsuccessful. A tenative density estimate of 1.3 mi^2/bear based on female home range sizes and various assumptions about population composition and productivity was derived. This estimate was considered too high for 1983 populations but was considered a reasonable approximation of the maximum carrying capacity of the upstream study area (400 bears). It is anticipated that this estimate will be refined once adequate habitat maps have been prepared by the plant ecology subtask.

Analyses of scats collected along salmon spawning sloughs in the downstream study area in 1983 revealed the same pattern as seen in 1983 studies. Berries were the most abundant and common item in these scats and salmon remains were uncommon. Radio-marked bears in the downstream study area, however, moved to the vicinity of these salmon-spawning sloughs during the salmon spawning season as in previous years. Based on these results it is suggested that radio-tracking studies of downstream black bears be deemphasized in FY 1985 but that scat collections along the sloughs be continued.

Of 26 black bear den sites found in the vicinity of the Watana impoundment, 15 will be inundated. Only 1 of 21 dens found in the vicinity of the Devils Canyon impoundment will be inundated.

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V. Introduction and Acknowledgements.

This progress report is an updated supplement to our Final Phase I report (Miller and McAllister 1982) and the first Phase II progress report (Miller 1983). The material discussed here does not repeat analyses presented in our earlier reports except where additional information was collected in 1983 that modifies or significantly strengthens the results presented in those reports. Also included in this report are the preliminary results of studies initiated in 1983. This report is a supplement to our earlier reports and does not present all the available information about the impacts of the proposed Susitna project on bear populations.

The dedications, talents and efforts of Dennis McAllister (ADF&G) have been of crucial importance throughout all aspects of this study. Valuable contributions were also made by K. Schneider, W. Ballard, B. Tobey, B. Taylor, H. Griese, C. Gardner, J. Whitman, N. Tankersley, S. M. Miller, D. Anctil, P. Hessing, B. Cassell, T. Cunning, N. Graves, T. Otto, C. Schwartz, L. Aumiller, P. Smith, and Terry Biwer (all ADF&G). S. Lawler, Penny Miles, and B. Brewer provided cheerful clerical assistance. C. Crouch and J. Hallanger provided administrative aid.

The skills of V. Lofstedt, C. Lofstedt, M. Hauke, and L. Rogers (Kenai Air Alaska) were appreciated in piloting helicopters and fixed-wing aircraft as were the skills of A. Lee (Lee's Air Taxi), K. Bunch (Sportsman's Flying Service), D. Deering (Deering Air Taxi), C. Allen (Allen Flying Service), and several helicopter pilots with Air Logistics Inc. (especially Jerry Dixon). Special thanks to Rick Halford (Susitna Lodge), and Jim Grimes (Adventures Unlimited) for permission to use their landing strips and facilities for storing fuel. Bruce Barrett, and other Su-Hydro fisheries study personnel (ADF&G) provided logistic support and information during our downstream bear study effort which was much appreciated

The cooperation of Granville Couey (Harza-Ebasco), the Watana Camp Manager, Bob Lund and their staff was appreciated. Robin Sener of LGL and his staff assisted in various ways as did Randy Fairbanks and the staff at Harza-Ebasco.

Funding for this project was provided by the Alaska Power Authority and Dr. Richard Fleming of that agency assisted in various ways.

VI. Methodology.

Methods used followed those discussed by Miller and McAllister (1982) and Miller (1983). Because of the larger number of radio-marked bears and their wider distribution, most of the 1983 radio-tracking flights took 2 days to accomplish. Typically radio-trackers would overnight on the Denali Highway or in Talkeetna. Radio-monitoring flights in 1983 were conducted on: 16 March, 13-17 and 25 April, 4, 10, and 23 May, 1-2, 6, 13-14, and 20-21 June, 8-11 and 20-21 July, 1-3, 10-11, and 16-17 August, 6-7, 16-17, and 26-27 September, 5 and 24 October, and 14 November. Uncertainties over budget allocation levels curtailed some flights scheduled in July and October, this compromised data collected in 1983 relative to previous years especially with reference to use of Prairie Creek and den entrance dates.

Tagging and recollaring efforts were conducted on 14-19 May 1983. No bears were killed. Bears handled in 1980-1983 are listed in Tables 1 and 2. Number of point locations obtained are listed in Tables 3 and 4.

A black bear census effort was attempted on 24-25 May using procedures described by Miller (1983). Because too few bears were seen relative to the number known present, this effort was aborted midway through the census. An effort to derive a bear density figure using female home range size was used in replacement, these procedures are described in the black bear density section of this report.

Specially-designed cub collars using a pattern described by Strathern et al. (in press) were applied to 6 brown bear cubs during the May tagging period. Breakaway collars were applied to 7 two-year old brown bears to evaluate dispersal. Specially-designed transmitters were also surgically implanted in 4 of these two-year olds plus 2 yearling brown bears by ADF&G veterinarians Bill Taylor and Bob Tobey. These implants and cub collars were experimental procedures that were tested as techniques to evaluate causes of subadult mortality.

Collars were replaced on black bears in accessible dens on March 21-24 and 14-16 April, 1983. At those times den sites were also marked. Snow was too deep in March, especially in the downstream study area, to easily visit all dens so remaining dens were visited in April. Bears handled during these periods are listed in Table 2.

Point locations for reported brown bear hunter kills from 1960-1972 were plotted on 1:250,000 scale USGS maps by GMU 13 area biologist Bob Tobey using hunter sealing documents as the data source. These points were digitized on the Susitna file and used to evaluate the characteristics of hunter harvests in the study area.

Based on teeth collected in 1983 the ages of some bears were changed. Change was called for when the age assigned to the new tooth did not correspond with the age expected based on the tooth collected earlier. The "correct" age was established in these cases by examining both sections again and deciding which section was the best. In most cases these changes involved a change of only one year. For black bear 321, however, the teeth collected in 1980 and 1983 were both clearly aged at 10. For this bear I arbitrarily assigned it as age 10 in 1980 and age 13 in 1983. Changes made in ages are indicated in Table 1 and 2.

VII. Results and Discussion--Brown Bears.

A. Sex and Age Composition of Study Animals.

Following the May tagging effort 43 brown bears were radio-marked including 6 cubs, 2 yearlings, 7 two-year olds, 5 adults in the downstream study area (379, 403, 407, 342, and 373), and 23 adults in the upstream area. During 1983 two radio-marked bears were shot and reported by hunters (380, 395), 3 radio-marked cubs were killed by other brown bears (005,006, 003), 2 cubs shed collars (007, 009), one yearling with an implant radio died of unknown causes (383), one 2-year old with an implant and breakaway died in the fall (389), and 1 adult shed its collar (373). Post denning numbers of radio-marked brown bears was, correspondingly, 33 including 4 bears assumed still alive whose den sites were not located prior to termination of the field season (381, 312, 393, and 293). Capture data from 1980-1983 are given in Table 1.

The sex and age composition of the 33 bears radio marked at the end of the 1983 season was: 7 adult (≥4) males (399, 400, 279, 282, 342, 280, and 293), 18 adult females (379, 403, 335, 349, 384, 396, 299, 407, 344, 381, 281, 340, 283, 312, 337, 315, 388, and 313), 4 two year old males (390, 392, 386, and 391), 2 two year old females (393 and 385), 1 yearling male (382), and 1 male cub (008). Ages of these bears can be obtained from Table 1.

B. Population Biology and Productivity--Brown Bears.

Miller (1983:22) predicted a pulse of cub production in 1983 based on the apparent berry failure in 1981. Seven (54%) of 13 radio-collared females were expected to produce cubs in 1983 but only 4 (32%) did (Table 5). The 3 bears that were expected to produce cubs but did not, were all expected to have their first litters in 1983. Two of these were age 5 and one was age 4 in 1983. These data may indicate that age of first reproduction is

older than indicated by Ballard et al. (1982). They may also indicate that age of first litter production was delayed by the poor 1981 berry crop. Of the 4 bears that did have cubs in 1983, 2 had lost yearling litters in 1982, 1 had lost a litter of 1 cub in 1982, and 1 produced its first litter at age 6 (Table 5). These observations support the pulse concept proposed by Miller (1983) in that females that lost litters in the year following the berry failure produced cub litters 2 years after the berry failure (Miller 1983). However, this concept is supported only if 1982 losses were abnormally high; if the observed losses were typical no effect from the reduced berry crop be concluded. Data are currently inadequate to evaluate typical rates of offspring loss. Observations to date are consistent with the hypothesis that food availability impacts productivity in study area brown bear populations. Reductions of food availability caused by the impoundments and related activities would, under this hypothesis, have consequences on brown bear productivity.

One female (344) lost her last yearling in July 1982, was subsequently seen with another bear and produced 2 cubs in 1983 (Table 5). This indicated that late breeding may successfully occur when litters are lost.

The predicted 1984 reproductive status of 18 radio-collared female brown bears (≥4 years) is given in Table 6. Thirteen (72%) of these bears may have cubs in 1984, 5 of these may produce their first litters at age 5 or 6 (Table 6). Three of these bears lost their 1983 litters and are expected to produce new litters in 1984 (Table 6).

Mean litter size of 19 brown bear litters observed since 1978 was 2.1 (range 1-3). Reports of litters of 4 in GMU 13 have been received. The mean size of 22 litters of yearlings observed since 1978 was 1.6 (1-2). Details of these observations are given in Table 7. The reproductive histories of individual radio-marked females are given in Table 8.

Details of losses from litters of cubs and yearlings are given in Table 7. These data are summarized in Table 9. Documented losses of cubs is 41-47% and of yearlings 30-33% (Table 9). Experimental procedures were tested in 1983 to evaluate causes of this mortality. Six specially-designed expandable collars equipped with small radios pulsing at 17 ppm in active mode and 43 ppm in inactive mode were applied to cubs of 3 radio-collared female brown bears. Three of these 6 cubs were killed by other brown bears, details of these observations follow:

Female 283 (age 15 in 1983) was still in its den on 4 May but was out with a single cub on 10 May. These bears were captured near this den on 14 May. The female was darted with Sernylan/Sparine and the cub (004) was captured by hand and calmed with 0.3 ml of M99. These bears were radio-tracked on 15 May at which time I found the female standing under a spruce tree, the cub was not seen but its radio collar was on active mode and its signal was coming from the same vicinity as the female. I assumed the cub was in the spruce tree. On 17 May the cub was found dead 2-3 miles from its location on 15 May. Female 283 was 2-3 miles away. The cub had been eaten almost completely and only a few bone fragments remained. Only brown bear tracks were seen in the snow around the dead cub. It was concluded that this cub was killed and eaten by an adult brown bear of unknown identity.

Female 281 produced her first observed litter in 1983 at age 6. This bear was in its den on 4 May, was observed at the den with 2 cubs on 10 May, was back in the den on 14 May and was captured on 15 May (with M99). Cubs were captured by hand and were not drugged. This family was located together on 16, 17, 23, and 24 May. On the last 2 locations these bears were at lower

elevations (2950 feet) than previously (over 4700 feet). On 1 June the cubs were found dead near the 24 May location, their mother was 8 miles away at 1750 foot elevation. One cub (005) was almost completely eaten like cub 004 (above), the other cub (006) was partially eaten, partially disemboweled and had its skull and pelvic area crushed. Canine puncture wounds were found in its throat and head. Cub 006 had been buried about 200 feet from cub 005 under a patch of moss that had been ripped loose in a typical-appearing bear cache. The location of these kills was outside of typical black bear habitat and brown bear predation was concluded to be the cause of death for both cubs. The stomach of cub 006 was full of willow catkins, a shrew skin and curdled milk. I suspect the lower elevation habitats to which this inexperienced mother bear moved so early in the spring may have increased the vulnerability of her cubs to predation by other brown bears.

Female 299 (age 17 in 1983) was still in its winter den when upstream capture efforts were terminating so the bear was darted in its den using M99. This bear had 3 cubs (007, 008, and 009) all of which were collared. No cubs were intentionally drugged but one had apparently ingested some drug and was, correspondingly, given some antagonist after which it quickly recovered. All 3 cubs apparently survived until den entrance (they were last seen on 27 Sept.). One cub shed its collar between 16 Sept. and 27 Sept. Another cub shed its collar between 20 June and 8 July. The third cub was apparently still wearing its collar (on active mode) when last monitored in its den on 14 November. One shed collar functioned as designed, the other broke at an unexpected location.

One other brown bear cub was handled in spring 1983 (with female 394 at age 6). The neck of this cub (#004) was badly scarred so it was not collared. The female was darted with M99 and the cub was calmed with a small dose of the same drug. The female and cub were captured on 15 May, the nest day the female was observed without its cub. It is possible that this loss was capture-related.

Although this data set is small it suggests the effectiveness of using the specially-designed cub collars. These data also suggest that is it better to avoid drugging the cubs if this can be done reasonably. These observations also indicate that M99 is an appropriate drug to use in immobilization of females with newborn cubs.

Results from the internal transmitters surgically implanted in yearlings and 2-year olds are less clearcut. Range of these transmitters was only 3-4 miles. Two yearlings with female 313 (age 12 in 1983) were given implant transmitters by ADF&G veterinarians Bob Tobey and Bill Taylor. On 14 May, the adult female was darted with Sernylan/Sparine, the yearlings with M99. Between 23 May and 2 June yearling 383 died. The carcass of this bear was not found, the internal transmitter had been carried away from the carcass. Based on the spacing of tooth marks found on the wax-coated transmitter we believe a fox removed it from the carcass. This bear's sibling (384) survived and entered its den with its mother. Surgery-related mortality for yearling 383 cannot be eliminated as a possibility but was considered unlikely.

Another bear (male, age 2, #389), fitted with an internal transmitter as well as a breakaway collar, died in the fall 1983. Cause of death has not yet been determined but an unrecovered hunter kill or wounding is considered likely.

All other bears fitted with internal transmitters are still alive. The short range of the internal transmitters used in 1983 precludes their effective use as a method of documenting dispersal of subadults. As a method of determining causes of yearling mortality, however, this procedure has potential. One bear (male, age 2, #390) shed its breakaway collar in mid summer and was subsequently located using just the surgically implanted internal transmitter. Fortunately this bear remained close to its maternal home range and did not disperse so some locations could be obtained even with the limited range of the internal transmitter.

Measurements of brown bear cubs and yearlings handled to date are given in Table 10 and 11.

C. Brown Bear Harvest Data.

Brown bear kill locations as reported on ADF&G sealing documents during the period 1961-1982 (N=351 points) in that portion of GMU 13 surrounding and including the Su-Hydro study area were plotted by GMU 13 area biologist Bob Tobey (Figure 1). the sex and age composition of these kills during the period 1970-1982 is presented in Table 12. In the period 1980-1982 a mean of 38 bears/year were taken in this area. Mean female ages have changed little during the period 1974-1982 (fall data) but mean male ages have declined. The proportion of males in the fall harvest has remained relatively constant (annual mean = 60%) during the last 9 years (Table 12). Liberalizations of seasons that occurred in 1980-1982 resulted in a 41% increase in mean annual harvest from 27/year (1974-1979) to 38/year (1980-1982) in the area illustrated in Figure 1. The further liberalizations in the season and bag limits that occurred in 1983 further increased harvests in this area although these data have not yet been compiled.

ADF&G bear studies in this area have been ongoing since 1978. Reported hunter kills of marked bears can be used to estimate hunter kill rate (Table 13-16). These kill rates are minimum estimates because marked bears that have not been reported as shot are treated as still alive. Actually some of these have been shot and not reported as marked bears or have suffered mortalities of other kinds. During this period 29 marked bears were shot and reported out of a total of 366 marked-bears-years available. This provides a minimum estimate of 7.9% mean annual exploitation rate (calculated from Table 16). In recent years the proportion of marked bears taken by hunters appears to have increased (Table 16). The sex ratio of marked bears in the harvest (72% males) compared to the sex ratio of marked bear years "available" (48% males, from Table 16) indicates heavy exploitation, especially of the male segment of this population.

D. Brown bear movements.

1. Subadult dispersal.

Project-related reductions in brown bear populations in the study area are likely to be reflected in neighboring areas as fewer subadults will be available to disperse from the impact area to colonize the surrounding areas. Dispersal can be documented by radio telemetry but standard radio collars may injure rapidly growing subadults. In 1983, therefore, we experimented with "dropoff" collars designed by Telonics, Inc. These collars were held in place with a length of surgical rubber tubing. This tubing is intended to weather and decompose allowing the collar to drop off before it becomes too tight.

One such dropoff collar was applied to 2-year old male 390 on 14 May along with its male sibling (389). The mother of these bears (388) was radio-collared at the same time. Both offspring were also given surgically implanted internal transmitters. G390 pulled its collar off between 20 June and 8 July. This bear did

not disperse (Figure 2) so it could still be periodically located using its internal transmitter. This bear is expected to disperse in 1984 as a 3-year old, one year later than is considered typical.

The male sibling (389) of 390 separated from its mother at the same time (6 June-13 June). On 20 June the mother was seen with a marked adult male (G400) so separation apparently coincided with estrus. G389 dispersed in a northeasterly direction in early August. It was last seen alive on 5 October, on 24 October its carcass was spotted. This carcass was not visited before deep snowfall so the cause of death was not determined. The area where this bear died, near the Denali Highway between the Clearwater and Maclaren Rivers, is heavily hunted so it is possible that this bear was wounded by a hunter. Another dead bear was spotted in a nearby area during moose census work in early November and neither bear was skinned. The distribution of G389 is illustrated in Figure 2.

G384 (female, age 12) was captured on a caribou kill on 15 May. Adult male 293 was within a half mile. G384 had at least two 2-year old offspring (391 and 392, both males) and 393 (female, age 2) was within a few hundred yards. At the time it was thought that all three 2-year olds were siblings but G393 was never again seen with this group so it is possible that 393 was not part of the group. The two males stayed with their mother until through 6 June, on 13 June their mother was seen with another bear and her offspring had separated from her. These brothers dispersed in a northeasterly direction immediately after separation (Figure 3) but remained together through 27 September. By 5 October these bears had separated (one was on an apparent beaver kill at this time) and they denned in different locations. Their female sibling (393) remained near its maternal home range (Figure 3) throughout the year but was not found in flights subsequent to 27 September, its den site was not located in 1983. This bear may have been shot and not reported.

G312 was recollared on 14 May and her 2-year old male offspring (386) was equipped with a breakaway collar and internal transmitter. On 2 June these bears were still together along with an unmarked bear, on 13 June separation had occurred and 312 was near male 399. G312 was also with a different unmarked bear on 21 July. These observations indicate separation coincided with estrus, as with the above females. Offspring 386 apparently dispersed north soon after separation, this bear was not found between 2 June and 20 July. On 20 July it was in the upper Susitna-Monahan Flats area and it denned in the Alaska Range near the West Fork Glacier of the Susitna River (Figure 4).

Home range size data for radio-marked 2-year olds are given in Table 17. Dates of separation of previous 2-year olds from their mothers are provided in individual reproductive life histories (Table 8).

2. Seasonal movements to Prairie Creek.

Miller and McAllister (1982) and Miller (1983) documented movements of study area brown bears to Prairie Creek during the king salmon spawning period. An annual summary of observed movements to Prairie Creek by radio-collared brown bears is given in Table 18. Since 1980 a total of 73 radio-collared bear-years existed in July. For 20 of the 73 bear-years available since 1980 (27%), the radio collared bear was found at Prairie Creek during the King salmon spawning season (Table 18). The portion of marked bears found at Prairie Creek in any one year varied from 13% in 1981 to 36% in 1980 (Table 18). This percentage appears higher for males (56%) than for females (18%), perhaps because:

1. Females may have a tendency to avoid Prairie Creek during years they have newborn cubs (e.g. 283, see Table 18);

2. Females have smaller home ranges and may be less inclined to move out of them to a salmon spawning area, females may be more territorial.

All bears still radio-collared that were previously documented as visiting Prairie Creek (282, 283, 380) visited it again in 1983, with the exception of male 293 (Table 18). Budgetary uncertainties during the Prairie Creek salmon spawning run resulted in relatively infrequent flights so these data represent minimal usage values. G293, for example, could have been missed at Prairie Creek between monitoring flights, but this was considered unlikely.

The home ranges of the individuals documented visiting Prairie Creek are illustrated in Figure 5 (1980-1983). The total area encompassed by the movements of these bears was 7,894 km^2. This is the minimal area from which brown bears are attracted to Prairie Creek because no bears have been tagged south and southwest of Prairie Creek. Doubtless bears in this area move to Prairie Creek as well. Some brown bears were tagged in the downstream study area in 1983 and one of these bears (407) moved from upper Gold Creek to Prairie Creek (Figure 5). This is interesting as salmon were available in the Susitna River around the mouth of Gold Creek, much closer to this bear's normal home range. These Susitna salmon, however, were primarily chum salmon. This movement may indicate that some bears, like human fisherman, may be willing to make large movements to indulge their preferences for king salmon over chum salmon. At McNeil River I have observed an apparent preference for relatively rare king salmon over abundant chums by fishing bears. A bear who caught a rare king salmon would eat it completely while chum salmon tended to be only partially eaten.

Seven radio-collared females were attracted to Prairie Creek (10 bear-years) from an inclusive area of 2,164 km^2, while 5 radio-collared males (9 bear-years) were attracted from an area of 7,216 km^2. Areas occupied by individuals during years they were not documented as using Prairie Creek were not included in these calculations (293 in 1983 and 283 in 1981, Table 18).

E. Density Estimation -- Procedure and Results.

Brown bear density estimates are difficult to obtain. The best approximation for the Su-Hydro study area comes from a 1979 estimate made in an adjacent study area (Miller and Ballard 1982). An attempt to derive an independent estimate in 1983 was made using a calculated estimate of the proportion of the adult population that is radio-marked. This calculated estimate derived from the frequency with which radio-marked bears were seen with other radio-marked bears or with other unmarked bears during the breeding season (Table 19). These calculations do not include bears in the downstream study area.

On radio-monitoring flights conducted on June 1-2, five radio-marked bears were observed with unmarked bears and 1 radio-marked bear was seen with another radio-marked bear. A simple-minded calculation would, correspondingly, indicate that 1/6 (17%) of adult bears were radio-marked (excluding females with cubs or yearlings that are not reproductively active). Similar calculations for the 6 June flight, the 13-14 June flight, and the 20-21 June flight (Table 19) would indicate that 0%, 13% and 33% of adults were radio-marked, respectively. The mean value for these 4 flights was 15%.

Making the assumption, based on these data, that 15% of the adult brown bears (excluding females w/litter of cubs or yearlings) were radio-marked, a population estimate based on the known numbers of marked bears can be derived. The mean number of radio-marked adults located on these 4 flights was 17 (16-18) (Table 19). The mean number of radio-marked adults actually seen on these 4 flights was 14 (13-17) (Table 19). This second number is more appropriate to use than the first because associations of bears not actually seen are unknown. Correspondingly, if 14 bears equals 15% of the adult population, this population estimate would be 93 adult bears excluding females with cubs and

females with yearlings ("non-estrus females"). Addition of non-estrus females to this estimate can be made from the following formula:

$$N=x/[(1-a)(b) + (1-b)] \text{ where:}$$

N = total number of adult bears present;

x = the number of estrus female and male adults (93 in this example);

a = an estimate of the percent of the adult female population that has cubs or yearlings (1-a, therefore is the proportion of the adult female population that is estrus);

b = an estimate of the percent of the adult population (N) that is female.

Females with cubs or yearlings are not in reproductive condition and, correspondingly, are not expected to be seen with other adults. The proportion of the female population that has cubs or yearlings ("a" in the above equation) can be estimated based on observed data in 1983 or a theoretical value can be used. In spring 1982, 2 upstream adult brown bear females had cubs (344 and 299), 1 had a yearling litter (313), and 13 had 2-year old or no offspring (394, 281, 315, 337, 388, 381, 312, 335, 396, 283, 340, 384, and 380). Females 281, 394, and 283 had cubs early in the year but lost these in May and were probably in estrus in June so these 3 bears are included in the list of 13 estrus females. Based on these observations, the value of (a) in the above equation would be 3/16 = 19%. A value of 19% would be a minimum estimate of "a" because of capture biases against females with cubs (Miller and Ballard 1982) and because of the conservative way females that lost litters were treated (the value would have been 6/16 = 38% before these litters were lost). A higher

estimate for (a) was obtained by making the, still conservative, assumption that in any one year a third of the adult females were estrus, a third had cubs and a third had yearlings. Under this assumption, 67% of the female population was composed of non-estrus females. The midpoint between these two values is 43% (Table 20).

Primarily because of hunter selectivity for males, the proportion of the adult population composed of females (b in the above equation) is greater than 50%. A minimum estimate of (b), correspondingly, would be 50%. Of all radio-collared adults, 76% were females in the first 2 years of this study (Miller and McAllister 1982:23) so this can be considered a maximum estimate of the proportion of females in the adult bear population. The midpoint between these values was 63% (Table 20).

Using these estimates in the above equation yields estimates of from 103 to 190 adult brown bears in the study population with an estimate of 128 adults obtained by using the midpoint values of (a) and (b). The composition of each of these estimates is also given in Table 20. By looking at the composition of each of these estimates it can be seen that most of the variation results in the estimated number of females with cubs or yearlings (based on "b" in the above equation). This value has a 800% change between lower and upper estimates (12 to 97). The number of males in the lower estimate of 103 bears is greater than the number in the upper estimate of 190 bears (Table 20); this is clearly unrealistic.

In order to obtain an estimate of the total bear population, the number of subadults in age classes 0, 1, 2, and 3, must be added to the above estimate of the number of adults (N). Miller and Ballard (1982; Table 1) estimated that bears aged 0-2.5 represented 79% of the population of females aged 3 or older, inclusion of 3-year old bears would make this percentage even higher. Another way to approach an estimate of the number of subadults is

to multiply the calculated number of adult females accompanied by cubs and yearlings by the mean litter size of cub and yearling litters (1.8 from Table 7), this provides an estimate of the number of cubs and yearlings in the spring population (Table 20). Assuming 50% mortality of cub and yearling age classes (see Table 9) the number of 2 and 3 year old bears would be less than 50% of the total number of cubs and yearlings in the spring, a value of 25% was arbitrarily chosen as an estimate the number of 2 and 3 year old bears (Table 20).

The range for the total spring population estimate using these values for numbers of subadults is 131-409 with an intermediate value of 212 (Table 20). It is noteworthy that the estimate for total number of adults varied only 84% between minimum and maximum estimates but that the total population estimate varied 212% between minimum and maximum estimates (Table 20). This change reflects the proportionally greater representation of females with cubs or yearlings in the maximum estimate, this greater representation is amplified when subadults are added in because the number of subadults is a direct function of the number of females with cub or yearling offspring.

Sources of error in the above estimate are numerous. The most serious sources are in the estimates of (a) and (b) used in the above equation. These estimates can be improved, however, with additional data. The initial starting point of the above calculations (the estimation of the proportion for the adult population that is radio-marked) represents another source of potentially large error. The implicit assumption behind the calculation of this value is that the probability of a radio-marked individual being seen with another radio-marked individual as opposed to a non-radio-marked individual is equivalent to the proportions of these 2 groups in the population. This assumption is correct only if marked individuals are mixed with the population of unmarked individuals in an unbiased manner. I know that this is not the case because capture efforts have been

concentrated in the vicinity of Watana Creek, correspondingly, a bear living in the vicinity of Watana Creek would have a higher probability of being seen with a marked individual than a bear living elsewhere in the study area. This bias would result in an overestimation of the proportion of the study area population that is marked and a corresponding underestimation of the size of the whole population. These calculations are included in this report in illustration of the process that could be followed in deriving a population estimate from data based on associations of marked bears during the breeding season. The only indication of the validity of the actual results obtained come from my subjective impression that they are correct within an order of magnitude.

Comparisons of these estimates with a more intensive spring density estimate of a bear/17 mi^2 (41 km^2) made in an adjacent area (Miller and Ballard 1983) are useful in evaluating the accuracy of this estimate. The area occupied by the radio-marked bears is 4,392 km^2 if just the spring point locations are used (Fig. 7), or 6,568 km^2 if the total 1983 home ranges are used (Fig. 8). Density estimates based on the above population estimates using both of the area figures are presented in Table 22. The 1979 estimate of 1/41 km^2 (Miller and Ballard 1983) corresponds pretty well with the estimates derived from using the conservative parameters in the above population estimate. This may indicate that the 1979 density estimate of 1/41 km^2 is conservative for the Susitna dam study area.

F. Brown Bear Denning Data.

Characteristics of brown bear den sites are given in Table 23. As previously reported (Miller 1983) no brown bear dens discovered to date would be inundated by the proposed Susitna impoundments (Table 23).

During the winter of 1982/83, female 380 used a den (#101) which was a natural cavity, all other dens examined have been excavated (Table 23). Den 101 was in a crack under a large boulder, it could not be determined if this den had been previously used. G380 was shot in fall 1983 so this bear could not reuse den 101 in 1983/84, her den site in 1981/82 was unknown.

No reuse of brown bear den sites has been documented in this study although many bears tend to use the same location in successive years (Table 24). A map of known brown bear den sites is given in Figure 8. Den entrance and emergence dates are given in Tables 25-28, these data are summarized in Table 29.

VIII. Results and Discussion-Black Bears

Following the May tagging effort 40 black bears were radio-collared, half of these were in the downstream study area. No cubs or yearlings were marked in 1983. Currently 27 black bears are radio-marked including 13 in the downstream study area. During 1983, 5 bears were known shot by hunters (367, 374, 410, 303, and 323), 2 bears disappeared and were suspected to have been shot (370, 372, both females with cubs), 3 bears shed transmitters (301, 318, 349), and 3 bears died (327, 379, and 365). No black bears were killed or died as a result of handling in 1983. Capture data from 1980-1983 are given in Table 2. Numbers of point location obtained are given in Table 4.

A. Sex and Age Composition of Study Animals-Black Bears.

The sex and age composition of the 14 remaining radio-marked black bears in the upstream study area (all ‘3 years of age) was 7 males (401, 346, 358, 359, 360, 324, 387), and 7 females (363, 354, 317, 289, 321, 329, 361). In the downstream area 2 adult males (408, 343) and 11 females (378, 376, 404, 405, 411, 409, 406, 402, 377, 369, 375) are radio-marked. Ages of these bear can be obtained from Table 2.

B. Population Biology and Productivity-Black Bears.

Miller (1983:68) predicted a pulse of cub production in 1983 based on the apparent berry failure in 1981. Of 19 radio-collared females, 18 (95%) could potentially have had cubs in 1983 and 14 did (70%) (Table 29). B364, missing at the end of 1982, was also listed as expecting cubs in 1983 but remained missing throughout 1983 so her status could not be verified. Three of the 4 bears that were expected to have cubs in 1983 but didn't were 5 years old in 1983 and were listed as expecting their first litters in 1983 (363, 367, 369), the fourth (378) was a 7 year old female in 1983. These data may indicate that mean age of first litter production is older than 5. One bear at

age 5 did produce a litter in 1983 (377) but lost its cubs by 19 May. One of the 5-year old females (363) that didn't produce a litter in 1983 may also have lost an unobserved litter early, the other 2 females were examined in their dens so it is certain they did not have cubs.

The predicted 1984 reproductive status of 23 radio-marked females (including 4 missing bears) is given in Table 30. Excluding the missing bears, 9 of 13 adult (≥5) females (67%) are expected to produce cubs in 1984. Identification of a pulse in cub production in 1983 based on the 1981 berry failure is not strongly supported by these data. The data, however, may be confounded by a capture bias against females with newborn cubs. If such a bias exists, and this is considered likely, then a pulse in cub production by radio-marked females would be expected in the year following initial capture of these females, independent of any environmental factor. Additional data are needed before these hypotheses can be analyzed. Because of the initiation of the downstream study in 1982 and corresponding capture of many new females, this bias could have caused a pulse in cub production by radio-marked females in 1983. It is also possible that the blueberry failure evident in the upstream area did not affect bears in the downstream study area that are buffered by salmon and salmonberries unavailable to upstream bears.

Black bears captured in the upstream study area included slightly more males than females while much the opposite was the case in the downstream study area (Table 32). This difference may reflect heavier hunting pressure in the downstream area which is accessible to riverboats out of Talkeetna and has a resident population of homesteaders. The upstream area is accessible only by plane or, in a few spots, ATVs. Comparisons of age data for these 2 populations are generally consistent with this hypothesis (Table 32). Downstream males tended to be younger than upstream males although the differences were not significant and the reverse was the case for females (Table 32). Heavier harvest in

the downstream study area is also supported by harvest rates of marked bears (Table 33), although sample sizes were small. Based on 100 marked-bears-years in the upstream area, 13% have been harvested compared to 29% in the downstream area (31 bear-years) (Table 33). Overall rate of harvest of marked bears in both areas was 14% (19% for marked males and 10% for marked females) (Table 33).

Apparent natural mortalities of radio-marked black bears are presented in Table 34. Three natural mortalities of radio-marked bears were recorded in 1983. Two of these were females with cubs, both were thought to have been killed by other bears (Table 34).

Black bear litter size is presented in Tables 35 and 36. As would be expected mean litter size is largest for the sample counted in dens (2.5), smaller when den data are excluded (2.2) and smaller yet for yearling litters (1.9). These data indicate a progressive loss of subadults from birth through separation from their mothers.

Overall, 40% of cubs were lost from litters of radio-collared females (excludes those cubs that were doubtless lost when their mothers' died). This percentage was higher in the upstream study area (54%) than in the downstream area (22%) (Table 37). This difference may reflect the marginal nature of the upstream habitat for black bears relative to the downstream habitat. This difference may also reflect the lower proportion of adult males in the more heavily hunted downstream population relative to the upstream population (Table 32); adult males may cause much of the cub mortality through intraspecific predation.

Morphometrics of black bear cubs and yearlings are given in Tables 38 and 39.

C. Black Bear Density Estimates.

1. Lincoln Index method. An attempt to census the black bear population using Lincoln Index techniques (Ricker 1975) on the ratio of marked to unmarked individuals observed during transect flights was made in spring 1983. A similar attempt in summer 1982 yielded a population estimate of 90 bears (47-172) ages 1 year old or older in the upstream area (Miller 1983:58). The spring 1983 effort was an attempt to replicate this previous effort during spring conditions when a different set of observability biases would exist.

The technique was not successful in spring 1983. In the downstream study area half of the sample units were counted, these contained 76% of available marked bears but no marked bears were seen (Table 40). Only 1 adult bear/hour of survey time was spotted. In the upstream area, 10 (of 37) sample units were counted, these contained 35% of available marked bears but only 1 marked bear was seen (Table 41). Only 1 bear/146 minutes of flight time was seen prior to aborting this unstream census effort.

The results of the summer 1982 census effort are given in Table 42 for comparison purposes.

2. Home range of females method. In Minnesota, Rogers (1977) found that female black bears tended to occupy largely exclusive home ranges. Hugie (1982) found similar results in Maine but Lindzey and Meslow (1977) found overlapping home ranges in Washington. If home ranges do not overlap, an estimate of the number of female adult bears present could be obtained by partitioning the available habitat into parcels that correspond to mean territory size and counting these.

Annual home ranges of adult female black bears radio-collared in this study revealed overlap (Figures 9-12). This overlap was especially evident in 1981 (Figure 10) when late summer berry crops failed and many bears made exceptional movements, apparently to compensate. Even in years of normal berry crops, however, female annual home ranges overlapped (Figures 9, 11 and 12).

Overlaps between female home ranges were less marked when only spring data (1 April-5 July) were included. These data for "spring" were chosen because they precede the ripening of the berries and the corresponding movements of bears to areas of berry abundance. Figures 13-15 illustrate the annual spring home ranges of radio-marked bears excluding locations at den sites. The area of these home ranges is given in Table 43a. The genetic relationship between these bears was unknown except for 329 which was the 3-year old offspring of 327 and overlapped extensively with 327 in 1983 (Figure 15). Spring home ranges defined in this manner overlapped less (Figures 13-15)than did annual home ranges but even these were clearly not exclusive (Figures 9-12).

Even though annual or spring female home ranges are demonstrably not exclusive, an estimate of the number of bears the habitat could support can be obtained by assuming that the home ranges were exclusive. Annual spring home ranges of 35 upstream female black bears (≥3 years old) averaged 10.8 km^2 (Table 43a). The amount of black bear habitat in the upstream study area can be equated with the area of the sample units delineated during the census attempt, 500 mi^2 or 1300 km^2 (Table 41). If this area were completely populated by black bear females with exclusive home ranges of 10.8 km^2 each, there would be space for 120 adult (≥3 years) females. Assuming equal sex ratios for adults there would also be 120 males present. Black bear females aged 3, 4, and 5 are not all reproductively mature, bears in these age classes constitute an estimated 30% of females ≥3 years old

leaving 80 females of reproductive age. Based on litter size data (Tables 35 and 36) each of these females would annually contribute about 1.0 cubs, and 0.8 yearlings. If there is a 50% mortality of yearlings each female would also annually contribute 0.4 two-year olds. Correspondingly, each of these 80 reproductively mature females would annually contribute about 2.2 subadults (‘3 years) to the total population or an additional 175 bears. Based on these calculations, the estimated population based on these assumptions would be about 400 bears. Based on the 500 mi^2 of black bear habitat present this would be a density of 1.3 mi^2/bear or 2.1 mi^2/adult ≥3 years. This estimate would be exaggerated by the degree to which the 500 mi^2 of habitat is incompletely occupied; to the degree that the home ranges overlap this estimate would be too low.

This result can be compared with estimates obtained in other ways. Miller and McAllister (1982:93) roughly estimated a study area population of 340 black bears based on a Lincoln Index during the tagging operation in August 1980; this represented a density of 1.6 mi^2/bear. The summer 1982 Lincoln Index attempt yielded a corrected Lincoln Index and estimate of 126 bears (Miller 1983:59). My guess on the 1980 bear population in the study area was 150-200 bears (Miller 1982:59).

My subjective impression of this new estimate is that it is too high. Part of the reason for this may be that all of the 500 mi^2 is not good spring habitat. Another possible reason for an overestimate is that the current population is suboptimal, below what the habitat could support. Miller (1983:58) noted that bear population appeared to have declined in the study area since the project started, this impression has been strengthened with the addition of 1983 studies.

Possibly this decline resulted from the poor 1981 berry crop. Regardless of where this population may be at the moment, an estimate of 400 black bears is a reasonable approximation of the number of black bears the habitat in the upstream study area could potentially support.

D. Berry Abundance.

Four transects designed to document changes in berry abundance between years were established in 1982 (Miller 1983). This procedure was replicated in 1983 although the exact same plots were not read, the plots read in 1983 were in the same general area, within 100 feet, of those read in 1982. The results for both years are given in Table 47. As mentioned by Miller (1983), insufficient manpower was available to sample enough plots to provide good documentation of true variability in berry abundance. Our samples were adequate, however, to provide some support for our subject interpretations of berry abundance (Table 48).

E. Food Habits.

Analyses of 42 bear scats collected in 1983 are presented in Table 49. Analyses of 33 scats collected previously were presented by Miller (1983, Table 11, page 45). As reported by Miller (1983) the predominant food in the scats collected on the shores of sloughs where salmon were spawning in the downstream study area were berries of Devil's club (*Oplopanax horridus*). Fish were even rarer in the 1983 scats (Table 49) than in the 1982 scats (Miller 1983) collected along the salmon-spawning sloughs. The difference in 1983 probably reflected the decreased availability of salmon in 1983 because 1983 had the expected low, odd year, run of pink salmon (*Oncorhynchus gorbuscha*), and very high water in the Susitna during much of the spawning period (Tables 50 and 51). Regardless, of the absence of abundant pink salmon in the spawning sloughs, many radio-collared black bears

moved to the vicinity of these sloughs during late summer 1983 as they did in 1982 (Table 51). These results support our tentative conclusions that these movements are more motivated by the prevalence of devils club berries in the riparian habitats along the sloughs than by the presence of spawning salmon.

Updated records on frequency of Susitna River crossings by radio-marked black bears are given in Table 52.

Efforts to devise a technique using thin layer chromotography on bile acids to separate black bear feces from brown bear scats were unsuccessful. Results of this study are reported in Appendix 1.

F. Black Bear Den and Denning Characteristics

Characteristics of black bear dens observed during winters of 1980/81 through 1983/84 are given in Table 53. The known history of use of individual dens is presented in Table 54. In March and April 1983, 13 dens previously used by radio-marked black bears were inspected. Eight of these were vacant, 3 (numbers 10, 9, and 7) were occupied by radio-marked bears, one (#19) was occupied by an unmarked bear, and one was collapsed. Seven of the vacant dens revisited were dug dens, the other (#19) was a natural cavity. History of den use by individual marked black bears is given in Table 55.

Twenty-six dens used at least once by a radio-collared black bear have been found in the vicinity of the Watana Impoundment, 15 (58%) of these will be inundated by the impoundment. By comparison only 1 of the 21 dens found in the vicinity of the Devils Canyon impoundment will be inundated by the proposed impoundment (Table 54).

Den entrance and emergence dates for radio-marked black bears are given in Tables 56 and 57 for 1982/83 and 1983/84 respectively. Data for previous years was given in Miller (1983).

Locations of black bear den sites are given in Figure 16 for the upstream study area and in Figure 17 for the downstream study area.

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APPENDIX I

DIFFERENTIATION OF BROWN BEAR AND BLACK BEAR SCATS:

AN EVALUATION OF BILE ACID DETECTION BY THIN LAYER CHROMATOGRAPHY

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DIFFERENTIATION OF BROWN BEAR AND BLACK BEAR SCATS:

AN EVALUATION OF BILE ACID DETECTION BY THIN LAYER CHROMATOGRAPHY

SUMMARY

A thin-layer chromatographic technique 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 21 known black bears and 20 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 was 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.

INTRODUCTION

Identifications of scat samples is an integral aspect of food habit studies, and particularly so when the studies involve similar and sympatric species. Identification of scat samples presents a major problem when the species under study are as similar as brown bears (*Ursus arctos*) and black bears (*Ursus americanus*). All too frequently, scats from one are impossible to visually differentiate from the other. This problem, as it relates to the work being done in the Susitna Hydroelectric Project Big Game Studies, was what prompted the study reported here.

Studies of bear movements (Miller, 1982; Miller, 1983) in the vicinity of proposed impoundments of the Susitna Hydroelectric (Su-Hydro) Project indicate that black bears spend the majority of the year in areas that will be flooded. Potential impacts on brown bears are less clear. While the brown bear population spends most of its time outside the impoundment areas, there seems to be a directed movement, by males and females without newborn cubs, toward the impoundment impact area in early spring. It was hypothesized that availability of over-wintered berries and emergent vegetation on south-facing slopes, as well as the presence of winter-killed or weakened ungulates may be the motivation for this brown bear movement (Miller, 1982), and that these foods might be more available in areas that would be inundated than those that would remain unflooded. Investigators sought to test this hypothesis by determining what foods are being utilized by brown bears through scat analysis, then assessing the availability of the same foods in other alternative areas that would not be inundated.

A key to this approach was the ability to differentiate brown bear scat samples from those of black bears. Since visual examination of the scats is not feasible for reliable identification, some other method was needed. Major et al. (1980) reported that just such a method had been developed. It was an analytic method using a technique known as Thin Layer Chromatography (TLC) to differentiate substances known to occur in vertebrate feces called bile acids.

Bile acids are large molecular weight acids, related to steroids, which are necessary for the intestinal digestion and absorption of dietary fat (Casdorph, 1976). Bile acids are produced in the liver and in the intestines, are stored in the bile, are generally distributed where needed by means of the enterohepatic circulation, and are found in small amounts in the digestive tract (Nes and McKean, 1977; Casdorph, 1976; Carey, 1982). According to Nes and McKean (1977), "there are about two dozen

natural representatives of bile acids, differing in the number and position of the nuclear hydroxyl groups and in the extent of oxidation and degradation of the side chain. Certain bile acids are unique to a few families and suborders, e.g., α and β-muricholic acid in the Murinae, phocaecolic acid in the Pinnipedia, and hyocholic acid in the Suidae." Conjugates of bile acids, known as bile salts, also occur in the digestive tracts of vertebrates, and in mammals, certain groups tend to predominate, with omnivores (including Ursidae) having a mixture of all the bile salt groups present in more limited degrees and kinds in herbivores and carnivores (Nes and McKean, 1977). The presence of these bile salts is additionally complicated by extensive microbial catabolism within the digestive tract, producing a potentially vast array of fecal acidic steroids (M. C. Carey, M.D., Harvard Medical School; Brigham and Women's Hospital, Gastroenterology Division, 75 Francis Street, Boston, Mass. 02115; 1983. Personal Communication).

Exactly which fecal bile acids are produced in bears is unknown, although there is speculation that like man, bears produce only two primary bile acids: cholic acid and chenodeoxycholic acid (Carey, 1983, pers. comm.). Primary bile acids are those formed from cholesterol in the liver. Intestinal bacteria form secondary bile acids from primary bile acids (such as deoxycholic from cholic and lithocholic from chenodeoxycholic acid in man). Tertiary bile acids are formed both in the liver and by intestinal bacteria from secondary bile acids and are comprised of their glycine and taurine conjugates (Carey, 1982).

Thin layer chromatography (TLC) is a fairly sensitive analytic technique involving the phenomenon of partition, the equilibration of a substance between two phases that are not mutually miscible. TLC utilizes a system in which a liquid is allowed to move by surface tension through and along a thin layer of solid (Nes and McKean, 1977). This widely used technique has been applied by several researchers to investigate the bile acids

present in the feces of a number of different mammals (Roscoe and Fahrenbach, 1963; Johnson, et al., 1979; Major, et al., 1980; Goodwin and Miller, 1983; Welsh and Picton, 1983). There are some limitations inherent within the technique itself, however, that must be considered when evaluating results obtained from its use. Reproducibility is so difficult to achieve with this technique that it is often used as a qualitative method only. Use of internal standards may alter this aspect of it, but by and large, results obtained in one laboratory are difficult to achieve in another. Factors affecting reproducibility include thickness of the layer of sorbent on the TLC plate, moisture content of the sorbent, chamber saturation, temperature, depth of developing phase, nature of the sorbent, pH of the sorbent, pH of the developing phase, sample size, solvent parameters, and relative humidity, to name a few. Some of these factors may be controlled (such as sorbent thickness, sample size, pH of developing phase), others may not (chamber saturation, relative humidity, temperature).

Extraneous problems, more related to the sample itself, may also affect reproducibility. In our case, samples containing plant pigments of one sort or another exerted a "masking" effect, and in some cases so much so that results were initially rendered useless.

METHODS

SAMPLES AND TREATMENTS

Fecal samples from 22 known black bears (BLB) and from 21 known brown bears (BRB) were used in this study. Table 1 lists the number and types of samples used. Brown bear scat samples were obtained from Su-Hydro research animals or their dens, as well as from the McNeil River viewing area. Black bear scat samples came from study bears in the Kenai Moose Research Center area, from Su-Hydro study bears, from hunters in Game Management Unit 14A,

and from research bears in the Fairbanks area. Bile samples from 4 BLB and 3 BRB were also obtained for use in this study.

Fecal samples were oven dried (50°C), pulverized by hand using a mortar and pestle, and extracted by allowing 1.0 g to soak for 24 hrs. in 17 ml of 1:1 benzene-methanol. The supernatant was decanted, filtered through coarse filter paper, and evaporated. The concentrated residue was redissolved in 0.5 ml 1:1 benzene-methanol and spotted on activated (oven-dried, 120°C for 1 hr) glass TLC plates, using micropipettes. Sample sizes varied from 5-60µl, depending upon pigment content and initial loading characteristics. Appendix I lists equipment and chemicals used in this study.

Bile samples were stored frozen after removal by syringe from gall bladders. 1.0 ml of the thawed liquid bile was diluted in 17 ml 1:1 benzene-methanol, allowed to stand at room temperature for 24 hrs, filtered, and evaporated as described above. Bile samples were redissolved in 0.5 ml benzene-methanol and applied to TLC plates in the same manner as the other samples. Two of the BLB bile samples were also applied without any treatment with solvents to provide a controlled comparison.

Standards used were: cholesterol, chenodeoxycholic acid, cholic acid, lithocholic acid, deoxycholic acid, cholic acid methyl ester, and dehydrocholic acid. Pure standard solutions were prepared by dissolving 0.5 mg per ml in 1:1 benzene-methanol and spotting onto TLC plates. A mixed standard solution was prepared by dissolving 5 mg of each standard in 10 ml 1:1 benzene-methanol, then combining the resultant 10 ml aliquots.

Pigmentation of extracted fecal samples presented a major obstacle in obtaining chromatograms with clarity and spot resolution. Major et al. (1980) used activated charcoal as a solution to the pigment problem, as did Roscoe (1963). Johnson et al., (1979) however, in applying Major's method to bobcat scats, found that

TABLE I. SAMPLES USED IN BILE ACID CHROMATOGRAPHY DETERMINATIONS

SPECIES	IDENTIFICATION	SAMPLE TYPE	COMMENTS
BRB	240	FECAL	PLANT FIBERS
BRB	242	FECAL	
BRB	244	FECAL	PLANT FIBERS
BRB	245	FECAL	HAIR, PLANT FIBERS, FEATHERS
		BILE	
BRB	249	FECAL	PLANT FIBERS
BRB	259	FECAL	PLANT FIBERS-LICHEN
BRB	264	FECAL	
BRB	273	FECAL	BONE, PLANT FIBERS, TOOTH FRAGMENTS
BRB	308A	FECAL-from den	LARGE QUANTITIES OF HAIR
		FECAL-at death	
BRB	TIDAL 1 McNeil R.	FECAL	GRASSES-SEDGE
BRB	TIDAL 2 McNeil R.	FECAL	GRASSES-SEDGE
BRB	TIDAL 3 McNeil R.	FECAL	GRASSES-SEDGE, MINERAL SOIL
BRB	TIDAL 4 McNeil R.	FECAL	GRASSES-SEDGE
BRB	TIDAL 5 McNeil R.	FECAL	GRASSES-SEDGE
BRB	TIDAL 6 McNeil R.	FECAL	GRASSES-SEDGE
BRB	TIDAL 7 McNeil R.	FECAL	GRASSES-SEDGE, SAND
BRB	ALPINE 1 McNeil R.	FECAL	GRASSES-SEDGE
BRB	ALPINE 1 McNeil R.	FECAL	GRASSES-SEDGE
BRB	ALPINE 3 McNeil R.	FECAL	
BRB	KODIAK WB	BILE	
BRB	KODIAK SM	BILE	
BLB	303	FECAL	BERRIES
BLB	321	FECAL	A) HAIR, SOME GRASSES
			B) PRIMARILY PLANT FIBERS
BLB	327	FECAL-from den	BERRIES
BLB	328	FECAL	BERRIES
BLB	366	FECAL	
		BILE	
BLB	367	FECAL-from den	HAIR, PLANT FIBERS
BLB	378	FECAL-from den	PLANT FIBERS, WOODY PLANT STEMS
BLB	NS	FECAL	
		BILE	
BLB	14A, BT	BILE	
BLB	14A, HG	BILE	
BLB	FBKS 1	FECAL	WOODY PLANT STEMS
BLB	FBKS 2	FECAL	HAIR, BERRIES
BLB	MRC 6-16-79	FECAL	
BLB	MRC 6-17-79	FECAL	
BLB	MRC 6-20-79	FECAL	PLANT FIBERS
BLB	MRC 6-25-79	FECAL	
BLB	MRC 6-26-79	FECAL	
BLB	MRC 6-5-80 #1	FECAL	
BLB	MRC 6-5-80 #3	FECAL	
BLB	MRC 6-6-80	FECAL	HAIR, FEATHERS
BLB	MRC 6-10-80	FECAL	
BLB	MRC 6-16-80	FECAL	
BLB	MRC 6-27-80	FECAL	
BLB	MRC 9-14-80	FECAL	

bile acids were removed when activated charcoal was used. Our preliminary trials resulted in similar findings, with the added feature of artifacts on the chromatogram when charcoal had been used in the extraction process.

Two major types of bear fecal samples present the greatest pigmentation problem: (1) those containing primarily plant fiber such as grasses and sedges, and (2) those containing berries. Four of the BRB samples containing up to 100% plant matter were subjected to four different treatments to test for pigment removal. Dried and pulverized aliquots were (a) allowed to soak in 125 ml hexane for 24 hrs, removed by vacuum filtration from the solvent, and air dried; (b) allowed to soak in 125 ml chloroform for 24 hrs, removed by vacuum filtration from the solvent before air drying; (c) washed over a vacuum with 125 ml hexane and air dried or (d) washed over a vacuum with 125 ml cholorform and air dried. All samples were then extracted and spotted on TLC plates as described above.

Two BLB sample aliquots having an extremely high berry content were soaked in 25 ml pH 8 distilled H_2O (pH adjusted with 1.0 N NaOH) for 2 hrs, then washed over a vacuum with 2 L pH8 H_2O. Samples were air dried overnight and extracted in the same fashion as described above.

Removal of pigments from berry-laden fecal samples by soaking followed by washing with slightly basic pH water produced satisfactory results. While some residual "streaking" of pigmented material up the plate still occurred, the density of the pigmentation was diminished enough to allow individual spots and visibly different color reactions to be seen under 366 nm light.

Of the two solvents tested for removal of plant pigments other than berries, hexane was deemed the more desirable. Both soaking in hexane and washing in hexane removed large amounts of the typical red-orange fluorescing pigment found in the plant-laden

feces. Chloroform soaking also removed significant amounts of pigment, but seemed to remove bile acids as well. Hexane did not do so to such an extent as the chloroform. Of the two treatments (soaking or washing) with hexane, soaking seemed to remove the most amount of interfering pigment, although with hexane as the solvent, either treatment produced acceptable results. In the case of chloroform as a pigment-removing solvent, simply washing the fecal samples over a vacuum did not remove enough pigment to allow satisfactory differentiation of TLC spots or colors under U.V.

TLC plates containing samples were allowed to develop in equilibrated paper lined tanks containing Petcoff's solution:hexane, methylethyl ketone, acetic acid 56:36:8 (V/V) (Chavez, 1976). After drying, the plates were visualized using a fresh solution of acetic acid:sulphuric acid: ρ-anisaldehyde, 50:1:0.5 (V/V) and placed in a 120° C oven for up to 5 minutes (Kritchevsky et al., 1963). Spraying the plates with the visualizing solution provided inconsistent and unsatisfactory results. It was found that dipping the plates in the fresh visualizing solution produced much higher quality chromatograms and uniformity of background. Colored spots appear against a tan-to-pink background.

After drying, plates were examined under room light and 366 nm U.V. light. Plates were photographed within 15 minutes of removal from visualizing solution to provide a permanent color record of the plates, as they tend to fade rapidly as well as undergo color changes with the passage of time. All photographs were taken using a 35 mm SLR camera fitted with a 50mm Macrolens, and using a Wratten Gel Filter 2a mounted on a filter holder in front of the lens. Photographs were taken at 30-, 60-, and 90-second exposures at F4, using 366 nm ultraviolet light onto Kodak Ektachrome ER 135 ASA 64 film (Jackson, 1965). Rf values were calculated by measuring the distance from the origin to the center of a given spot, then dividing this by the distance from the origin to the solvent front.

RESULTS AND CONCLUSIONS

Probably the most important aspect to be taken into consideration in the assessment of our results is that of sample size. As stated previously, we used fecal samples from 21 known BLB and 20 known BRB. This is in extreme contrast to the number of samples tested by Welsh and Picton (1983) who used 2 known BLB and 2 known BRB fecal samples, along with 2 unknowns, and with our own earlier work (Goodwin and Miller, 1983) which utilized only 2 BRB and 3 BLB samples. Because of the larger number of known samples, we were able to look more intensively at variations between individuals as well as at the potential differences between *Ursus arctos* and *Ursus americanus*.

Visual examination of the fluorescing scat chromatograms, focusing on proximal Rf's and similarity of color hues, revealed no consistent differences between scats of black bears and scats of brown bears. Inevitably, a few individuals would exhibit presence or absence of colored spots seemingly missing or present in a majority of samples from the same species. Eventually it became apparent that a statistical analysis of all Rf's obtained from all the scats analyzed would be the only reliable and comprehensible way to evaluate the potential differences between the bile acid production of the two species of bears. To this end, a chi square test was applied. The null hypothesis that there was no significant difference between the scats of brown bear and black bear could not be rejected ($p=0.5125$). Figures 1A and 1B are schematic representations of the Rf values obtained on chromatograms of four typical BRB and four BLB, respectively. Rf values from standards mixtures are shown as well. The fact of variability among individuals within a species is readily apparent from these figures.

Figure 2 is a schematic representation of Rf values obtained from fecal samples which illustrate another, perhaps even more important, source of variability in bile acid production: that which

occurs within a given individual. The single fecal sample obtained from BRB 321 was composed of two adjoining but quite distinctly different types of material. The scat was separated into two parts on the basis of this difference and chromatograms were run on each part. BRB 321A is the chromatogram obtained from that portion of the scat which contained some hair, a large proportion of unidentifiable amorphous material (presumably of animal origin given the presence of the hair), and a small amount of undigested plant fibers. BRB 321B is the chromatogram from that portion of the scat containing primarily plant fibers. The schematics of the chromatograms show distinct differences in Rf values. The chromatograms themselves showed these differences as well, notably in the numbers of spots detectable and the colors displayed under ultraviolet light. BRB 321A showed 4 more spots and more varied color reactions than did 321B, with spots fluorescing lavender, bright blue, and blue green, for instance, under the U.V. BRB 321B exhibited mostly red-orange hues along the entire chromatogram, a characteristic typical of fecal samples containing high percentages of plant fiber.

Figure 2 also shows the schematic of Rf values obtained from fecal samples removed from the den of BRB 308B (taken on 5-28-81) and later from this same bear at its death as a capture mortality (8-6-81). While these two fecal samples are more similar than those of BRB 321, there remains a distinct chromatographic difference, a verification of the variability possible within a given individual with respect to production of bile acids and related steroids. Color differences seen on the chromatograms under ultraviolet light accentuated this variation. The den sample showed a large spot at Rf=0.38 which fluoresced a bright robin's egg blue. The death sample showed a smaller, fainter spot at Rf=0.37 which fluoresced pale lavender. This same sample showed a brown spot at Rf=0.010 which was not present in the den sample, while the den sample had two pale blue spots (Rf=0.19 and 0.26) which were not visible in the other sample.

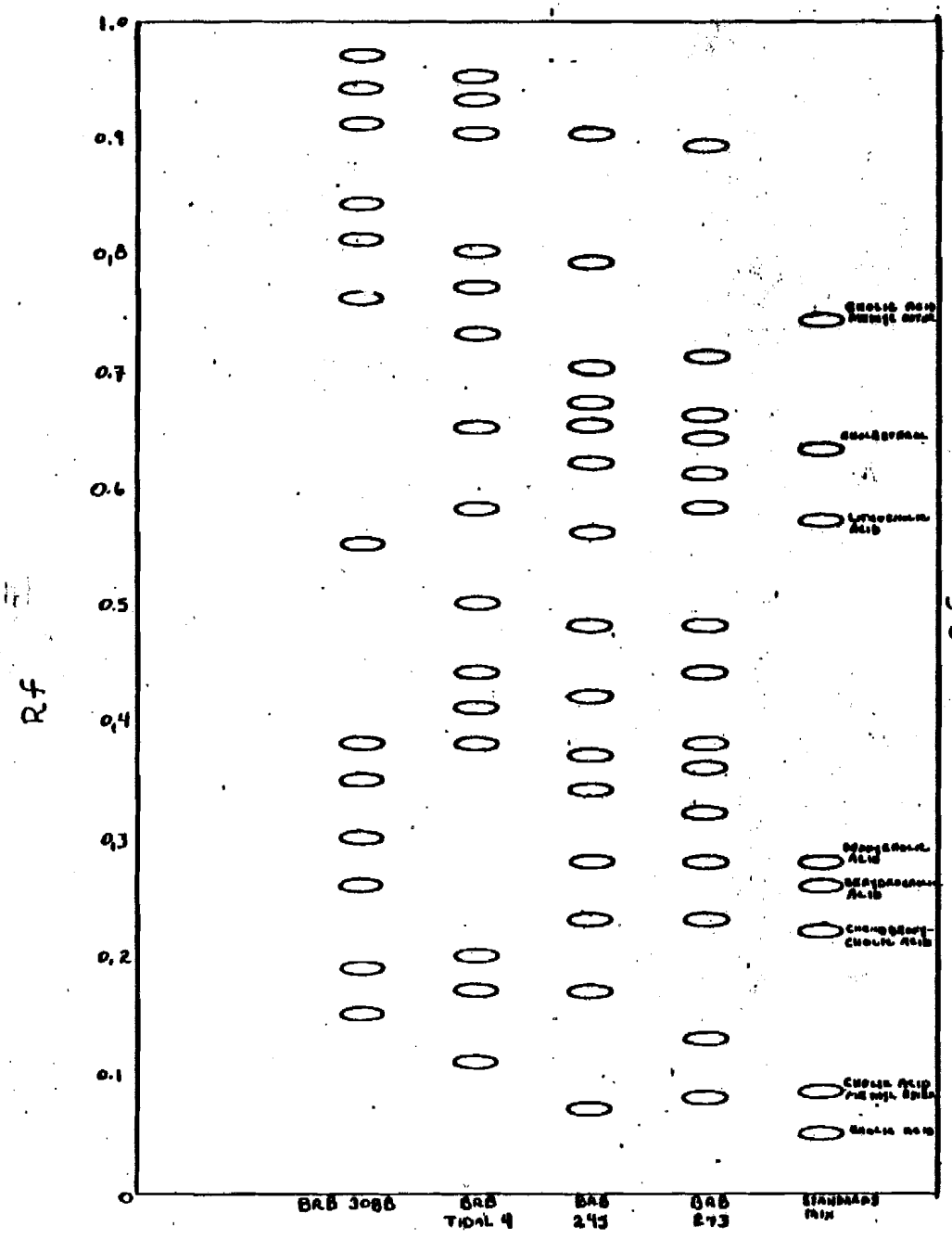

FIGURE 1A. Schematic of Rf values of four typical brown bear fecal samples and standards mixture.

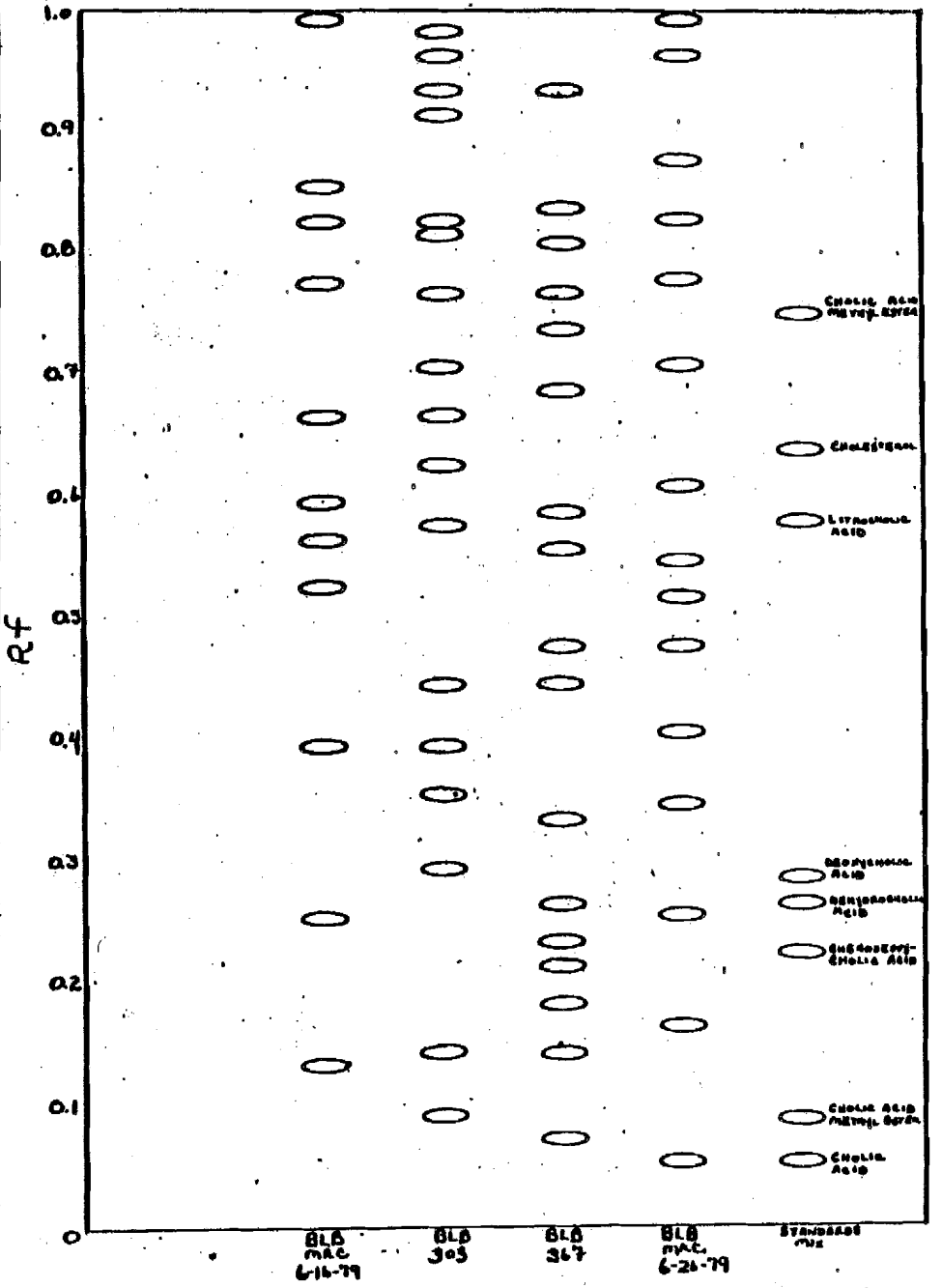

FIGURE 1B. Schematic of Rf values of four typical black bear fecal samples and standards mixture.

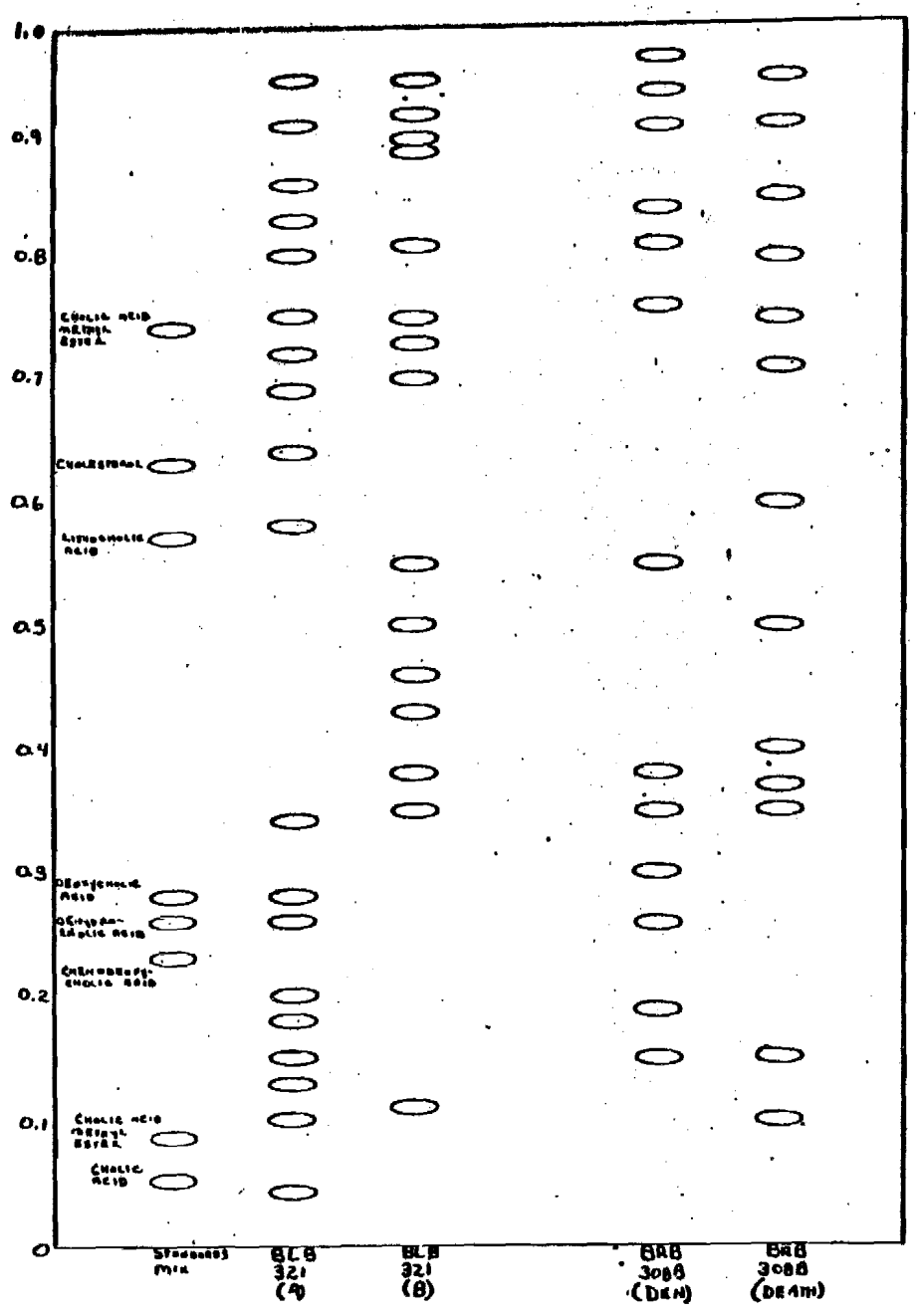

FIGURE 2. Schematic of Rf values of fecal samples from two individual bears. BLB 321A and BLB 321B represent two distinct protions of one scat. Portion (A) contains hair, amorphous matter, and small amounts of plant fiber. Portion (B) contains primarily plant fibers.

BRB 308B(DEN) was taken from scats removed from this Su-Hydro research bear's den. BRB 308B (DEATH) was a fecal sample removed from the bear's carcass at the time of its death as a capture mortality.

The variation in fecal bile acids among individuals within a species, as well as the variation over time within an individual, is not surprising. The large number of fecal acidic steroids produced by microbial catabolism within the digestive tract would suggest just such a phenomenon in both cases. However, several other factors also affect the production of fecal bile acids. These factors have been investigated only to a limited extent even in man, so any conclusions are necessarily speculative, particularly when extrapolated to the even greater unknown regions of Ursine functions. The trends, however, are worth noting, and must be taken into consideration in evaluating bile acid production.

Age and weight, not surprisingly, seem to affect production of fecal bile acids (Miettenen, T.A., 1973) with increasing body weight correlating positively with an increase in fecal bile acids, and age correlating negatively. The third factor, and possibly the most significant from our standpoint, is that of diet. The amount and kind of fiber (nutritive or non-nutritive) and the amount and kind of fats and related plant sterols present in the diet can increase or decrease, through various mechanisms, the production of fecal bile acids (Nes and McKean, 1977; Nair and Kritchevsky, 1976; Grundy, 1976). It would seem unlikely, then, that the identification of closely related species based on quantification of fecal bile acids would be feasible, particularly in omnivores such as the two under study here. Scat analysis of both brown and black bears has demonstrated the presence of plant matter, including up to twelve different species of berries, a variety of grasses, sedges, lichens, *Equisetum* spp, and animal matter including moose, hare and ground squirrel, fish, birds, and insects (Miller, 1983; Miller, 1984.). A predominance of one or another in the diet would be expected to produce differing amounts of fecal bile acids, these amounts fluctuating over time in response to the correspondent dietary content changes.

Chromatograms obtained from bile samples were "cleaner" in terms of numbers of compounds exhibited, and in terms of apparent differences between species, although our sample size (3 BRB and 4 BLB) was too small to provide any significant information. Figure 3 shows Rf values, schematically represented, of the bile samples, along with those of the standards mixture. The relative "purity" of the bile samples is to be expected: only a few bile acids (and related steroids) are produced in the liver, compared to the large number of possible conjugates produced by the bacterial intermediaries of the gut (Carey, 1983. Pers. comm.).

Tentative identification of bile acids in the bile samples were made, based on comparisons of a combination of proximal Rf values and color reactions under 366 nm ultraviolet light with those known bile acids and steroids in the standards mixture. It must be kept in mind that these are in no way definite identifications; rather, they are highly subjective evaluations which may or as well may not hold up to more rigorous chemical identification procedures.

A blue-green spot, similar in hue to that shown by the cholesterol standard, and at a proximal Rf (Cholesterol=0.63), appeared in all three brown bear bile chromatograms (Rf's=0.63, 0.63, and 0.64). One BLB sample showed a spot at Rf=0.65, but it fluoresced a pale orange, and most likely is not the same material as those in the BRB samples.

Other differences between the bile samples remain less clear. However, it does seem that compounds having Rf between 0.37 and 0.64 seem to be singularly lacking in BLB bile samples, while that space on a BRB chromatogram is amply filled. Of the 4 BLB biles examined, none showed spots having these Rf's, and only two were at the edge (i.e., RF=0.36 and 0.65), while the 3 BRB biles displayed a total of 9 spots in this range. Similarly, BRB bile did not seem to have spots occurring above Rf=0.71 (with one exception at 0.88 in one sample), while within the 4 BLB biles, 7

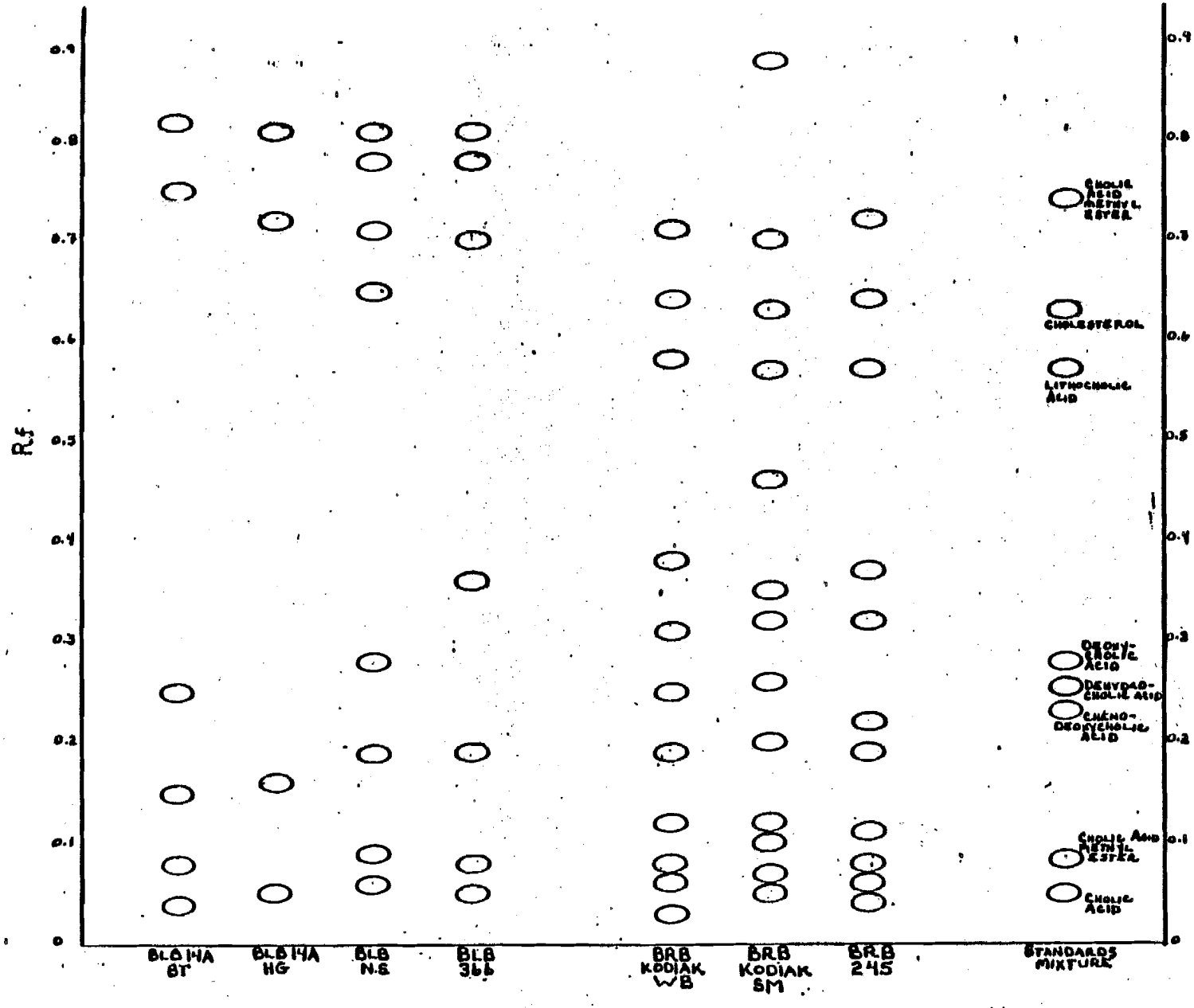

FIGURE 3. Schematic of Rf values of bile samples and standards mixture.

spots occur above the 0.71 designation. In general, the BRB biles showed twice as many spots on the chromatograms as did the BLB biles (BRB average=12 spots, n=3; BLB average=6 spots, n=4). Again, we did not presume to make absolute statements about the identity of steroids showing up on the bile TLC plates, noting only similarities and apparent trends.

It is unfortunate, but not surprising, that TLC analysis of the bear fecal samples did not provide such nice differences as did the bile samples. While we cannot unequivocally state that no significant differences exist between the fecal bile acid profiles of brown bears and black bears, we do feel that this particular method of analysis, subject as it is to the artifacts and vagaries of technique and the masking effects of diet coupled with individual variation, does not provide a reliable means of differentiating *Ursus arctos* from *Ursus americanus*. It is entirely possible that other solvent systems, or modifications of the chromatographic principle (two-dimensional TLC; serial elution; gas chromatography, etc.) may be applied in a more successful fashion. Certainly the specific effects of diet on the fecal bile acid profile of bears warrant further investigations, as does the problem we initially attempted to solve.

ACKNOWLEDGEMENTS

Appreciation is expressed to Jonathan Lewis of Alaska Department of Fish and Game (ADF&G) for his excellent laboratory assistance; to Dennis McAllister, Larry Aumiller and Dr. Charles Schwartz (all of ADF&G) for provision of samples; and to Dr. Sterling D. Miller (ADF&G) for his suggestions and support. This study was supported in part by funds from the Alaska Power Authority.

APPENDIX I. A: MANUFACTURERS OF SUPPLIES USED IN TLC STUDY

MCB MANUFACTURING CHEMISTS, INC.
P.O. Box 7203
2121 South Leo Avenue
Los Angeles, CA 90022

J. T. BAKER CHEMICAL COMPANY
Phillipsburg, N.J. 08865

SIGMA CHEMICAL COMPANY
P.O. Box 14508
St. Louis, MO 63178

SUPELCO, INC.
Supelco Park
Bellefonte, PA 16823

SCIENTIFIC MANUFACTURING INDUSTRIES (SMI)
Emeryville, CA 94608

OSTER CORPORATION
Milwaukee, Wisconsin

WHATMAN LTD.
London, England

VWR SCIENTIFIC, INC.
P.O. Box 3551
Seattle, WA 98124

W. A. HAMMOND DRIERITE COMPANY
Xenia, Ohio

APPENDIX I. A: (CONTINUED)

ULTRA-VIOLET PRODUCTS, INC.
San Gabriel, California

EASTMAN KODAK COMPANY
Rochester, N.Y. 14650

PENTAX CORPORATION
9 Inverness Drive East
Englewood, CO 80112

E. M. SCIENCE
2909 Highland Ave.
Cincinnati, Ohio 45212

APPENDIX I. B: SUPPLIES AND SPECIFICATIONS USED IN TLC STUDY

ITEM	SPECIFICATIONS	MANUFACTURER*
		*See Appendix IA
CHOLESTEROL	1) Sigma CH-S; Chromatography standard; Grade 99+%	SIGMA
	2) Supelco #4-5000	SUPELCO
CHENODEOXYCHOLIC ACID	Supelco #4-6507; 98% & 99%	SUPELCO
CHOLIC ACID	1) Sigma C-1129; from bile; 99-100%; 3-7-12-trihydro cholanic acid; cholalic acid.	SIGMA
	2) Supelco #4-6500	SUPELCO
LITHOCHOLIC ACID	1) Sigma α-6250; 5β-cholinic acid-3α-01; 3α-hydroxy-5β-cholanic acid.	SIGMA
	2) Supelco #4-6515	SUPELCO
DEOXYCHOLIC ACID	1) Sigma D-2510; Grade II; 7-deoxycholic acid.	SIGMA
	2) Supelco #4-6504	SUPELCO
CHOLIC ACID METHYL ESTER	Methyl cholate; Sigma C-3508	SIGMA
DEHYDROCHOLIC ACID	Sigma #D-3750	SIGMA

APPENDIX I. B: (CONTINUED)

ITEM	SPECIFICATIONS	MANUFACTURER*
GLACIAL ACETIC ACID	1) Reagent Grade, A.C.S. #AX73-14	MCB
	2) HPLC reagent; JT 9515-3	J. T. BAKER
BENZENE	1) Glass distilled, Omnisolv; BX212	MCB
	2) HPLC reagent; JT 9149-3	J. T. BAKER
2-BUTANONE	Methylethyl Ketone; Omnisolv; BX1673	MCB
HEXANE	HPLC reagent; Non-UV; Omnisolv; HX298	MCB
METHANOL	1) Omnisolv; MX488	MCB
	2) HPLC reagent; JT 9093-3	J. T. BAKER
p-ANISALDEHYDE	AX1525 2239	MCB
SULFURIC ACID	96.1%; JT 9681-3	J. T. BAKER
CHLOROFORM	Reagent grade; Jt 9180-3	J. T. BAKER
DESSICATOR STORAGE CABINET	Lucite; 8"x9"x10"	SMI
SAMPLE SPOTTING AND QUANTITATING TEMPLATE	Lucite; 20xmx20cm	SMI

APPENDIX I. B: (CONTINUED)

ITEM	SPECIFICATIONS	MANUFACTURER*
OSTER AIRJET DRYER	Model 202; 120v,460W	OSTER
DEVELOPMENT TANK LINERS	0.3mm Chromatography paper, Medium flow rate; 47x 75 cm.	WHATMAN
FILTER PAPERS	Grade 613; Coarse	VWR
DESSICATOR	Anhydrous indicating $CaSO_4$	DRIERITE
MICROPIPETTE	1.0, 2.0, 5.0, and 10.0µl; disposable tips	SUPELCO
ULTRAVIOLET LAMP	1) Blak-Ray Lamp; Model UVL-21; Long-wave 366nm; 115v, 0.16 amps.	ULTRA-VIOLET PRODUCTS
	2) Mineralight Lamp; Model UVSL-25; Multi-band Uv-254/ 366nm; 115v,0.16 amps.	ULTRA-VIOLET PRODUCTS
CAMERA	35mm; Pentax Spotmatic; Single Lens Reflex	PENTAX
MACROLENS	50mm; F4; Takumar	ASAHI/PENTAX
GEL FILTER	Wratten 2A; 75x75mm	EASTMAN KODAK
GLASS DEVELOPING TANKS	approx. 7x26x28 cm; glass lids	VWR

APPENDIX I. B: (CONTINUED)

ITEM	SPECIFICATIONS	MANUFACTURER*
TLC PLATES	Precoated glass; Silica Gel 60nm pore diameter; 0.25mm layer; fluorescence indicator; 20 x 20 cm.	E. M REAGENTS

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Table 1. Brown bears captured in Susitna Dam Studies as of Jan., 1984

Tattoo	Capture Sex	Age	Wt.	Date	Frequency	Serial #	Ear Tags	Comments
(277)	F	10.5	225*	4/10/80	(148.004)		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	(150.368)		1100/1099	collar shed by 6/12/80, recaptured 5/18/83
280	M	5.5	300*	4/20/80	149.508		1097/1098	recollar next spring
(214)	M	4.5	300*	4/22/80	(151.512)		1072/1071	collar shed 9/9/80
281	F	3.5	250*	4/22/80	152.840		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	148.950		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	150.041/.103		1116/1115	
(294)	M	10.5	607	5/2/80	150.142./.092		-- --	died on 8/6/81 recapture
(295)	M	12.5	589	5/3/80	(150.061/.102)		1303/1304	collar shed by 5/4/80
299	F	13.5	285	5/4/80	150.041/.112		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	(152.830)		(1126/1125)	shot 9/83
(308B)	F	5.5	240	5/6/80	153.810		1096/1095	turgid(?) - died on 8/6/81 recapture
(309)	M	12.5	600	5/6/80	(150.650)		1117/1118	collar shed by 5/14/80
312	F	10.5	319	5/7/80	152.860		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	152.820		1119/1120	w/314 @2.5
314	F	2.5	154	5/7/80	--		1049/1050	w/313
315	F	2.5	90*	5/7/80	--		1127/1128	alone, recaptured 5/18/83
(284#)	M	3.5	125	5/5/81	(152.603)		1074/1073	near 283 w/2c, shot by hunter on 5/18/81
(331)	F	6.5	172	5/5/81	(152.780)		(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	152.760		1292/1291	estrus, missing in 1982 w/2c
335	F	3.5	194	5/5/81	152.560		1220/1219	recaptured 5/14/83, age changed + 1 '83 tooth
281#	F	4.5	--	5/6/81	152.583		1201/1202	estrus? recaptured 5/15/83
283#	F	13.5	261	5/6/81	152.543		1089/1090	w/338 and 339, recaptured 5/14/83
338	M	0.5	12	5/6/81	--		1224/1223	w/283 and 339, not drugged
339	F	0.5	13	5/6/81	--		1222/1221	w/283 and 338, not drugged
312#	F	11.5	280	5/6/81	152.740		1300/1299	w/2c @0.5 (not captured), recaptured 5/14/83
313#	F	10.5	284	5/6/81	152.790		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	152.493		1294/1293	w/3c reunited on 5/9/81, recaptured 5/14/83
340	F	3.5	190	5/6/81	152.770		1225/1218	not estrus, recaptured 5/15/83
280#	M	6.5	394	5/7/81	152.710		1097/1267	w/F 341, recaptured 5/16/83
341	F	6.5	224	5/7/81	152.750		1208/1207	w/M 280
299#	F	14.5	291	5/7/81	152.513		1109/1110	w/2 @2.5 (297 and 298 - not recaptured), not estrus, recaptured 8/6/81
342A	M	2.5	220	5/7/81	152.661		1228/1227	alone, see 5/25/82 recapture
344	F	5.5	--	5/8/81	152.730		1204/1203	w/2 cubs subsequently, recaptured 5/14/83
(345)	M	7.5	495	5/8/81	--	--	-- --	capture mortality
(308B)#	F	6.8	--	8/6/81	--	--	-- --	recapture mortality
299#	F	14.8	--	8/6/81	152.861		1109/1110	collar replaced, recaptured 5/18/81

Table 1. (continued)

Tattoo	Capture Sex	Age	Wt.	Date	Frequency	Serial #	Ear Tags	Comments
293#	M	4.8	--	8/6/81	150.710		1115/1116	collar replaced, recaptured 5/18/83
(294#)	M	11.8	--	8/6/81	152.841		-- --	recapture mortality
347	M	14.8	500*	8/6/81	--		1234/1233	collar shed 9/81
342A#	M	3.5	250*	5/25/82	150.871		1228/1227	collar replaced
(373)	M	9.5	450*	6/11/82	(150.022)		-- --	no tattoo, w/G283 (F), collar shed 6/83
282#	M	6.5	350*	6/11/82	150.741		529/1643	recapture of marked bear
379	F	5.5	300*	6/11/82	150.102		1595/1585	w/2@c, Downstream study
(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
313#	F	12.5	300*	5/14/83	153.890	6259	same	w/2@1
382	M	1.5	66	5/14/83	148.110 (Imp)	12546	2135/2134	w/313 and 383
(383)	F	1.5	53	5/14/83	(148.070) (Imp)	12542	(2490/2491)	w/313 and 382, died unknown causes
283#	F	15.5	--	5/14/83	152.550	6340	same	w/cub #3
(003)	F	0.5	--	5/14/83	(151.430)	1024	(1360/1359)	w/283, special cub collar, no tattoo, cub eaten
337#	F	15.5	--	5/14/83	152.720	6309	same	w/385@2
385	F	2.5	60	5/14/83	3.42-8.14 (Imp)	15210-12548	1695/1694	w/337, breakaway 5B collar
312#	F	13.5	350*	5/14/83	152.572	6342	1299/1300	w/386@2
386	M	2.5	200*	5/14/83	3.47-8.10 (Imp)	15212-12545(Imp)	2146/2141	w/312, breakway 5B collar
344#	F	7.5	325*	5/14/83	150.891	10445	same	w/2@0, not captured
335#	F	5.5	--	5/14/83	--	--	same	no radio in chopper
335#	F	5.5	236	5/16/83	150.220	15276	same	alone, one year added to '81 age based on '83 tooth
388	F	14.5	450*	5/14/83	153.070	6988	2478/2477	w/388 and 389@2
389	M	2.5	135	5/14/83	3.53-8.09 (Imp)	15214-12544	2170/2171	w/388 and 390, breakaway 5B collar
390	M	2.5	125*	5/14/83	3.46-8.08 (Imp)	15211-12543	2148/2147	w/388 and 389, breakaway 5B collar-shed
340#	F	5.5	250*	5/15/83	152.510	15285	same	--
384	F	12.5	300*	5/15/83	150.300	15279	2499/2500	w/391, 392, 393@2
391	M	2.5	140*	5/15/83	153.490	15213	2078/2079	w/384 et al., breakaway 5B collar
392	M	2.5	140*	5/15/83	152.971	15246	2111/2110	w/384 et al., breakaway 4B collar
393	F	2.5	105	5/15/83	152.991	15247	1589/1598	w/384 et al., breakaway 4B collar
293#	M	6.5	439	5/15/83	152.930	15291	same	--
394	F	6.5	250*	5/15/83	150.270	15277	1693/1692	w/cub #4
(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	(152.910)	(15289)	(2415/2416)	alone, regular 6B collar, shot 9/4/83
281#	F	6.5	325*	5/15/83	152.480	15284	same	w/2@0 (#5 and #6)
(005)	M	0.5	8.5	5/15/83	(151.422)	(1023)	(1350/134)	w/281, expandable cub collar, no tattoo, eaten
(006)	F	0.5	8.3	5/15/83	(151.460)	(1026)	(1346/1345)	w/281, expandable cub collar, no tattoo, eaten
280#	M	8.5	482	5/16/83	152.920	15290	same	--
396	F	13.5	274	5/16/83	150.470	14885	1685/1684	w/2@2 (397, 398)
397	F	2.5	132	5/16/83	--	--	2493/2492	w/396
398	F	2.5	135*	5/16/83	--	--	2105/2104	w/396
399	M	9.5	600*	5/17/83	150.290	15278	2087/2108	--
400	M	20.5	542	5/17/83	150.350	15281	2132/2133	--
299#	F	16.5	275*	5/18/83	150.480	15283	same	w/3@0 (007, 008, 009), darted in den
007	M	0.5	13*	5/18/83	(151.430)	1024	1347/1348	w/G299, special cub collar, no tattoo, shed 10/83
008	M	0.5	13*	5/18/83	151.440	1025	1342/1343	w/G299, special cub collar, no tattoo
009	M	0.5	13*	5/18/83	(151.410)	1022	536/535	w/G299, special cub collar, no tattoo, shed 7/83
279#	M	12.5	700*	5/18/83	150.590	10339	1653/1100	recapture, previous shed collar
315#	F	5.5	203	5/18/83	152.900	15288	same	estrus, alone, just marked previously
403	F	6.5	275*	5/18/83	150.180	15275	1564/1565	w/2@0, not captured, Downstream
407	F	4.5	220*	5/19/83	150.680	2905	2401/1543	alone

* Weight estimated, () indicates shed collar or dead bear, # recapture,- collar or mark replaced subsequently,
Last tattoo = 411, last cub = #15.

Table 2. Black bears captured in Susitna Dam Studies as of April, 1984

Tattoo	Capture Sex	Age	Wt.	Date	Frequency	Serial #	Ear Tags	Comments
(287)	M	10.5	225*	5/1/80	(150.111/082)		1083/1084	Shot on 9/8/82
(288)	F	10.5	125*	5/1/80	(150.032/122)		1095/1083	w/2 ylgs, turgid, collar shed by 8/27/80
289	F	9.5	130*	5/2/80	150.092/062		1103/1104	w/2 ylgs, turgid, had 3 cubs in 1981, see 4/82 recapture
(290)	F	8.5	103	5/2/80	150.022/.142		1306/1305	w/2 ylgs, turgid, see 8/6/81 recapture
(291)	M	(3.5)	73	5/2/80	(150.030)		-- --	Post-capture mortality
(296)	M	(10.5)	227	5/3/80	(--)		-- --	Capture mortality
(300)	M	(7.5)	274	5/4/80	(150.023/.121)		-- --	Post-capture mortality
301	F	7.5	115	5/4/80	153.850		1043/1044	w/1 ylg, turgid, had 2 cubs in 1981, see 3/83 recapture
(302)	M	8.5	287	5/4/80	(150.189)		1106/1105	collar shed by 8/4/80, recaptured 5/9/81
(303)	M	(8.5)	217	5/4/80	(153.870)		(1055/1056)	shot 9/8/83
(304)	M	10.5	235	5/4/80	150.031/0.080		1315/1316	collar shed in 1982
(305)	M	(9.5)	217	5/5/80	(151.350)			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	----
(316)	F	(12.5)	150*	5/7/80	(148.912)		-- --	w/1 newborn & 1 ylg shot by hunter 8/28/80
317	F	7.8	133	8/18/80	152.703		1195/1196	w/2 cubs, see 3/83 recapture
(318)	F	5.8	126	8/18/80	152.690		1046/1045	w/1 cub, also immobilized in den on 3/81, see 3/83 recapture, shed 7/83
(319)	M	3.8	174	8/18/80	(152.682)		1194/1193	died summer 1981
(320)	M	(4.8)	200*	8/18/80	(152.663)		-- --	shot by hunter 9/9/80
321	F	10.8	175*	8/18/80	152.673		1243/1244	had 2 cubs in 1981, recaptured 5/15/83
(322)	M	4.8	154	8/19/80	(152.643)		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	152.612		1200/1199	see 3/83 recapture
324	M	5.8	190	8/19/80	152.624		1252/1251	w/322, see 3/83 recapture
(325)	F	11.8	164	8/18/80	(152.632)		1191/1192	collar shed in 80/81 den, see 8/6/81 recapture
(326)	F	(5.8)	125	8/19/80	(152.560)		-- --	w/2 cubs, shot by hunter 8/28/80
(327)	F	(5.8)	118	8/19/80	(152.653)		1247/1248	w/2 cubs, immobilized in den 3/81, 3/83
(328)	F	6.8	150	8/19/80	(152.573)		1246/1245	w/303, had 2 cubs in 1981, collar shed in 81/82 den
(303#)	M	(8.8)	260	8/19/80	(153.870)		-- --	recapture, shot 9/8/83
329	F	1.3	15*	3/23/81	(150.470)		1266/1265	w/327 and sibling, w/heavy collar, see 4/82 & 3/83 recaptures
(330)	M	1.3	31	3/25/81	(152.990)		1276/1275	w/318, died summer 1981
(342B)	M	(5.5)	165	5/7/81	(152.483)		1206/1205	cinnamon color, shot on 9/15/81
343	M	5.5	184	5/7/81	152.594		1214/1213	alone, Devil Mountain, recaptured 5/16/83
346	M	9.5	175*	5/9/81	(150.120)		1226/1184	alone, see 3/83 recapture
302#	M	9.5	300*	5/9/81	150.200		1257/1105	alone, old collar previously shed
(290#)	F	9.8	160+*	8/6/81	--		1306/1279	neck infected, collar not replaced
(304#)	M	11.8	--	8/6/81	152.550		1286/1316	collar replaced, shed 6/82
(325#)	F	12.8	150*	8/6/81	(152.720)		1191/1192	second collar shed in 81/82 den
(303#)	M	(9.8)	250*	8/7/81	(150.370)		(1055/1056)	collar replaced, shot 9/8/83
(287#)	M	11.8	200*	8/7/81	(150.190)		(1083/1084)	collar replaced, shot on 9/8/82
(348)	M	9.8	300*	8/6/81	(152.523)		1131/1132	alone, shot on 9/82
(349)	F	4.8	170*	8/6/81	(152.502)		1326/1325	alone, see 3/83 recapture, shed 7/83
329#2	F	2.3	29	4/1/82	(153.041)		same	recapture in den, see 3/83 recapture
289#2	F	11.3	112	4/1/82	(152.810)		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
(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	150.541		517/1600	w/2 cubs
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	(150.521)		501/1651	died winter 82/83
(322#)	M	(6.5)	90*	5/27/82	(150.590)		1662/525	recapture, previous shed collar, died summer '82
358	M	2.5	60*	5/27/82	150.630		502/1656	----
359	M	4.5	118	5/27/82	152.640		512/1655	----
360	M	7.5	250*	5/27/82	(152.820)		511/1657	----

Table 2. (continued)

Tattoo	Sex	Capture Age	Capture Wt.	Capture Date	Frequency	Serial #	Ear Tags	Comments
362	F	2.5*	40*	5/27/82	--		503/504	no tattoo
363	F	4.5	120*	5/27/82	(150.100)		505/1593	----
364	F	9.5	170*	5/27/82	(150.060)		521/1591	missing since Sept.'82
(365)	M	5.5	100*	5/28/82	(150.502)		523/1626	downstream study, see 3/83 recapture-collar loosened, died 9/83
(366)	M	6.5	200*	5/28/82	(150.891)		538/1627	downstream study, shot on 8/5/82
(367)	F	4.5	100*	5/28/82	(152.870)		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	(152.603)		527/1578	downstream study - age based on '83 tooth
370	F	7.5	220*	5/28/82	152.030		528/1577	downstream study
(371)	M	2.5	150*	5/28/82	--		--	capture mortality, downstream study
372	F	9.5	135*	5/28/82	153.860		537/1576	downstream study
(374)	F	7.5	125*	6/11/82	(152.680)		(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	153.871		507/1630	w/3@1, downstream study, recaptured 5/19/83, age changed (+ 4)
376	F	6.5	125*	6/11/82	150.080		531/1587	w/1@1, downstream study, see 9/2/82 recapture
377	F	4.5	126	6/11/82	150.721		509/1659	downstream study, recaptured 5/19/83, age changed (- 1)
378	F	6.5	175*	6/11/82	150.031		510/1628	downstream study
376#2	F	6.7	160*	9/2/82	150.080		530/1584	recapture, slough 8B, snare
301#2	F	10.3	135	3/20/83	153.820	6298	same	w/2@0, recapture in den, collar shed 7/83
317#2	F	10.3	--	3/23/83	152.521	6338	1547/1196	w/2@0, recapture in den
(318#2)	F	8.3	--	3/23/83	(152.661)	(6351)	same	w/2@0, recapture in den, shed 7/83
323#2	M	5.3	--	3/21/83	153.000	6264	1696/1650	recapture in den
324#2	M	8.3	--	3/22/83	153.450	6443	1661/1251	recapture in den
329#3	F	3.3	56	3/22/83	same	same	same	recapture in den, old collar loosened
(327#2)	F	8.3	--	3/23/83	(153.180)	(6416)	same	w/2@0, recapture in den, died summer 1983
346#2	M	11.3	--	3/21/83	150.530	12449	same	recapture in den
(349#2)	F	6.3	--	3/22/83	(153.480)	(6446)	same	w/2@0, recapture in den, shed 7/83
361#2	F	8.3	--	3/21/83	153.841	6305	same	w/4@0, recapture in den
(365#2)	M	6.3	--	3/23/83	(same)	(same)	same	recapture in den, collar loosened, died 9/83
(379)	F	9.3		3/24/83	(153.510)	(6449)	none	w/3@0, captured in den #19, died 7/83
369#2	F	5.3	--	4/14/83	same	same	same	collar loosened in den, no cubs
372#2	F	10.3	--	4/15/83	same	same	same	w/3@0, collar loosened in den
376#3	F	6.3	--	4/16/83	same	same	same	w/3@0, collar okay in den
370#2	F	8.3	--	4/16/83	same	same	same	w/2@0, collar loosened in den
(367#2)	F	5.3	--	4/16/83	(same)	(same)	same	collar loosened in den, no cubs, shot July 1983
378#2	F	7.3	--	4/16/83	same	same	same	w/2@0 (not sexed or weighed), collar okay in den
387	M	4.5	175*	5/14/83	153.831	6288	2126/2127	--
321#2	F	13.5	115	5/15/83	152.830	15286	same	had cubs (n=?), not captured
343#2	M	7.5	225*	5/16/83	152.850	15287	same	--
401	M	3.5	96	5/18/83	150.330	15280	2103/2102	--
402	F	10.5	130	5/18/83	150.190	3616	2373/2372	w/3@1, not captured, Downstream study
375#2	F	10.5	--	5/19/83	same	same	same	w/1@0, not captured, old collar loosened, age changed + 4 ('83 tooth)
(374#2)	F	8.5	120*	5/19/83	(same)	(same)	(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	150.450	15282	same	alone, collar replaced, neck infected, age changed - 1 ('83 tooth)
404	F	11.5	135*	5/19/83	150.090	15272	2449/2450	w/1@0, captured, Downstream study
013	F	0.5	10	5/19/83	--	--	2449/2450	no tattoo, w/404, Downstream study
405	F	17.5	180*	5/19/83	150.111	6314	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	150.160	15273	2444/2445	w/2@0, not captured, Downstream study
408	M	3.5	160*	5/19/83	150.170	15274	2119/2120	alone, Downstream study
409	F	5.5	90*	5/19/83	150.142	6310	1527/1526	alone, Downstream study
(410)	F	7.5	120*	5/19/83	(152.980)	(6262)	(1536/1537)	w/2@0, not captured, Downstream study, shot 7/19/83
411	F	8.5	130*	5/19/83	150.130	6402	1548/1549	w/2@1, not captured, Downstream study

* Weight or age estimated, () shed collar or dead bear, # recapture, _ subsequently changed, Last Tattoo = 411, last cub = 15.

Table 3. Number of brown bear point locations, 1980-1983 Su-Hydro studies.

	1980	1981	1982	1983	1980-1983
Number of observations of marked bears	144	401	328	576	1449
Number of radio-marked bears with 5 locations	11	17	19	34	
Number of observations of unmarked bears (ID=99)	23	33	55	26	137
Number of observations by month of marked bears (%)					
Jan-Mar, Nov-Dec	1(1)	0	5(2)	20(3)	26(2)
April	9(6)	17(4)	7(2)	8(1)	41(3)
May	32(22)	111(28)	36(11)	110(19)	289(20)
June	24(17)	105(26)	98(30)	133(23)	360(25)
July	26(18)	41(10)	47(14)	64(11)	178(12)
August	27(19)	41(10)	62(19)	105(18)	235(16)
September	9(6)	56(14)	38(12)	96(17)	199(14)
October	16(11)	30(7)	35(11)	40(7)	121(8)

Table 4. Number of black bear point locations, 1980-1983 Su-Hydro studies.

	1980	1981	1982	1983	1980-1983
Number of observations of marked bears	212	421	603	614	1850
Number of radio-marked bears with 5 locations	20	23	35	39	
Number of observations of unmarked bears (ID=99)	48	54	69	43	214
Number of observations of marked bears by month (%)					
Jan-Mar, Nov-Dec	1(0)	6(1)	6(1)	21(5)	45(2)
April	0	7(2)	6(1)	0	13(1)
May	47(22)	98(23)	59(10)	104(17)	308(17)
June	28(13)	102(24)	167(28)	162(26)	459(25)
July	26(12)	57(14)	94(16)	75(12)	252(14)
August	66(31)	66(16)	134(22)	114(19)	380(21)
September	31(15)	75(18)	87(14)	83(14)	276(15)
October	13(6)	10(2)	50(8)	44(7)	117(6)

Table 5. Predicted and observed spring 1983 reproductive status of radio-collared female brown bears.

ID	1983 age	Predicted 1983 Status*	Comments	Observed 1983 status
281	6	cubs	first litter	2 cubs
335	5	cubs	first litter, bred in 1982	alone
340	5	cubs	first litter	alone
381	4	cubs	first litter	alone
344	7	cubs?	lost yearlings in July '82 and bred	2 cubs
283	15	cubs	lost ylgs in spring '82 and bred	1 cub
299	16	cubs	lost cub in spring 1982	3 cubs
379**	6	yearlings	had cubs in 1982	ylgs
313	12	yearlings	cubs in 1982	ylgs
312	13	2-year olds	yearlings in 1982	weaned litter
337	15	2-year olds	yearlings in 1982	weaned litter
380	16	2-year olds	radio failure in 1982?	weaned litter

* (See Table 5 in Miller 1983, p. 22).
** bear occurs in the downstream study area.

Table 6. Predicted spring 1984 reproductive status of radio-collared female brown bears.

ID	1984 age	Predicted 1984 status	Comments	Observed 1984 status
281	7	cubs	lost '83 litter(2) in May	NA
283	16	cubs	lost '83 litter(1) in May, bred	NA
394	7	cubs	lost '83 litter(1) in May, bred	NA
312	14	cubs	weaned 1@2 in '83, bred	NA
337	16	cubs	weaned 1@2 in '83, bred	NA
384	13	cubs	weaned 3@2 in '83, bred	NA
388	15	cubs	weaned 2@2 in '83, bred	NA
396	14	cubs	weaned 2@2 in '83, bred	NA
315	6	cubs	first litter?	NA
335	6	cubs	first litter	NA
340	6	cubs	first litter, bred in '83	NA
381	5	cubs	first litter	NA
407**	5	cubs	alone in '83, first litter?	NA
299	17	3 ylgs	had cubs in '83	NA
344	8	1 ylg	had cubs in '83	NA
403**	7	1 ylg	had cubs in '83	NA
313	13	w/1@2	with 1@1 in '83	NA
379**	7	w/1@2	with ylgs in '83	NA
385	3	barren	weaned from G337 in '83	NA
393(missing?)	3	barren	weaned from G384 in '83	NA

** bear occurs in the downstream study area

Table 7. Summary of Nelchina Basin brown bear litter size data (based on spring observations of radio-collared bears).

Part 1. Litters of newborn cubs

BEAR ID(year-age)	LITTER SIZE (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 one yearling which stayed with her until last observation on 9/12/79	2 of 3 lost
213(1978, 10)	2(1979)	lost apparent yearling 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 11 June 1979, survivor lived at least until last observation on 3 August 1979 (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-y 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
283(1981, 13)	2(1981)	weaned 2 at 2 in 1980, lost 1 cub by 9/1 other lost as yearling	1 of 2 lost
283(1983, 15)	1(1983)	killed by brown bear by 5/17/83, cub was collared	1 of 1 lost
337(1981, 13)	3(1981)	cubs and female reunited, 1 cub lost in 81/82 den, other 2 survived to exit (1	1 of 3 lost

Table 7. Part 1. (cont'd)

BEAR ID(year-age)	LITTER SIZE (year)	COMMENTS	Summary
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	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
299(1980, 13)	1(1982)	bear weaned 2 @ 2 in 1981, cub lost by 6/9/82	1 of 1 lost
G299(1983, 16)	3(1983)	all cubs collared, alive thru Oct.	0 of 3 lost
281(1983, 6)	2(1983)	both killed by brown bear by 6/1/83, cubs collared	2 of 2 lost
G394(1983, 6)	1(1983)	lost(capture related?) by 5/16, bred	1 of 1 lost (capture related?)
G403,(1983, 6)	2(1983)	may have lost 1 in Sept.	1 of 2 lost

Summary

No. of cubs	No. of litters	mean litter size (range)	15 of 32 cubs lost in first year of life (2 of these possibly capture related)
39	19	2.05 (1-3)	

Table 7. Part 2. (litters of yearlings)

BEAR ID(year-age)	LITTER SIZE (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 expt. 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 yearlings 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
213(1978, 10)	1(1978)	apparent ylg was not captured, had cubs following year	1 of 1 lost (capture related?)

Table 7. Part 2. (cont'd)

BEAR ID(year-age)	LITTER SIZE (year)	COMMENTS	Summary
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
312(1982, 12)	1(1982)	survived, weaned next year	0 of 1 lost
283(1982, 14)	1(1982)	lost by 5/18/82	1 of 1 lost
337(1982, 14)	2(1982)	lost 1 by 6/17/82, other survived	1 of 2 lost
380(1982, 15)	2(1982)	both survived to den entrance, at least 1 exited den and was weaned	0 of 2 lost
344(1982, 6)	2(1982)	lost 1 by 6/17, other by 7/26/82	2 of 2 lost
313(1983, 12)	2(1983)	lost 1 (surgery related?) by 6/2/83, other survived thru Oct.	0 of 1 lost
379(1983, 6)	2(1983)	lost 1 in June-Sept. period	1 of 2 lost

Summary

No. of yearlings	No. litters	mean litter size (range)	
36	22	1.64 (1-2)	6 of 20 lost

Table 7. Part 3. (litters of 2-year old offspring)

BEAR ID(year-age)	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
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
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?)

Summary

No. of 2-year olds	No. of litters	Mean litter size(range)
24	14	1.7(1-3)

Table 8. 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.	2 ylgs., May-Oct.	2 @ 2 in May, weaned in June and bred	bred
1979	1 ylg., May-Sept. 2 ylgs., lost in 78/79 den?)	1 @ 2, weaned in June	2 @ 2 weaned in May, radio failure	no data	2 of 3 cubs lost in June, 1 survived April-Sept.
1980	no data	no data	no data	no data	no data

	MOTHER'S ID (age in year when first captured)				
year	G299 (13 in 1980)	G312(10 in 1980)	G313(9 in 1980)	G283(13 in 1980)	G277(10 in 1980)
1980	2 of 2 ylgs. survived May-Oct.	weaned 1 @ 2 in May breeding not observed	weaned 1 @ 2 in May, bred	weaned 2 @ 2 in June, bred	2 @ 1 survived April thru August, collar shed in den
1981	weaned 2 @ 2 in May and bred	1 of 2 cubs lost in June, other survived May-Oct.	1 @ 0 lost in May (?capture related?)	1 of 2 cubs lost in Aug., other survived	no data
1982	lost 1 of 1 @ 0 in June	yearling survived	2 @ 0 survived	lost 1 @ 1 in May, bred	no data
1983 October	3 @ 0 survived (all marked in dens, nos. 7-9)	weaned 1 @ 2 in June, bred, offspring=G385, transmitted	1 @ 1 lost in June (transmitted internally), sibling 382 alive thru October)	lost 1 @ 0 in May, bred. lost cub had transmitter	no data

Table 8. (cont'd)

year	MOTHER'S ID (age in year when first captured) G331 (6 in 1981)	G334(10 in 1981)	G337(13 in 1981)	G344(5 in 1981)	G344(6 in 1981)
1981	2 @ 2 weaned in May, bred	weaned 1 @ 2 in May, bred, bear missing since Sept.	lost 1 @ 0 in winter den, 2 survived	2 @ 0 survived	alone, bred in May
1982	no cubs, bred, died in July (reason?)	no data	lost 1 @ 1 in June other survived	lost 1 @ 1 in May, lost other in early July	had 2 @ 0 thru July, bear missing subsequently
1983 (thru Oct.)	--	no data	weaned 1 @ 2 in [had May, bred	2 @ 0, lost 1 by late June, other survived	no data

year	MOTHER'S ID (age in year when first captured) G379(5 in 1982)	G380(5 in 1982)	G384(12 in 1983)	G388(14 in 1983)	G394(6 in 1983)
1982	2 @ 0 survived	2 @ 1 survived until denning, one may have died in den	no data	no data	no data
1983 (thru Oct.)	2 @ 1, think lost 1 (June-Sept.)	at least, 1 @ 2 weaned in May, possibly both. shot in Sept.	weaned 2 or 3 @ 2 in June, bred	weaned 2 @ 2, bred	lost 1 @ 0 in May (?capture related possible?), bred

year	MOTHER'S ID (age in year when first captured) G396(13 in 1983	G403(6 in 1983)
1983 (thru Oct.)	weaned 2 @ 2 in May, bred	2 @ 0 thru Aug. May have lost 1 in Sept.

Table 9. Summary of known losses from brown bear litters of cubs and yearlings. Losses dated from emergence in year indicated to emergence the following year.

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 (thru Oct.)	6' of 11 lost (G283, G344, G299, G281, G394, G403)	2 of 4 lost (G379, G313")
TOTALS:	15 of 32 lost = 47%	6 of 20 lost = 30%
Excluding possible capture-related deaths and incomplete data:	11 of 27 lost = 41%	5 of 15 lost = 33%

\# last observation on 8/3/79

\## last observation on 9/12/79

* 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 bben 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.

Table 10. Morphometrics of brown bear cubs-of-the-year handled in GMU 13, 1978-1983

CUB ID	MOTHER'S ID	DATE HANDLED	SEX	WT(lbs)	COMMENTS
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
007	G299	18 May 1983 (den)	M	over 10.0	neck=225mm, collared
008	G299	18 May 1983 (den)	M	over 10.0	neck=245mm, collared
009	G299	18 May 1983 (den)	M	over 10.0	neck=225mm, collared
001	G213	22 May 1979	M	10.0	transplanted, see Ballard
002	G213	22 May 1979	M	10.0	et al. (1980)
--	G207	27 May 1978	M	12.0	see Spraker, et al. (1981)
--	G207	27 May 1978	F	12.0	

Totals: 8 males and 6 females

Table 11. Morphometrics of brown bear yearlings handled in GMU 13, 1978-1983

YLG ID	MOTHER'S ID	DATE HANDLED	SEX	WT(lbs)	COMMENTS
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
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.
G232	G234	23 June 1978	F	100(est.)	Spraker, et al. (1981)
G235	G234	23 June 1978	F	100(est.)	

Totals: 11 males and 7 females

Table 12. Brown bear harvests in the Su-Hydro study area (Figure 1). Includes DLP kills.

	SPRING SEASON				FALL SEASON			
	Total	% males	Mean age(n)	range	Total	% males	Mean age(n)	range
MALE HARVESTS								
Year								
1970	-				4	80	5.3(4)	2.8-9.8
1971	-				4	27	3.3(4)	1.8-5.8
1972	-				6	67	8.0(6)	3.8-17.8
1973	-				4	100	4.3(4)	1.8-5.8
1974	-				12	55	6.4(11)	1.8-16.8
1975	-				18	53	7.4(16)	2.8-14.8
1976	-				10	42	7.3(10)	1.8-21.8
1977	-				13	100	7.0(13)	1.8-23.8
1978	-				21	48	5.2(16)	1.8-14.8
1979	-				19	58	6.7(15)	1.8-14.8
1980	5	71	7.8(5)	2.4-17.4	12	57	3.8(11)	1.8-6.8
1981	7	78	5.1(7)	2.4-7.4	22	65	5.3(21)	0.8-25.8
1982	6	67	6.4(6)	3.4-12.4	20	61	3.7(20)	1.8-8.8
'74-'76	-				40	50	7.1(37)	1.8-21.8
'77-79	-				53	66	6.2(44)	1.8-23.8
'80-'82	18	72	6.3(18)	2.4-17.4	54	61	4.3(52)	0.8-25.8
FEMALE HARVESTS								
1970	-				1		6.8(1)	--
1971	-				11		8.4(11)	1.8-15.8
1972	-				3		4.1(3)	3.8-4.8
1973	-				0			
1974	-				10		7.4(8)	1.8-12.8
1975	-				16		7.6(16)	1.8-13.8
1976	-				14		4.6(13)	1.8-10.8
1977	-				0			
1978	-				13		6.1(12)	2.8-11.8
1979	-				14		6.5(10)	1.8-16.8
1980	2		5.4(2)	3.4-7.4	9		4.8(6)	2.8-11.8
1981	2		3.4(2)	2.4-4.4	12		6.5(11)	2.8-20.8
1982	3		6.1(3)	3.4-8.4	13		7.6(12)	1.8-14.8
'74-'76	-				40		6.5(37)	1.8-13.8
'77-'79	-				27		6.3(22)	1.8-16.8
'80-'82	7		5.1(7)	2.4-8.4	34		6.6(29)	1.8-20.8

Table 13. 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
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	-	-	-	-
230	M/9 in '78	A	T,shot Sp	-	-	-	-	-
211	M/4 in '78	A	T,NR	ND	ND	ND	ND	
216	M/11 in '78	A	T,NR	ND	ND	ND	ND	
210/242	M/2 in '78	A	T,ND	ND	ND	ND	ND	
214	M/4 in '78	A	A	A	ND	ND	ND	
215	F/2 in '78	A	T,NR	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	-
207	F/11 in '78	A	A	ND	ND	ND	ND	
208	F/12 in '78	A	A	ND	ND	ND	ND	
220	F/5 in '78	A	A	ND	ND	ND	ND	
222	M/11 in '78	A	ND	ND	ND	ND	ND	
227	M/9 in '78	A	ND	ND	ND	ND	ND	
234	F/5 in '78	A	ND	ND	ND	ND	ND	
200	M/7 in '78	A	ND	ND	ND	ND	ND	
204	F/7 in '78	A	A	ND	ND	ND	ND	
225	M/4 in '78	A	A	ND	ND	ND	ND	
231	F/12 in '78	A	A	ND	ND	ND	ND	
Max. No. Bears potentially alive in year includes ND (M:F)		28(15:13)	26*(15:11)	25(14:11)	23(12:11)	21(11:10)	18(10:8)	15(7:8)
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)	
% of potentially alive bears known shot in year		4%	4%	8%	9%	14%	17%	
Cumulative % (min.) of marked bears shot (N=27)		4%	7%	15%	22%	33%	44%	

Not Included:
Subadults @2 in 1978, = 203, 223, 224 (all ND)
Subadults @1 = 232 (ND)
* suspected mortality of 213 in 1979, not included as alive in 1979 or subsequently

Table 14. 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
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	-
241	M/3 in '79	A,ND	ND	ND	ND	ND	
249	M/5 in '79	A,ND	ND	ND	ND	ND	
258	M/21 in '79	A,ND	ND	ND	ND	ND	
264	F/4 in '79	A,ND	ND	ND	ND	ND	
267	F/4 in '79	A,ND	ND	ND	ND	ND	
274	F/11 in '79	A,ND	ND	ND	ND	ND	
276	M/4 in '79	A,ND	ND	ND	ND	ND	
236	F/5 in '79	A,R	ND	ND	ND	ND	
237	M/10 in '79	A,R	ND	ND	ND	ND	
240	F/5 in '79	A,R	A	ND	ND	ND	
244	F/6 in '79	A,R	A	ND	ND	ND	
251	F/10 in '79	A,R	A	ND	ND	ND	
273	F/3 in '79	A,R	A	ND	ND	ND	
248	F/4 in '79	A,NR	ND	ND	ND	ND	
261	F/7 in '79	A,NR	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)
No. marked bears known shot in year (M:F)		1(1:0)	3(2:1)	2(1:1)	1(1:0)	2(2:0)	
Known % of potentially alive bears shot in year		4%	13%	10%	6%	12%	
Cumulative % (min.) of marked bears shot (N=24)		4%	17%	25%	29%	38%	

Not Included:
Subadults @2 in 1979 = 259
Subadults @1 in 1979 = 275, 262 or 263, 256, 257, 252, 253, 245, 271, 239, 238.

Table 15. 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
1980 captures						
277	F/10 in '80	A	ND	ND	ND	
279	M/9 in '80	A	A	A	A	
280	M/5 in '80	A	A	A	A	
281	F/3 in '80	A	A	A	A	
282	M/4 in '80	A	A	A	A	
283	F/12 in '80	A	A	A	A	
284	M/2 in '80	A	Shot-F	-	-	
286	M/3 in '80	ND	ND	ND	ND	
292	F/3 in '80	ND	ND	ND	ND	
293	M/3 in '80	A	A	A	A	
294	M/10 in '80	A	Died in Aug.	-	-	
295	M/12 in '80	ND	ND	ND	ND	
299	F/13 in '80	A	A	A	A	
297	M/1 in '80	A	Shot-F	-	-	
306	F/3 in '80	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	ND	ND	ND	ND	
311	M/2 in '80	Shot-F	-	-	-	
312	F/10 in '80	A	A	A	A	
313	F/9 in '80	A	A	A	A	
315	F/2 in '80	A	A	A	A	
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	
337	F/13 in '81	-	A	A	A	
340	F/3 in '81	-	A	A	A	
341	F/6 in '81	-	A	Lost in July -shot?	-	
342a	M/2 in '81	-	A	A	A	
344	F/5 in '81	-	A	A	A	
347	M/14 in '81	-	A	ND	ND	
1982 captures						
373	M/9 in '82	-	-	A	ND	
379	F/5 in '82	-	-	A	A	
380	F/15 in '82	-	-	A	Shot-F	
381	F/3 in '82	-	-	A	A	

(continued on next page)

Table 15. (cont.)

Bear ID	Sex/age	1980	1981	1982	1983	1984
1983 captures						
385	F/2 in '83	-	-	-	A	
386	M/2 in '83	-	-	-	A	
388	F/14 in '83	-	-	-	A	
389	M/2 in '83	-	-	-	A	
390	M/2 in '83	-	-	-	A	
384	F/12 in '83	-	-	-	A	
391	M/2 in '83	-	-	-	A	
392	M/2 in '83	-	-	-	A	
393	F/2 in '83	-	-	-	A	
394	F/6 in '83	-	-	-	A	
395	F/3 in '83	-	-	-	Shot-F	
396	F/13 in '83	-	-	-	A	
399	M/9 in '83	-	-	-	A	
400	M/20 in '83	-	-	-	A	
403	F/6 in '83	-	-	-	A	
407	F/4 in '83	-	-	-	ND	
A. Max. No. marked bears potentially alive in year, includes ND. Excludes tagging and natural mortalities (M:F)		22(12:10)	30(14:16)	29(12:17)	43(18:25)	40(17:23)
B. No. KNOWN shot in year (M:F)		1(1:0)	3(3:0)	1(1:0)	3(1:2)	ND
Min. % known shot (B/A)		5%	10%	3%	7%	ND
C. No. known shot plus suspected (unreported) shot in year (M:F)		1(1:0)	4(3:1)	2(1:1)	3(1:2)	ND
Probable min. % shot (C/A)		5%	13%	7%	7%	ND
D. No. bears known alive (excludes ND, died & lost)		17	23	21	34	31
Probable % shot (C/D)		6%	17%	10%	9%	ND
Cumulative % shot (bear-years= 124, from row A).		1%	4%	6%	8%	ND

Not Included:
Subadults @2, 1980: 285, 314,
1983: 397, 398
Subadults @1, 1980: 298
1983: 382

Table 16. Summary of Tables 13-15, hunter killed brown bear marked in GMU 13.

	1978	1979	1980	1981	1982	1983	1984
Maximum No. of marked bears potentially alive in year (includes N.D.) (M:F)	27(14:13)	50(27:33)	70(37:33)	73(35:38)	68(31:37)	78(35:43)	69(28:41)
No. marked bears known shot* (M:F)	1(0:1)	2(2:0)	6(5:1)	7(5:2)	5(3:2)	8(6:2)	NA
Min. % of marked bears shot in year	4%	4%	9%	10%	7%	10%	NA
% males in population of marked bears	52%	54%	53%	48%	46%	45%	41%
% males in harvest of marked bears	0	100%	83%	71%	60%	75%	1978-1983 72%

* includes row C in Table 15

Table 17. Home range sizes (km^2) of two-year old radio-marked brown bears in 1983.

BEAR ID	Sex	Mother's ID/ (1983 home range)	Entire 1983 home range/ (No. of points)	Post-separation home range/(No. of points)	COMMENTS
389	M	388/(146)	1,954/(16)	1,947/(10)	Dispersed, Figure 2
390	M	same	86/(14)	51/(8)	Didn't disperse, Figure 2
391	M	384/(199)	1,169/(15)	782/(10)	Dispersed, Figure 3
392	M	same	1,252/(15)	826/(10)	Dispersed, Figure 3
393	F	same	156/(14)	156/(12)	Didn't disperse, no den, Figure 3
386	M	312/(191)	939/(13)	243/(8)	Dispersed, Figure 4

Table 18. Annual use of Prairie Ck. area by radio-collared brown bears during July and August king salmon spawning period. Reproductive status reflects July data for females (c=newborn cubs).

Males (age in year first captured)	1980	1981**	1982	1983
279 9(80)	ND(shed)	ND	ND	yes
280 5(80)	no	no	no	no
214 4(80)	no	-	-	-
282 4(80)	-	-	yes	yes
293 3(80)	yes	yes	yes	no
294 10(80)	yes	yes	-(dead)	-
342a*2(81)	-	no	no	no
373 9(82)	-	-	yes	ND(shed)
386 2(83)	-	-	-	no
389 2(83)	-	-	-	no
390 2(83)	-	-	-	no
391 2(83)	-	-	-	no
392 2(83)	-	-	-	no
399 9(83)	-	-	-	yes
400 20(83)	-	-	-	no
Subtotals:				
No. using Prairie Ck. (males)	2	2	3	3
Total No. of collared males	4	4	5	12
No. collared males excluding subadult dispersers	4	3	4	7
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

(continued on next page)

Table 18. (cont.)

Females (age in year first captured)	1980	1981**	1982	1983
277 10(80)	no?	ND-(shed)	ND	ND
281 3(80)	no, alone	no, alone	no, alone	no, alone
283 12(80)	yes, alone	no, w/2c	yes, alone	yes, alone
299 13(80)	no, w/2@1	no, alone	no, alone	no, w/3c
308b 5(80)	yes, alone	no?, alone	-dead	-
312 10(80)	no, alone	no, w/1c	no, w/1@1	no, alone
313 9(80)	no, alone	no, alone	no, w/2c	no, w/1@1
315 2(80)	-	-	-	yes, alone
331 6(81)	-	no, alone	-dead	-
334 10(81)	-	no, alone	-missing	-
335 2(81)	-	no, alone	no, alone	no, alone
337 13(81)	-	no, w/3c	no, w/1@1	no, alone
340 3(81)	-	no, alone	no, alone	no, alone
341 6(81)	-	no, alone	no,w/2c	-missing
344 5(81)	-	no, w/2c	no, w1@1	no, alone
379* 5(82)	-	-	no, w/2c	no, w/2@1
380 15(82)	-	-	yes, w/2@1	yes, alone
381 3(82)	-	-	no, alone	no, alone
385 2(83)	-	-	-	no, alone
388 14(83)	-	-	-	no, alone
384 12(83)	-	-	-	no, alone
393 2(83)	-	-	-	no, alone
394 6(83)	-	-	-	yes, alone
395 3(83)	-	-	-	no, alone
396 13(83)	-	-	-	yes, alone
403* 6(83)	-	-	-	no, w/2c
407* 4(83)	-	-	-	yes, alone
Subtotals:				
No. using Prairie Ck. (females)	2	0	2	6
Total No. of collared females	7	13	13	22
% females using Prairie Ck.	29	0	15	27
TOTALS:				
No. bears using Prairie Ck.	4	2	5	9
No. bears radio-collared (excluding dispersing males)	11	16	17	29
% bears using Prairie Ck.	36	13**	29	31

* Downstream study area
** Poor monitoring conditions in 1981

Table 19. Annual home range sizes for Su-Hydro upstream study area brown bears. (Includes individuals with 5 or more relocations).

Bear ID (age @ capture)	1980 Obs. Period (No. locations)	1980 Home Range (km^2)	1981 Obs. Period (No. locations)	1981 Home Range (km^2)	1982 Obs. Period (No. locations)	1982 Home Range (km^2)	1983 Obs. Period (No. locations)	1983 Home Range (km^2)
MALES								
342a (2)	---	---	May-Oct (8)	1776	May-Oct (17)	730	Apr-Oct (15)	932
386 (2)	---	---	---	---	---	---	May-Oct (13)	939
389 (2)	---	---	---	---	---	---	May-Oct (16)	1954 (died)
390 (2)	---	---	---	---	---	---	May-Oct (14)	88
391 (2)	---	---	---	---	---	---	May-Oct (15)	1169
392 (2)	---	---	---	---	---	---	May-Oct (15)	1252
293 (3)	May-Oct (8) no den	1409	May-Sep (11)	2727 no den	Jun-Aug (12)	2578	May-Sep (10) no den	222
214 (4)	Apr-Sep (11)	975	shed	---	---	---	--	
280 (5)	Apr-Oct (10)	499	Apr-Oct (25)	570	May-Oct (17)	376	Apr-Oct (17)	--
282 (6)	---	---	---	---	Apr-Oct (17)	1534	Apr-Oct (21)	2135
373 (9)	---	---	---	---	Jun-Oct (11)	606	shed in June	--
279 (9 in '80)	(shed)	---	---	---	---	---	May-Oct (20)	1431
399 (9)	---	---	---	---	---	---	May-Oct (19)	1183
294 (10)	May-Oct (14)	495	May-Aug (9)	143 (died)	---	---	--	
400 (20)	---	---	---	---	---	---	May-Oct (14)	1733
	$\bar{x}$ (all males) = (10.8)	845	(13.3)	1304	(11.4)	1165		
	S.D. =	439	--	1174	--	902		
	range = (8-14)	495-1409	(9-25)	143-2727	(9-14)	376-2578		
FEMALES								
335 (2)	---	---	May-Oct (34)	180	May-Oct (20)	131	Apr-Oct (19)	183
315 (2 in '80)	not collared	---	---	---	---	---	May-Oct (18)	280
393 (2)	---	---	---	---	---	---	May-Sep (14) no den	156 (lost)
385 (2)	---	---	---	---	---	---	May-Oct (16)	253
395 (3)	---	---	---	---	---	---	May-Aug (11)	458 (shot)
281 (3)	Apr-Oct (13)	189	Apr-Oct (41)	368	May-Oct (22)	233	Apr-Oct (19)	302 (w/2@c)****

(continued on next page)

Table 19. (Continued)

SM-15

Bear ID (age @ capture)	1980 Obs. Period (No. locations)	1980 Home Range (km^2)	1981 Obs. Period (No. locations)	1981 Home Range (km^2)	1982 Obs. Period (No. locations)	1982 Home Range (km^2)	1983 Obs. Period (No. locations)	1983 Home Range (km^2)
340 (3)	---	---	May-Oct (39)	613	May-Oct (23)	712	Apr-Oct (18)	539
381 (3)	---	--	---	--	Jun-Oct (17)	265	Apr-Oct (18) (no den)	251
407 (4)*	---	--	---	--	---	--	May-Oct (17)	186
308b (5)	May-Oct (15)	142	May-Aug (14)	(died)	---	---	--	--
344 (5)	---	---	May-Oct (21)	270(w/2@c)	May-Oct (22)	401(w/2@1)***	Apr-Oct (18)	287(w/2@c)
379 (5)*	---	---	---	---	Jun-Oct (19)	3389(w/2@c)	Apr-Oct (20)	1248(w/2@1)
331 (6)	---	---	May-Oct (24)	1281	May-Jul (10)	252(died)	---	--
341 (6)	---	---	May-Oct (28)	889	May-Jul (9)	23(w/2@c)	lost	--
394 (6)	---	---	---	---	---	---	May-Oct (20)	201(w/1@c)****
403 (6)*	--	--	--	---	---	--	May-Oct (19)	1890(w/2@c)
313 (9)	May-Oct (14)	82	Apr-Oct (25)	211	May-Oct (22)	128(w/2@c)	Apr-Oct (20)	272(w/2@1)
277 (10)	Apr-Oct (6)	147(w/2@1)	(shed)	---	---	---	--	--
312 (10)	May-Oct (13)	157	Apr-Oct (24)	181(w/2@c)	May-Oct (20)	252(w/1@1)	Apr-Sep (15) (no den)	191
334 (10)	---	---	May-Sep (31)	111*	missing	---	--	--
283 (12)	Apr-Oct (12)	233	May-Oct (20)	94(w/2@c)**	May-Oct (20)	206(w/1@1****)	Apr-Oct (20)	416
384 (12)	--	--	--	--	--	--	May-Oct (16)	199
299 (13)	May-Oct (10)	188(w/2@1)	Apr-Oct (24)	358**	May-Oct (21)	191(w/1@c****)	May-Oct (24)	224(w/3@c)
337 (13)	---	---	May-Oct (19)	270(w/3@c)**	May-Oct (20)	356(w/2@1)	May-Oct (20)	246
396 (13)	---	---	--	--	--	---	May-Oct (16)	254
388 (14)	---	---	---	--	--	---	May-Oct (16)	146
380 (15)	---	---	---	---	Jun-Oct (9)	493(w/2@1)	Apr-Sep (12)	450(shot 9/83)
	$\bar{x}$(all females)=(11.7)	163	(26.5)	380	(18.1)	286		
	S.D.= ---	47	---	352	--	323		
	Range=(6-15)	82-233	(14-41)	94-1281	(9-B)	23-1216		
	$\bar{x}$(all males & females)=(11.4)	411	(23.4)	597	(17.3)	677		
	S.D.= ---	421	---	717	--	889		
	Range=(6-15)	82-1409	(8-41)	94-2727	(9-23)	23-2578		

* Downstream study area
** Not included in statistical comparisons
*** Yearlings lost in July
**** Yearlings or cub lost in May

Table 20. Number of Susitna river crossings by radio-marked brown bears, 1980-1983.

SMIL07
SM-1

Bear ID	Yr. Initial capture (age)	No. of River Crossings 1980	1981	1982	1983	Comments
Males						
389	1983(2)	-	-	-	1	388's cub, died fall '83
390	1983(2)	-	-	-	0	388's cub, implant active
391	1983(2)	-	-	-	1	384's cub
392	1983(2)	-	-	-	0	384's cub
393	1983(2)	-	-	-	4	384's cub, missing **
293	1980(3)	2	0	1	2	Wide-ranging
214	1980(4)	0	-	-	-	shed collar in '80
399	1983(4)	-	-	-	4	active
280	1980(5)	2	10	3	8	active
308A	1980(6)	0	-	-	-	Missing in '80, shot in '83
282	1982(6)	-	-	6	4	active
279	1980(9)	0	-	-	3	active
373	1982(9)	-	-	3	0	shed collar
294	1980(10)	1	0	-	-	recapture mortality
295	1980(12)	1	-	-	-	shed collar in '80
309	1980(12)	0	0	-	-	shed collar in '81
347	1981(14)	-	0	-	-	shed collar in '81
400	1983(20)	-	-	-	1	active
342A@	1981(2)	-	1	0	2	active
Total males		6	11	13	30	

(continued)

Table 20. (continued)

Bear ID	Yr. Initial capture (age)	No. of River Crossings 1980	1981	1982	1983	Comments
Females						
315	1980(2)	-	-	-	4	radio-collared in 1983, active
385	1983(2)	-	-	-	0	337's cub
386	1983(2)	-	-	-	0	active
281	1980(3)	1	6	5	6_{*2}	cubs killed by other bears
335	1981(3)	-	0	0	0	334's cub, active
340	1981(3)	0	6	8	4	active
381	1982(3)	-	-	4	1	active
395	1983(3)	-	-	-	1	shot (hunter) '83
308B	1980(5)	5	7	-	-	recapture mortality
344	1981(5)	-	0_{*2}	0_{y2}	0_{*2}	active
331	1981(6)	-	4_{+2}	3	-	died July 1982
341	1981(6)	-	9	0_{*2}	-	missing 1982 **
394	1983(6)	-	-	-	10	lost cub as capture mortality?
313	1980(9)	0	0	0_{*2}	2_{y1}	active
277	1980(10)	0_{y2}	-	-	-	collar shed in 1980
312	1980(10)	0	0_{*2}	0_{y1}	0_{+1}	active
334	1981(10)	-	0_{+1}	-	-	missing 1982 **
283	1980(12)	0_{+2}	0_{*2}	4	2	1983 cub killed by another bear
384	1983(12)	-	-	-	0_{*2-3}	active
299	1980(13)	2_{y2}	2	2	0_{*3}	active
337	1981(13)	-	0_{*3}	0_{y2}	0	active
396	1983(13)	-	-	-	0_{*1}	active? slow pulse

(continued)

Table 20. (continued)

Bear ID	Yr. Initial capture (age)	No. of River Crossings 1980	1981	1982	1983	Comments
388	1983(14)	-	-	-	0_{+2}	active
380	1982(15)	-	-	0_{y2}	0	shot
407 @	1983(4)	-	-	-	0	active
379 @	1982(5)	-	-	1_{*2}	5_{y1}	active
403 @	1983(6)	-	-	-	1_{*2}	active
Total females		8	34	27	36	
Total both sexes		14	45	40	66	

@ = Downstream bears

Reprod. status as of 31 May: * - cub

y = yrlg

+ = 2 yr old

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

Table 21. Associations of radio-marked brown bears during spring 1983. (Includes only bears in upstream study area, excludes bears with cub or yearling offspring throughout this period and excludes 2 year-old bears, as companions). Sex is in parenthesis.

Bears seen with unmarked bears (presumably of opposite sex)	Bears seen with other marked bears	Bears seen without adult companions	Bears radio-located not seen visually	Total No. of radio-collared adult* bears located (No. seen)
23 May, 1983 Flight				
G394(F,cubs lost earlier)	--	G281(Fw/2@0) G315(F) G337(F) G388(Fw/2@2) G293(M) G340(M)	--	17(17)
		G280(M) G381(F) G312(Fw/1@2) G395(F@3)* G335(F) G400(M) G279(M) G282(M) G396(Fw/1@2) G283(F)		16
1-2 June 1983 Flights				
G396(F) G283(F) G312(F) G400(M) G315(F)**	G337(F)w/G279(M)	G381(F) G384(Fw/2@2) G395(F@3)* G388(Fw/2@2) G399(M) G340(F)	G281(F cubs had been killed) G335(F) G293(M)	15(12)

Table 21. (cont'd)

Bears seen with unmarked bears (presumably of opposite sex	Bears seen with other marked bears	Bears seen without adult companions	Bear radio-located but not seen visually	Total No. of radio-collared adult* bears located (No. seen)
6 June 1983 Flight				
G283(F)	--	G380(F)	G396(F)	17(13)
G282(M)		G395(F@3)*	G280(M)	
G315(F)		G337(F)	G281(F)	
G335(F)		G399(M)	G381(F)	
G400(M)		G340(F)		
G279(M)		G384(Fw/2@2)		
		G394(F)		
		G340(F)		
13-14 June 1983 Flight				
G380(F)	G283(F)w/G282(M)	G315(F)	--	17(17)
G279(M)	& another bear***	G394(F)		
G399(M)		G396(F)		
G335(F)		G312(F)		
G400(M)		G388(F)		
G384(F)		G395(F@3)*		
G283(F)***		G340(F)		
		G281(F)		
		G280(M)		
		G381(F)		
20-21 June 1983 Flight				
G282(M)	G388(F)w/G400(M)	G312(F)	G315(F)	18(13)
G396(F)	G283(F)w/G279(M)	G384(F)	G394(F)	
G337(F)		G280(M)	G335(F)	
G340(F)		G399(M)	G281(F)	
		G380(F)	G381(F)	

(Continued)

Table 21. (cont'd)

* G395 is a 3 year old female that was not in estrus when captured, therefore it is not unusual that she was never seen with another bear during this period.

** G315(F) was seen with G394 (another female) and an unmarked bear on the 1-2 June flight, since only one unmarked male (presumably) was seen in this group of 3 bears, G394 was not counted as being with another bear in the totals and neither G394 or G315 was counted as being with another marked bear.

*** G283(F) was seen with G282(M) and another bear on 13-14 June, therefore it is counted twice (in each of the first two columns).

Table 22. Parameters used in formulating brown bear population estimates based on estimated proportion of adults (excluding non-estrus females) in the population that are radio-marked. Cautionary statements in text should be reviewed in interpretation of these estimates.

Calculated number of adult bears excluding females with cubs or yearlings based on calculation that 15% of population is marked ("X" in above equation)	93	93	93
	Minimum	Midpoint	Maximum
Estimate of the proportion of the adult female population with cubs or yearling offspring ("a" in equation)	0.19	0.43	0.67
Estimate of the proportion of adult population composed of females ("b" in equation)	0.50	0.63	0.76
Total number of adult bears ($\hat{N}$ in above equation)	103	128	190
Composition of $\hat{N}$			
number of adult males	52	47	46
number of adult non-estrus females	12	37	97
number of estrus females	40	45	47
Number of cubs and yearlings (number of non-estrus females times mean cub and yearling litter size of 1.8)	22	67	175
Number of 2 and 3 year-old bears (25% of number of cubs and yearlings)	6	17	44
Estimate of total spring population	131	212	409
Area inhabited by above population (km^2) / Area (km^2) inhabited by radio-marked individuals during breeding season 1983 (Fig. 7)	4,391	4,391	4,391
Corresponding density estimate (km^2/bear)	33.5	20.7	10.7
Area (km^2) inhabited by radio-marked individuals during all of 1983 (Fig. 8)	6,568	6,568	6,568
Corresponding density estimate (km^2/bear)	50.1	31.0	16.1

Table 23. Characteristics of brown bear dens in the Susitna study area during winters of 1980/81, 1981/1982, 1982/1983.

	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

(continued on next page)

Table 23. (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	105	G337	15	5150**	45**	336**	Tundra	-	-	-	-	-	-	-	Collapsed
w/1 @2	107	G337	15	4900**	35**	34**	Tundra	-	-	-	-	-	-	-	Spring den, collapsed
w/1 @2	108	G312	13	4540**	40**	51**	Tundra, Grass	-	-	-	-	-	-	-	Collapsed
w/2 @0	109	G344	7	4750**	50**	101**	Tundra	-	-	-	-	-	-	-	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
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

(continued on next page)

Table 23. (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
UNKNOWN CAVITY TYPE															
w/1 yrl	41	G283	14	4000	26	161	--	-	-	-	-	-	-	-	Not visited
w/2 @2	48	G337	14	5050	45**	253**	--	-	-	-	-	-	-	-	Not located
	45	G281	5	4575**	25	176	Grass	-	-	-	-	-	-	-	Not located

* 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

Table 24. Distances between den sites (miles) used in different years by radio-collared brown bears. Based on principle winter den, early spring dens not considered.

Bear ID	Sex	Age	80/81-81/82	80/81-82/83	80/81-83/84*	81/82-82/83	81/82-83/84*	82/83-83/84*	$\bar{x}$	S
G283	F	13 in'81	3.2	2.4	1.6	5.3	4.9	1.7	3.2	1.6
G313	F	10 in'81	4.1	4.4	3.4	6.7	1.0	5.7	4.2	2.0
G337	F	13 in'81	3.3	2.4	1.9	3.7	3.1	0.6	2.5	1.1
G344	F	5 in'81	3.1	1.5	3.8	1.6	1.2	2.5	2.3	1.0
G299	F	14 in'81	8.9	6.7	7.1	3.5	3.5	0.5	5.0	3.1
G280	M	6 in'81	8.1	6.3	6.0	2.0	2.5	0.5	4.2	3.0
G281	F	4 in'81	1.9	1.7	1.7	0.2	0.2	0.1	1.0	0.9
G335	F	4 in'82	-	-	-	2.4	2.0	0.9	1.8	0.8
G340	F	4 in'82	-	-	-	0.3	17.7	17.6	11.9	10.0
G342	M	3 in'82	-	-	-	1.3	7.1	7.4	5.3	3.4
G312	F	11 in'81	2.1	0.6	-	1.6	-	-	1.4	0.8
G282	M	7 in'83	-	-	-	-	-	4.5	4.5	-
G379	F	6 in'83	-	-	-	-	-	5.3	5.3	-
		$\bar{x}$ =	4.3	3.3	3.6	2.6	4.3	3.9	$\bar{x}$ (N=56)=3.7	
		s =	2.7	2.3	2.2	2.0	5.1	5.1	s =3.5	
									Range =0.1-17.7	

* 83/84 den locations are preliminary, based on aerial locations.

Table 25. 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).

Bear ID	Sex	1980 Entrance			1981 Emergence			Days In Den		
		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	13 Oct	27 Oct	20 Oct	7 Apr	21 Apr	14 Apr	162	190	176
283	F	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	13 Oct	27 Oct	20 Oct	7 Apr	21 Apr	14 Apr	162	190	176
308	F	13 Oct	27 Oct	20 Oct	30 Apr	5 May	2 May	185	204	195
312	F	29 Sep	-	-	30 Apr	6 May	3 May	-	-	-
313	F	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 26. 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	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	1 Oct	7 Oct	4 Oct	6 May	12 May	9 May	211	223	217
283	F	1 Oct	7 Oct	4 Oct	12 May	18 May	15 May	217	229	223
293	M	22 Sep				1 Jun				
299	F	1 Oct	7 Oct	4 Oct	19 Apr	6 May	28 Apr	194	217	206
312	F	1 Oct	16 Oct	8 Oct	12 May	18 May	15 May	208	229	218
313	F	7 Oct	16 Oct	12 Oct	18 May	26 May	22 May	214	231	222
331	F	7 Oct	16 Oct	12 Oct	6 May	12 May	9 May	202	217	210
335	F	1 Oct	7 Oct	4 Oct	19 Apr	6 May	28 Apr	194	217	206
337	F	1 Oct	7 Oct	4 Oct	18 May	26 May	22 May	223	237	230
340	F	7 Oct	16 Oct	12 Oct	19 Apr	6 May	28 Apr	185	211	198
341	F	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	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 27. 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).

		1982 Entrance			1983 Emergence			Days in Den		
Bear ID	Sex	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	6 Oct	20 Oct	13 Oct	14 May	16 May	15 May	206	222	214
283	F	6 Oct	15 Oct	10 Oct	14 May	15 May	15 May	211	221	217
299	F	6 Oct	15 Oct	10 Oct	23 May	1 Jun	28 May	220	238	230
312	F	6 Oct	20 Oct	13 Oct	25 Apr	4 May	30 Apr	187	210	199
313	F	15 Oct	20 Oct	18 Oct	14 May	15 May	15 May	206	212	209
335	F	20 Sep	6 Oct	28 Sep	17 Apr	25 Apr	21 Apr	193	217	205
337	F	20 Oct	15 Nov	2 Nov	10 May	14 May	12 May	176	206	191
340	F	6 Oct	15 Nov	26 Oct	25 Apr	4 May	30 Apr	161	210	186
344	F	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	20 Oct	17 Nov	4 Nov	25 Apr	4 May	30 Apr	159	196	177
381	F	6 Oct	15 Oct	10 Oct	17 Apr	25 Apr	21 Apr	184	201	193
380	F	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 28. Brown bear den entrance and emergence dates, winter of 1983/84.

Bear ID	Sex	1983 Entrance			1984 Emergence			Days in Den		
		Min.	Max.	Mid.	Min.	Max.	Mid.	Min.	Max.	Mid.
G279	M	26 Sep	24 Oct	10 Oct						
G280	M	5 Oct	25 Oct	15 Oct						
G281	F	26 Sep	24 Oct	10 Oct						
G282	M	5 Oct	24 Oct	15 Oct						
G283	F	26 Sep	5 Oct	1 Oct						
G293	M	27 Sep	---	---						
G299	F	27 Sep	24 Oct	11 Oct						
G313	F	5 Oct	24 Oct	15 Oct						
G315	F	26 Sep	24 Oct	10 Oct						
G335	F	15 Sep	26 Oct	6 Oct						
G337	F	5 Oct	24 Oct	15 Oct						
G340	F	5 Oct	24 Oct	15 Oct						
G342	M	26 Sep	14 Nov	21 Oct						
G344	F	5 Oct	14 Nov	25 Oct						
G379	F	5 Oct	14 Nov	25 Oct						
G381	F	25 Oct	---	---						
G384	F	5 Oct	25 Oct	15 Oct						
G385	F	26 Sep	24 Oct	10 Oct						
G386	M	5 Oct	24 Oct	15 Oct						
G388	F	26 Sep	15 Nov	21 Oct						
G390	M	5 Oct	24 Oct	15 Oct						
G391	F	5 Oct	24 Oct	15 Oct						
G393	F	27 Sep	---	---						
G394	F	5 Oct	24 Oct	15 Oct						
G396	F	27 Sep	25 Oct	11 Oct						
G399	M	5 Oct	25 Oct	15 Oct						
G400	M	27 Sep	24 Oct	11 Oct						
G403	F	24 Oct	14 Nov	4 Nov						
	Mean	2 Oct	27 Oct	15 Oct						
	"S"	8.2	9.6	7.5						
	n	28	25	25						

Table 29. Mean den entrance and emergence dates of male and female brown bears. ("S" is the standard deviation, but it includes variability from the fluctuating time between observations, as well as variability in denning times).

			Females			Males		
			mean	"S"	n	mean	"S"	n
1980	Entrance	Minimum	4 Oct	14	6	13 Oct	N/A	1
		Maximum	24 Oct	7	6	27 Oct	0	2
		Mid point	14 Oct	12	5	20 Oct	N/A	1
1981	Entrance	Minimum	3 Oct	3	11	22 Sep	0	2
		Maximum	11 Oct	5	11	16 Oct	21	2
		Mid point	7 Oct	4	11	27 Sep	N/A	
1982	Entrance	Minimum	9 Oct	9	11	13 Oct	10	2
		Maximum	27 Oct	16	11	30 Oct	22	2
		Mid point	18 Oct	12	11	22 Oct	16	2
1983	Entrance	Minimum						
		Maximum						
		Midpoint						
1981	Emergence	Minimum	21 Apr	11	6	14 Apr	10	2
		Maximum	29 Apr	7	6	26 Apr	6	2
		Mid point	24 Apr	9	6	20 Apr	8	2
1982	Emergence	Minimum	3 May	12	11	19 Apr	0	2
		Maximum	14 May	8	11	14 May	16	3
		Mid point	9 May	10	11	27 Apr	1	2
1983	Emergence	Minimum	4 May	13	13	17 Apr	0	2
		Maximum	10 May	11	13	25 Apr	0	2
		Mid point	7 May	12	13	21 Apr	0	2

Table 30. Predicted and observed spring 1983 reproductive status of radio-collared female black bears.

ID	1983 age	Predicted 1983 status*	Comments	Observed 1983 status
289	12	cubs	weaned ylgs and bred in '82	2 cubs
301	10	cubs	weaned ylgs and bred in '82	2 cubs
317	10	cubs	weaned ylgs in '81, no cubs in '82	2 cubs
318	8	cubs	weaned ylgs in '81, no cubs in '82 bred in '82	2 cubs
327	8	cubs	weaned ylgs in '81, no cubs in '82	2 cubs
321	13	cubs	lost cubs in '81, no cubs in '82	cubs
349	6	cubs	no offspring in '82, or fall '81	2 cubs
361	8	cubs	no offspring in '82	4 cubs
363	5	cubs	no offspring in '82, bred	alone
354	6	yearlings	cubs in '82	weaned litter
329	3	barren	subadult, not bred in '82	alone
367**	5	cubs?	first litter?	alone
369**	5	cubs?	first litter?	alone
378**	7	cubs	first litter?	alone
376**	7	cubs	first litter? Thought might have had ylgs in spring '82, based on age this is now considered unlikely	3 cubs
374**	8	cubs	weaned yearlings in '81 (probably)	3 cubs
372**	10	cubs	bred in '82	2 cubs
375**	10	cubs	may have weaned yearlings in '82	2 cubs
370**	8	cubs	alone in 1982	2 cubs
377**	5	cubs	alone in 1982	1 cub at least

* See Table 18 in Miller 1983, p. 69

** bear occurs in the downstream study area

Table 31. Predicted spring 1984 reproductive status of radio-collared female black bears.

ID	1984 age	Predicted 1984 status	Comments	Observed 1984 status
321	14	cubs	lost '83 litter in May	NA
349(missing)	7	cubs	apparently lost '83 litter, shed collar	NA
354	7	cubs	weaned '83 yearlings	NA
363	6	cubs	alone in '83	NA
369**	6	cubs?	first litter expected in '84	NA
377**	6	cubs	apparently lost '83 litter, shed collar	NA
402**	11	cubs	weaned '83 yearlings	NA
409**	6	cubs	apparently alone in '83	NA
411**	9	cubs	weaned '83 yearlings	NA
289	13	1 ylg	cubs in '83	NA
301(missing)	11	ylgs	cubs in '83, shed collar	NA
317	11	1 ylg	cubs in '83	NA
318(missing)	9	ylgs	cubs in '83, shed collar	NA
361	9	3 ylgs	cubs in '83	NA
370**(missing)	9	ylgs	cubs in '83, lost contact-shot?	NA
372**(missing)	11	ylgs	cubs in '83, lost contact-shot?	NA
375**	11	1-2 ylgs	cubs in '83	NA
376**	8	3 ylgs	cubs in '83	NA
378**	8	2 ylgs	cubs in '83	NA
404**	12	1-2 ylgs	cubs in '83, last seen in July '83	NA
405**	18	2 ylgs	cubs in '83	NA
406**	12	2 ylgs	cubs in '83	NA
329	4	barren?	first litter expected in 1985	NA

** bear occurs in the downstream study area

Table 32. Comparisons of black bear ages and sex ratios in upstream and downstream study areas. Includes bears 2.0 years old and older, age and sex ratio data based on first capture (recaptures not counted again).

	UPSTREAM STUDY AREA	DOWNSTREAM STUDY AREA	BOTH AREAS
No. males captured	25	5	30
No. females captured	20	17	37
No. males/100 females	125.0	29.4	81.1
Mean age (males)	5.5	4.2	5.3
range (age of males)	2-10	2-6	2-10
S.D.	3.0	1.6	2.8
Mean age (females)	6.9	7.5	7.1
range (age of females)	2-12	3-17	2-17
S.D.	2.9	3.5	3-2
mean age (both sexes)	6.1	6.7	6.3
S.D.	3.0	3.4	3.1

Statistical Tests:

H_0 = Same sex ratio in each study area
$X^2 = 13.6$, d.f. = 3, $p < 0.005$.*
H_0 = Mean age of males is the same in each study area
$t = 0.92$, d.f. = 28, $p > 0.2$
H_0 = Mean age of females is the same in each study area
$t = 0.59$, d.f. = 35, $p > 0.2$
H_0 = Mean age of bears is same in each study area
$t = 0.78$, d.f. = 65, $p > 0.2$
H_0 = Mean age of males = mean age of females (upstream data)
$t = 1.56$, d.f. = 43, $p > 0.10$
H_0 = Mean age of males = mean age of females (downstream data)
$t = 2.00$, d.f. = 20, $p < 0.10$*
H_0 = Mean age of males = mean age of females (both areas)
$t = 2.53$, d.f. = 65, $p < 0.025$*
(* = reject H_0)

Table 33. 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
Upstream Study Area						
287	M/10 in '80	A	A	Shot-F	-	-
288	F/10 in '80	A(shed)	ND	ND	ND	
289	F/9 in '80	A	A	A	A	
290	F/8 in '80	A	A(remvd)	ND	ND	
301	F/7 in '80	A	A	A	ND(shed)	
302	M/8 in '80	A	A	A(shot?)	-	-
303	M/8 in '80	A	A	A	Shot-F	-
304	M/10 in '80	A	A	A(shed)	ND	
305	M/9 in '80	Shot-F	-	-	-	-
307	M/2 in '80	A	Shot-S	-	-	-
310	M/2 in '80	ND	ND	ND	ND	
316	F/12 in '80	Shot-F	-	-	-	-
317	F/7 in '80	A-S	A	A	A	
318	F/5 in '80	A-S	A	A	ND-shed	
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	
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	
325	F/11 in '80	A-S	A	Shed	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	Shed	ND	
329	F/1 in '81	-	A	A	A	
330	M/1 in '80	-	died-S	-	-	-
342b	M/5 in '81	-	Shot-F	-	-	-
346	M/9 in '81	-	A	A	A	
348	M/9 in '81	-	A-S	Shot-F	-	-
349	F/4 in '81	-	A-S	A	shed	
354	F/5 in '82	-	-	A	A	
357	M/4 in '82	-	-	died-W	-	-
358	M/2 in '82	-	-	A	A	
359	M/4 in '82	-	-	A	A	
360	M/7 in '82	-	-	A	A	
361	F/7 in '82	-	-	A	A	
362	F/2 in '82	-	-	ND	ND	
363	F/4 in '82	-	-	A	A	
364	F/9 in '82	-	-	A,shot?	-	-
379	F/9 in '83	-	-	-	died-S	-
387	F/4 in '83	-	-	-	A	
401	M/3 in '83	-	-	-	A	

(continued on next page)

Table 33. Cont.

		1980	1981	1982	1983	1984
Upstream subtotals						
Maximum No. bears potentially alive (includes ND) in year (excludes natural mortalities (M:F)		24(12:12)	24(12:12)	27(12:15)	25(10:15)	
No. known shot (M:F)		4(2:2)	2(2:0)	2(2:0)	2(2:0)	
No. additional bears suspected shot (M:F)		0	0	2(1:1)	0	
% known or suspected shot		17%	8%	15%	8%	
Downstream Study Area						
343	M/5 in '81	-	A	A	A	
365	M/5 in'82	-	-	A	Died-F	
366	M/6 in '82	-	-	Shot-F	-	-
367	F/4 in '82	-	-	A	Shot-S	-
369	F/4 in '82	-	-	A	A	
370	F/7 in '82	-	-	A	(Shot?)-S	-
372	F/9 in '82	-	-	A	(Shot?)-S	-
374	F/7 in '82	-	-	A	Shot-F	-
375	F/5 in '82	-	-	A	A	
376	F/6 in '82	-	-	A	A	
377	F/5 in '82	-	-	A	A	
378	F/6 in '82	-	-	A	A	
402	F/10 in '83	-	-	-	A	
404	F/11 in '83	-	-	-	A	
405	F/17 in '83	-	-	-	A	
406	F/11 in '83	-	-	-	A	
408	M/3 in '83	-	-	-	A	
409	F/5 in '83	-	-	-	A	
410	F/7 in '83	-	-	-	Shot-S	
411	F/8 in '83	-	-	-	A	
Downstream subtotals						
Max. No. bears potentially alive (includes ND) in year (excludes natural mortalities) (M:F)		-	1(1:0)	12(3:9)	18(2:16)	
No. known shot (M:F)		-	0	1(1:0)	3(0:3)	
No. additional bears suspected shot (M:F)		-	0	0	2(0:2)	
% known or suspected shot		-	-	8%	28%	

(continued on next page)

Table 33. Cont.

	1980	1981	1982	1983	1984
Upstream & Downstream Areas Combined					
Total bears potentially alive in year (excludes natural mortalities, includes ND) (M:F)	24(12:12)	25(13:12)	39(15:24)	43(12:31)	
No. known shot (M:F)	4(2:2)	2(2:0)	3(3:0)	5(2:3)	
No. additional bears suspected shot (M:F)	0	0	2(1:1)	2(0:2)	
% known or suspected shot	17%	8%	13%	16%	

Table 34. 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 Oct. 1983, 9 months after recapture in den. Scavenged (killed?) by wolves. Guess may have been wounded by hunter (no evidence). Good condition.
Brown bears		
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).

Table 35. 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 Sept., other survived
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
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)
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
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
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, collar shed in July
B354 (5 in '82)	2	both survived to den entrance, at least 1 ylgs. at exit in '83
B361 (8 in '83)	4(in den) [3 at exit]	lost 1 in den prior to exit, others survived
B370 (8 in '83)	2(in den) [2 at exit]	bear missing after 5/23/83, cubs alive at that time

Table 35. (cont'd)

MOTHER'S ID (age-year)	LITTER SIZE	COMMENTS
B372* (10 in '83)	3(in den) [3 at exit]	lost 1 in early July, others survived to 7/20, female lost in Sept.
B374* (7 in '83)	3	think lost 2 in July, bear shot in Sept.
B375* (6 in '83)	2	think both survived
B376* (5 in '83)	3(in den) [3 at exit]	all survived
B377* (6 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
B378* (7 in '83)	2(den) [2 at exit]	both survived
B379 (9 in '83)	3(den) [2 at exit]	lost all cubs by 5/23/83, bred again, died in July
B404* (11 in '83)	1	survived thru 7/20 at least
B405* (17 in'83)	2	both survived
B406* (11 in '83)	2	both survived
B410* (7 in '83)	2	both survived thru June, bear shot in July

Total number of cubs	number of litters	mean litter size (range)	comments
59	27	2.2(1-4)	all cub litters counted at earliest observation
46	21	2.2(1-3)	spring observations only (w/o den data or summer litters)
52	22	2.4(1-4)	earliest observation excluding summer litters
27	11	2.5(2-4)	observations in dens only

* Downstream study area

Table 36. Summary of black bear litter size data based on observations of bears with litters of yearlings.

MOTHER'S ID (age-year)	LITTER SIZE	COMMENTS
B289 (9 in 1980)	2	weaned by 5/22/80, bred, 3 cubs in '81
B289 (11 in 1982)	2(in den)	weaned by 6/9/82, bred, had 2 cubs in 1983
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
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
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
B354 (6 in 1983)	1(?)	at least 1 ylg exited den (perhaps both?), weaned by 6/2/83
B402 (10 in 1983)	3	weaned in early July
B411 (8 in 1983)	2	weaned after 6/13
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)

Total number of ylgs. observed	number of litters	mean litter size (range)	comments
23	12	1.9(1-3)	all litters with ylgs. counted

Table 37. Summary of known losses of black bear cubs. 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	3 of 7 lost (289, 301, 321)	no data	3 of 7 lost
1982	0 of 2 lost (354)	no data	0 of 2 lost
1983 complete data	6 of 11 lost (289, 317, 361, 379)	1 of 12 lost (375, 376, 377, 378, 405, 406)	7 of 23 lost
1983 incomplete data*	4 of 4 lost (328, 349)	3 of 6 lost (372, 374)	7 of 10 lost
1983 preliminary total	10 of 15 = 67% lost	4 of 18 = 22% lost	14 of 33 = 42% lost
TOTALS (all years)	13 of 24 = 54% lost	4 of 18 = 22% lost	17 of 42 = 40% lost

* incomplete data resulted from not observing the family status of the bear before it entered its 1983/84 den, shed collars, collar failures, or early hunter kills. Tabulated losses occurred prior to loss of the female to these causes.

B404 (last seen on 7/20/83) not included in 1983
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.

Table 38. Morphometrics of black bear cubs-of-year handled in the Susitna Hydro Project.

CUB ID	MOTHER'S ID	DATE HANDLED	SEX	WT(lbs)	COMMENTS
--	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
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
355	B354	26 May 1982	F	--	ear tags
356	B354	26 May 1982	M	--	ear tags

Totals: 11 males and 22 females, In dens=10 males and 15 females.

Table 39. Morphometrics of black bear yearlings handled in the Susistna Hydro Project.

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

Totals: 4 males and 1 female

Table 40. Results of downstream (Curry-Devils Canyon) black bear census effort on 24 May 1983.

Sample Unit# (observer)	Size (mi^2)	Time spent (min.)	Total black bears seen	(No. marked)	Marked black bears present* (bear ID
37	20.1	0	-	-	343
40	12.4	0	-	-	369;406
41	9.8	0	-	-	-
42N	12.8	0	-	-	-
42S	15.0	0	-	-	367
43 (sm)	14.6	72	2	(0)	409
44 (dcm)	37.7	105	0	(0)	410;411; 372;370
45 (dcm)	20.8	115	2+3c	(0)	405;408; 377;376; 402;404
46 (sm)	12.3	62	1+1c	(0)	-
47 (sm)	14.7	29	1	(0)	375;378
TOTALS:	170.2 present 100.1 counted	383	6+4c	(0)	17 (13 in SUs counted)

*Based on precensus radio-tracking flight on 23 May 1983. Black bears 374 and 365 were outside of the sample unit borders on this flight although 374 had moved inside (SU 46) by June 1.

Table 41. Results of upstream (Devils Canyon-Oshetna) black bear census effort on 24-25 May 1983.

Sample Unit# (observer)	Size (mi^2)	Time spent (min.)	Total black bears seen	(No. marked)	Marked black bears present* (bear ID)
1 (dcm)	11.6	54	0	(0)	-
2	25.6	0	-	-	-
3	18.9	0	-	-	-
4 (sm)	15.4	57	0	(0)	-
5 (dcm)	14.0	63	0	(0)	324;303;321
6 (sm)	13.4	52	0	(0)	-
7A (dcm)	11.3	43	0	(0)	379
7B	10.1	0	-	-	401
8 (dcm)	12.6	64	1+2c	(1-317)	317;318
9 (dcm)	20.1	68	3	(0)	-
10	9.0	0	-	-	-
11	14.9	0	-	-	-
12	19.4	0	-	-	-
13	12.5	0	-	-	329;327
14	11.4	0	-	-	289
15	7.6	0	-	-	-
16	13.1	0	-	-	-
17	9.6	0	-	-	-
18 (sm)	11.2	71	0	(0)	-
19	8.7	0	-	-	-
20	22.7	0	-	-	349;387
21	14.2	68	0	(0)	361
22	7.7	45	0	(0)	-
23	9.6	0	-	-	-
24	11.8	0	-	-	-
25	20.9	0	-	-	359
26	20.7	0	-	-	360;358;323
27	8.6	0	-	-	-
28	13.4	0	-	-	-
29	14.0	0	-	-	363
30	10.8	0	-	-	354
31	12.1	0	-	-	-
32	11.9	0	-	-	301
33	9.5	0	-	-	-
34	19.5	0	-	-	-
35	14.6	0	-	-	-
36	17.9	0	-	-	-
TOTALS:	496.9 present 131.5 counted	585	4+2c	(1)	20 (7 in SUs counted)

*During precensus flight on 23 May 1983. All radio-marked bears were found inside the sample units except B346 and this bear was inside SU 29 on 2 June 1983.

Table 42. Results of upstream (Devils Canyon–Oshetna) black bear census effort on 19–20 August 1982.

Sample Unit# (observer)	Size (mi^2)	Time spent (min.)	Total black bears seen (No. marked)	Marked black bears present* (bear ID)
1 (sm)	11.6	55	3(1)	321
2	25.6	-	-	-
3	18.9	-	-	-
4 (sm)	15.4	47	0(0)	-
5 (sm)	14.0	39	0(0)	-
6 (sm)	13.4	34	2(1)	289
7 (sm)	21.4	79	3(3)	287,303,324,317
8 (sm)	12.6	47	0(0)	-
9 (sm)	20.1	46	1(0)	-
10 (sm)	9.0	35	1(0)	-
11	14.9	-	-	-
12 (dcm)	19.4	67	1(0)	-
13 (dcm)	12.5	54	2(0)	329,327
14 (sm)	11.4	42	1(1)	-
15 (dcm)	7.6	41	1(0)	361,364
16 (dcm)	13.1	47	0(0)	-
17	9.6	-	-	-
18 (dcm)	11.2	47	0(0)	349
19	8.7	-	-	-
20 (sm)	22.7	92	2(0)	-
21 (dcm)	14.2	73	1(0)	-
22 (dcm)	7.7	51	0(0)	-
23 (sm)	9.6	38	2(0)	-
24 (dcm)	11.8	29	0(0)	-
25 (sm)	20.9	79	0(0)	-
26	20.7	65	0(0)	357,358,323
27 (sm)	8.6	25	0(0)	-
28	13.4	-	-	-
29 (dcm)	14.0	55	1(0)	363
30 (dcm)	10.8	55	1(1)	354,359
31 (dcm)	12.1	50	2(0)	301
32 (dcm)	11.9	40	1(1)	346
33 (dcm)	9.5	58	5(1)	360,318
34 (dcm)	19.5	56	0(0)	-
35 (sm)	14.6	74	6(0)	-
36 (sm)	17.9	40	1(0)	-
37** (dcm)	20.1	67	1(0)	-
TOTALS:	517.0 present 439.3 counted	1627	38(9)	21 (all in SUs counted)

*During precensus flight on 17–18 Aug. 1982. All radio-marked bears were found inside the sample units.

**In 1982 SU 37 was included in the downstream study area.

Table 43a. Spring home ranges (1April - 5 July) sizes (km^2) of individual female black bears upstream of Devils Canyon used as basis for density calculations. Only bears ≥3 y included in summary. Number of points indicated in brackets. Excludes den codes I, D, P, and J.

Bear ID(age in first year monitored	1980	1981	1982	1983
B288(10)	3.8[9]	---	---	---
B289(9)	26.5	21.5[7](w/3c)	12.8[6]	2.5[6]
B290(8)	13.7[10]	13.3[8]	---	---
B301(7)	8.0[10]	0.7[5](w/2c)	8.6[8]	0.3[6](w/2c)
B317(7)	--	8.0[7]	4.1[6]	5.7[7](w/2c)
B318(5)	--	10.4[8]	7.1[6]	3.5[5]
B321(10)	--	4.2[7](w2c)	8.6[7]	16.6[8]
B327(5)	--	30.1[25]	12.4[6]	2.9[7](w/2c)
B328(6)	--	2.1[8](w/2c)	---	---
B329(1 in 1981)	--	---	---	4.2[7]
B349(4)	--	---	2.8[8]	7.5[5]
B354(5)	--	---	12.1[6](w/2c)	37.1[5]
B361(7)	--	---	6.9[6]	1.6[5](w/3c)
B363(4)	--	---	12.3[6]	15.2[7]
B364(9)	--	---	45.4[6]	---
B379(9)	--	--	--	3.7[6](w/3c)
Summary by bear-year (all females)				(Overall mean)
Mean=	13.0	11.3	12.1	8.4	10.8
S.D.=	9.9	10.2	11.6	10.4	10.4
N=	4	8	11	12	35
range=	3.8-26.5	0.7-30.1	2.8-45.4	0.3-37.1	0.3-45.4
Females w/o cubs					
Mean=	13.0	15.5	12.1	12.4	12.9
S.D.=	9.9	10.0	12.2	12.3	11.0
N=	4	4	10	7	25
range=	3.8-26.5	8.0-30.1	2.8-45.4	2.5-37.1	2.5-45.4
Females w/cubs					
Mean=	--	7.1	12.1	2.8	5.5
S.D.=	--	9.7	--	2.1	6.6
N=	--	4	1	5	10
range=	--	0.7-21.5	--	0.3-5.7	0.3-21.5

Table 43b. Spring home ranges (Jan - 10 July) sizes (km^2) of individual female black bears upstream of Devils Canyon used as basis for density calculations. Only bears ≥3 y included in summary. Number of points indicated in brackets.

Bear ID (age in first year monitored	1980	1981	1982	1983	Inclusive 1980-1983
B288(10)	3.8[10] (shed in Sep)	-	-	-	-
B289(9)	30.6[8]	21.5[9] (w/3c)	15.8[8]	2.7[8]	48.7[33]
B290(8)	34.2[11]	19.0[11] (thru 8/6 collar removed)	-	-	49.1[22]
B301(7)	8.0[11]	1.3[7] (w/2c)	8.9[10]	0.8[8] (w/2c) thru July-shed	18.5[36]
B317(7)	-(summer capt. w/2c)	8.0[9]	6.5[8]	6.1[9] (w/2c) shot 9/8	13.9[26]
B318(5)	-(summer capt.)	11.7[9]	16.3[9]	4.4[7] (thru 7/8 shed	23.4[25]
B321(10)	-(summer capt.)	4.2[7] (w/2c)	12.9[10]	24.1[10]	27.4[27]
B325(11)	-(summer capt.)	-(summer)	-(shed)	-	-
B327(5)	-(summer capt., w/2c)	30.1[26]	13.0[8]	5.5[9] (w/2c) died 7/8	34.1[43]
B328(6)	-(summer capt.)	2.1[9] (w/2c)	-(shed)	-	-
B329(1 in 1981)		7.3[8] (age=1)	4.1[8] (age=2)	4.5[9]	19.1[25]
B349(4)		-(summer capt.)	8.6[10]	15.8[7] (lost cubs in May)-shed 8/1	24.4[17]
B354(5)			16.1[7] (w/2c)	50.2[8]	67.3[15]
B361(7)			22.6[7]	46.1[7] (w/3c)	72.6[14]
B363(4)			13.4[7]	18.3[9]	24.6[16]
B364(9)			82.8[7] (thru Sep radio failed?)	-	-
B379(9)				3.8[7] (3 cubs lost in May, died 7/1)	-
Summary by bear-year (all females)					(Overall mean)
Mean=	19.2	12.2	19.7	15.2	16.4
S.D.=	15.5	10.4	21.4	17.0	16.7
N=	4	8	11	12	35
range=	3.8-34.2	1.3-30.1	6.5-82.8	0.8-50.2	0.8-82.8
Females w/o cubs					
Mean=	19.2	17.2	20.1	17.4	18.8
S.D.=	15.5	9.7	22.5	18.3	17.8
N=	4	4	10	6	24
range=	3.8-34.2	8.0-30.1	6.5-82.8	2.7-50.2	3.8-82.8
Females w/cubs					
Mean=	-	7.3	16.1	13.0	11.2
S.D.=	-	9.6	-	17.0	13.5
N=	0	4	1	6	11
range=	-	1.3-21.5	-	0.8-46.1	0.8-46.1

Table 44. Spring home range (Jan - 10 July) sizes (km^2) of individual female black bears downstream of Devils Canyon used as basis for density calculations. Only bears ≥3 years of age included in summary. Number of points indicated in brackets.

Bear ID (age in first year monitored	1982	1983	Inclusive 1982-1983
B367(4)	7.4[7]	3.5[7] (shot 7/31)	8.9[14]
B369(4)	3.2[7]	9.4[8]	12.1[15]
B370(7)	29.8[7]	-(lost 5/31 w/cubs)	-
B372(9)	18.5[7]	5.2[7] (w/3c)-lost 9/1	18.8[14]
B374(7)	-(malfunction)	5.1[9] (w/3c)-shot 9/6	-
B375(9)	2.8[5]	8.4[9] (w/2c)	27.7[14]
B376(6)	-(malfunction)	1.9[9] (w/3c)	-
B377(4)	4.4[5]	15.9[8] (w/1c)	16.0[13]
B378(6)	4.6[5]	5.6[9] (w/3c)	8.6[14]
B402(10)		1.2[7]	-
B404(11)		4.2[6] (w/1c)	-
B405(17)		3.0[6] (w/2c)	-
B406(11)		4.8[6] (w/2c)	-
B409(5)		2.2[6]	-
B410(7)		8.4[6] (w/2c)-shot 7/21	-
B411(8)		7.4[6]	-
Summary by bear-year (all females)			(Overall mean)
Mean=	10.1	5.8	7.1
S.D.=	10.2	3.8	6.6
N=	7	15	22
range=	2.8-29.8	1.2-15.9	1.2-29.8
Females w/o cubs			
Mean=	10.1	4.7	7.9
S.D.=	10.2	3.5	8.3
N=	7	5	12
range=	2.8-29.8	3.5-9.4	2.8-29.8
Females w/cubs			
Mean=	-	6.3	6.3
S.D.=	-	4.0	4.0
N=	0	10	10
range=	-	1.2-15.9	1.2-15.9

Table 45. Annual home range sizes for the Su Hydro downstream black bears (includes individuals with 5 or more locations).

ID (age in first year monitored)	1982 Observation Period (No. of Locations)	1982 Home Range (km^2)	1983 Observation Period (No. of Locations)	1983 Home Range (km^2)	Comments
MALES					
408 (3)	---	---	May-Oct (16)	227	
365 (5)	May-Sep (11)	656	May-Sep (15)	252	died 9/83
366 (6)	May-Aug (10)	136	shot 9/82	--	
FEMALES					
369 (4)	May-Sep (18)	10	May-Oct (20)	26	
367 (4)	May-Sep (17)	18	May-Jul (9)	4	
377 (4)	Jun-Sep (15)	12	May-Oct (18)	25(w/cubs)*	
409 (5)	--	--	May-Oct (16)	26	
376 (6)	Jun-Sep (13)	21	May-Oct (21)	34(w/3@c)	
378 (6)	Jun-Sep (14)	8	May-Oct (20)	10(w/2@c)	
370 (7)	May-Sep (18)	16	May [4]	--(w/cubs)	lost 5/83
374 (7)	malfunction[3]	--	May-Sep (16)	30(w/3@c)	shot 9/83
410 (7)	--	--	May-Jul (9)	19(w/2@c)	shot 7/83
411 (8)	--	--	May-Oct (17)	31	
372 (9)	May-Sep (17)	56	May-Aug (13)	76(w/2@c)	lost 9/83
375 (9)	Jun-Sep (16)	17	May-Jul (9)	4(w/2@c)	
402 (10)	--	--	May-Oct (17)	13	
404 (11)	--	--	May-Oct (16)	36(w/1@c)	
406 (11)	--	--	May-Oct (17)	18(w/2@c)	
405 (17)	--	--	May-Oct (17)	25(w/2@c)	
$\bar{x}$(all females)=	--	(16.0)	19.8	(15.7)	25.1
S.D. =		1.9	15.3	4.0	17.3
range =		(13-18)	8-56	(9-21)	4-76
$\bar{x}$(all males and females)=		14.9	95.0	15.7	50.4
S.D. =		2.9	200.9	3.7	73.2
range =		(10-18)	(8-656)	(9-21)	(4-252)

* litter lost in May

Table 46. Annual home range sizes for Su-Hydro upstream study area black bears. (Includes individuals with 5 or more locations).

Bear ID (age @ capture)	1980 Obs. Period (No. locations)	1980 Home Range (km^2)	1981 Obs. Period (No. locations)	1981 Home Range (km^2)	1982 Obs. Period (No. locations)	1982 Home Range (km^2)	1983 Obs. Period (No. location)	1983 Home Range (km^2)
Males								
330 (1)	---	---	May-Oct (14)	10	dead 7/81	---	---	---
323 (2)	Aug-Oct (6)	20	May-Oct (19)	383	May-Oct (20)	1126	May-Sep (17)	1089(shot 9/83)
358 (2)	---	---	---	---	May-Oct (17)	11	May-Oct (17)	53
319 (3)	May-Jul (6)	67	May-Jul (10)	43	dead 7/81	---	---	---
401 (3)	--	--	--	---	--	--	May-Oct (18)	91
291 (4)	May-Jul (7)	20	Dead 7/80	---	---	---	---	---
322 (4)	Aug-Oct (5)	10	Shed 12/80	---	May-Jul (7)	21	dead 7/82	
359 (4)	---	---	---	---	May-Oct (18)	83	May-Oct (19)	154
357 (4)	---	---	---	---	May-Oct (18)	11	dead 10/82	---
387 (4)	---	--	--	--	--	---	May-Oct (16)	164
324 (5)	Aug-Oct (6)	29	May-Oct (20)	248	May-Oct (21)	140	May-Oct (17)	170
342B(5)	---	---	May-Sep (40)	611	shot 9/81	---	---	---
343 (5)	---	---	May-Oct (16)	289	May-Oct (19)	370	May-Oct (20)	501
302 (8)	May-Jul (6)	4	May-Oct (36)	326(shed)	May-Jul (11)	51	missing	--
303 (8)	May-Oct (15)	95	May-Oct (18)	93	May-Oct (20)	74	May-Aug (11)	43(shot 9/83)
305 (9)	May-Aug (9)	48	shot 8/80	---	---	---	---	---
346 (9)	---	---	May-Oct (16)	62	May-Oct (22)	91	May-Oct (16)	119
348 (9)	---	---	Aug-Oct (7)	389	May-Jun (9)	136	shot 9/82	---
287(10)	May-Oct (17)	136*	May-Oct (15)	268*	May-Sep (18)	250	shot 9/82	---
304(10)	May-Sep (15)	35*	May-Oct (18)	41*	shed 7/82	---	---	---
$\bar{x}$(all males)=	(9.2)	46.0	(18.3)	230.3	(16.7)	197.0	(16.8)	253.8
S.D. =	--	42.0	--	184.5	--	311.0	--	343.4
range =	(5-17)	4-136	(7-40)	10-611	(9-22)	11-1126	(11-20)	43-1089

(Continued on next page)

Table 46. (continued)

Bear ID (age @ capture)	1980 Obs. Period (No. locations)	1980 Home Range (km^2)	1981 Obs. Period (No. locations)	1981 Home Range (km^2)	1982 Obs. Period (No. locations)	1982 Home Range (km^2)	1983 Obs. Period (No. locations)	1983 Home Range (km^2)
FEMALES								
329 (1)	---	---	May-Oct (19)	15	May-Oct (19)	9	May-Oct (18)	24
363 (3)	---	---	---	---	May-Oct (18)	20	May-Oct (18)	21
349 (4)	---	---	Aug-Oct (6)	36	May-Oct (20)	47	May-Jul (8)	16(shed)
318 (5)	Aug-Oct (6)	25(w/1@c)	May-Oct (20)	1036	May-Oct (20)	472	May-Jul (7)	4(shed)
327 (5)	Aug-Oct (6)	3(w/2@c)	May-Oct (35)	31	May-Oct (19)	34	May-Jul (9)	6(dead)
354 (5)	---	---	---	---	May-Oct (19)	65(w/2@c)	May-Oct (17)	62
328 (6)	Aug-Oct (6)	4	May-Oct (19)	28(w/2@c)	shed 12/81	---	---	---
301 (7)	May-Oct (20)	18	May-Oct (15)	13(w/2@c)	May-Oct (18)	18	May-Jul (9)	1(w/2@c)(shed)
317 (7)	Aug-Oct (6)	4(w/2@c)	May-Oct (19)	14	May-Oct (18)	44	May-Oct (19)	17(w/1@c)
360 (7)	---	---	---	---	May-Oct (20)	145	May-Oct (19)	299
361 (7)	---	---	---	---	May-Oct (18)	88	May-Oct (16)	60(w/3@c)
290 (8)	May-Oct (18)	45	May-Aug (15)	116	collar removed	---	---	---
289 (9)	May-Oct (14)	43	May-Oct (20)	26(w/3@c)	May-Oct (20)	29	May-Oct (17)	19(w/2@c)
364 (9)	---	---	---	---	May-Sep (16)	122	lost 9/82	---
379 (9)	---	--	---	---	---	---	May-Jul (8)	29(w/2@c)(dead)
288(10)	May-Aug (16)	7	shed 8/80	---	---	---	---	---
321(10)	Aug-Oct (6)	3	May-Oct (14)	771(w/2@c)	May-Oct (20)	14**	May-Oct (18)	29
325(11)	Aug-Oct (6)	8	Aug-Oct (9)	136	shed 12/81 & 12/80	---	---	---
$\bar{x}$(all females)=	(10.4)	16	(16.7)	200	(18.9)	85.2	(14.1)	45.2
S.D.=	---	16	---	355	---	123.7	---	78.5
Range=	(6-20)	3-45	(6-34)	12-1036	(16-20)	9-472	(7-19)	4-299
$\bar{x}$(all males & females)=	(9.8)	31	(17.9)	216.7	(17.8)	133.9	(15.2)	130.5
S.D.=	---	35	---	273	--	236.3	--	243.8
Range=	(5-20)	3-136	(6-40)	10-1036	(9-22)	9-1126	(7-20)	4-1089

* Excludes atypical location of 80/81 den
** Cubs lost in Aug.

Table 47. Comparisons of berry abundance in 4 transects in 1982 & 1983 (10 plots of one square meter/transect) in the impoundment study area.

	Transect 1		Transect 4		Transect 2		Transect 3	
Location	Between Vee Canyon and Oshetna (upstream)		Confluence of Susitna R. and Deadman (downstream)		Vee Canyon-Oshetna Ck. (upstream)		Middle Deadman-Watana Camp (downstream)	
Elevation	2325 feet		2100 feet		3050 feet		2450 feet	
Aspect	218°		239°		216°		201°	
Slope	8°		4°		5°		7°	
Vegetation type	WSB		WSB		B*		B	
Date	8/21/82	8/18/83	8/21/82	8/18/83	8/21/82	8/18/83	8/21/82	8/18/83
Blueberries (Vaccinium uliginosum)								
No. berries	303	238	32	41	489	1104	77	297
range (no/plot)	1-191	0-120	0-8	0-19	0-164	59-202	0-31	0-119
S.D.	57	39	3.2	6.2	54.9	53.6	11.7	39.4
% canopy cover:								
mean	21.2	24.0	31	22.5	36.0	41.0	57.0	44.5
range	5-60	10-40	15-70	10-60	5-80	15-70	15-80	30-70
S.D.	15.9	11.3	17.9	15.9	24.6	19.3	23.0	15.0
Lowbush cranberry (V. vitis-idaea)								
No. berries	28	94	0	127	45	604	23	102
range	0-15	0-23	-	0-114	0-16	4-109	0-15	0-33
S.D.	5.1	9.1	-	35.6	-	36.7	-	11.5
% canopy cover:								
mean	3.4	15.1	3.9	9.3	6.7	36.5	8.7	20.0
range	0-10	1-50	0-15	0-25	2-10	15-80	0-30	10-60
S.D.	3.5	14.8	5.1	11.7	3.0	19.6	8.6	15.5
Crowberries (Empetrum nigrum)								
No. berries	17	65	112	614	200	452	1	344
range/plot	0-10	0-39	0-58	0-261	0-50	0-169	-	0-128
S.D.	3.1	13.0	17.9	80.8	19.7	52.8	-	40.1
% Canopy cover:								
mean	2.9	8.0	10.2	18.5	10.9	18.0	0.4	16.5
range	0-10	0-30	0-30	5-35	0-50	0-50	0-2	0-30
S.D.	3.4	8.9	10.2	11.1	14.5	17.5	-	11.1
Bearberry (Arctostaphylos uva-ursi)								
No. of berries	22	22	0	0	0	0	0	0
range/plot	0-20	0-19	-	-	-	-	-	-

* Transect #2 was clearly in a birch shrub type although according to the vegetation map it was in woodland black spruce (WSB).

Berryweights on 8/18/83=
130 gms/1000 for V. vitis-idaea
304 gms/1000 for V. uliginosum
260 gms/1000 for E. nigrum

Table 48. 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 sub-average	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 emmigration 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.

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Table 48. (continued)

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.

Table 49. Scat 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	Location	Sample No.	Comments	1	2	3	4	5	7	9	10	11	12	13	14	15	16	17	18
Summer - Fall - Sloughs																				
8/25/83	?	downstream	5	Slough 8A					5										2	
8/25/83	?	downstream	7	Slough 8A			T		5											
8/25/83	?	downstream	8	Slough 8A					5											
8/25/83	?	downstream	28	Slough 8A	T				5											2
8/25/83	?	downstream	31	Slough 8A					4		2								T	T
8/24/83	?	downstream	13	Slough 8B			T		5						T				T	
8/24/83	?	downstream	4	Slough 8B					5									T	T	T
8/24/83	?	downstream	21	Slough 8B			T		5										T	
8/24/83	?	downstream	17	Slough 8B					5										T	T
8/24/83	?	downstream	30	Slough 8B	T		T		4		T								T	T
8/24/83	?	downstream	6	Slough 8B	T				4		T									2
8/24/83	?	downstream	18	Slough 8B					3										T	2
8/24/83	?	downstream	9	Slough 8B					3										3	T
8/24/83	?	downstream	15	8B + nematode	3		3		3											
8/25/83	?	downstream	14	Slough 8A					4									T	T	T
8/25/83	?	downstream	22	Slough 8A	T		2		2		5						T	(ants)		2
8/25/83	?	downstream	3	Slough 11					5											
8/26/83	BRB?	downstream	43	Slough 20					3											
8/26/83	BRB?	downstream	33	Slough 21					5											T
8/26/83	BRB?	downstream	29	Slough 21			T		5		T								T	
8/26/83	BRB?	downstream	26	Slough 21					5											
8/26/83	?	downstream	24	Slough 21	3				3									2		T
8/26/83	?	downstream	16	McKenzie Ck.					5					T			T		T	T
8/25/83	?	downstream	19	Moose Ck.	2				5									T	T	T
8/25/83	?	downstream	27	Moose Ck.					5											T
8/25/83	?	downstream	11	Moose Ck.					5											
8/24/83	?	downstream	12	Slough 8	T		T		5											T
8/25/83	?	downstream	23	Slough 8A			T		5								T	(ants)		
8/25/83	?	downstream	20	Slough 8A					5											
8/25/83	?	downstream	25	Slough A'	T		3		3		T							T		T
8/18/83	?	upstream	42	Berry Plot #1		3							T		T			2		
8/18/83	?	upstream	44	Berry Plot #2		3				3			T			T	T		T	
8/18/83	?	upstream	45	Berry Plot #1		T				3	T	T						3		
8/18/83	?	upstream	46	Berry Plot #1	2	3					2									
Spring Samples																				
5/19/83	BKB	upstream	36	B404	2						5									
6/7/83	?	upstream	32	Forest area	5															
6/7/83	BKB	upstream	34	B361 den	5	T					2									
6/8/83	?	upstream	35	+ nematodes		3		3												
6/8/83	BKB	upstream	40	B372 den							5									
6/9/83	BKB	upstream	10	B374							5									
6/10/83	BKB	upstream	37	B358 den		2		2		2		T	T					T		
6/9/83	?	downstream	38	Deadhorse Ck.	5												T			

(Continued)

Table 49. (continued)

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

Berries

2. Vaccinium vitis-idea (lowbush cranberry)
4. Empetrum nigrum (cranberry)
5. Oplopanax horridus (Devil's Club)
6. Arctosptaphylos alpina (bearberry)
7. Vaccinium uliginosum (blueberry)
17. Other berries
Sambucus racemosa (red elderberry)
Oxycoccus microcarpus (bog cranberry)
Sorbus scouplina (Greene Mt. ashberry)
Sheperdia canadensis (soapberry) - #42
Cornus canadensis (Cornus berry)
Strepotpus amplexifolius (watermelon berry)

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, 1981-1983.

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

(continued on next page)

Table 50. (cont'd)

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

* 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. Number of Susitna River crossings by radio-marked black bears, 1980-1983.

Bear ID	Yr. initial capture (age)	No. river crossings by upstream bears 1980	1981	1982	1983	Comments
Males (upstream)						
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	active
319	1980(3)	4	3	-	-	dead, 9/81
401	1983(3)	-	-	-	2	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	active
387	1983(4)	-	-	-	0	active
324	1980(5)	0	4	4	4	active
342B	1981(5)	-	0	-	-	shot (hunter) 9/81
343	1981(5)	-	3	3	2	active
300	1980(7)	-	-	-	-	dead 5/80
360	1982(7)	-	-	2	4	active
302	1980(8)	0	12	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	active
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	

(continued)

Table 52. (continued)

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

(continued)

Table 52. (continued)

Bear ID	Yr. Initial capture (age)	1982	1983	Comments
Males (downstream)				
408	1983(3)	-	0	active
365	1982(5)	0	0	dead 9/83
366	1982(6)	1	-	shot 8/82
Total Males		1		
Females (downstream)				
369	1982(3)	0	0	active
367	1982(4)	0	0	shot ("DLP")
377	1982(4)	2	3	active
409	1983(5)	-	0	active
376	1982(6)	2_{y1}	4_{*3}	active
378	1982(6)	0	0_{*1}	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}	active
375	1982(9)	5	4_{*1}	active
372	1982(9)	0	0_{*2}	missing**
402	1983(10)	-	2_{y3}	active
404	1983(11)	-	2_{*1}	active
406	1983(11)	-	0_{*2}	active
405	1983(17)			0_{*2} active
Total females (downstream)		9	17	
Total both sexes (downstream)		10	17	

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

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

Table 53. Characteristics of black bear dens in the Susitna study area during winters of 1980/1981, 1981/1982, 1982/1983, 1983/84.

	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	W**	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	253	Alder, Willow	30	41	48	1220	-	-	1220	Yes	1	-	-
w/3 @0	93	B374	7	1775	42	204	Alder, Grass	60	33	81	-	-	36	117	Yes	-	-	-
FEMALES w/o offspring (at exit)																		
	85	B377	6	2270	47	127	Alder, Grass	10	-	-	-	-	-	-	-	-	-	-
	33	B318	7	1890	41	361	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	-
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
	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
	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

(continued on next page)

Table 53. (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
UNKNOWN SEX	72	-	-	2370	30	168	Spruce, Birch	0	41	23	-	58	89	1068**	Yes	3	-	No
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	379	Alder/birch	80	22	59	163	203	116	198	?	4	-	Yes
w/2 ylgs	50	B301	9	2275	43	219	Cottonwood, Spruce	20	28	56	76	136	98	193	Yes	2	-	No
w/2 @0	68	B318	8	1975	32	0	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	-	-	-
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	-	-

(continued on next page)

Table 53. (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	SMIL(SM-1 C
MALES	99	B363	5	2775	21	177	Alder	90	30	74	-	112**	53**	94**	No	3	-	No
	20*	B323*	3	1950	46	176	Alder/birch	-	-	-	-	-	-	-	?*	-	-	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	-	-	-	-	-	-	-	-			
SPECIES UNKNOWN	3	-	-	2340	35	(254)	Dwarf birch	0	50	54	-	-	-	170	No	-	-	No
UNKNOWN CAVITY TYPE																		
MALES	40	B324	7	1400**	-	-	--	-	-	-	-	-	-	-	-	-	?	-
	49	B323	4	1875**	41	204**	Spruce, Birch	-	-	-	-	-	-	-	-	-	-	?
	51	B346	10	2370**	30	168**	Spruce, Birch	0	38	53	-	-	48	-	Yes	-	-	No
	62	B319	4	1600**	60**	90**	Spruce, Alder	-	-	-	-	-	-	-	-	-	-	-
FEMALES	65	B329	1	1900**	45**	0**	--	-	-	-	-	-	-	-	-			
	63	B290	9	1850**	15**	45**	--	-	-	-	-	-	-	-	-	-	-	-
	64	B290	9	1700**	15**	0**	--	-	-	-	-	-	-	-	-	-	-	-
UNKNOWN SEX	61	?	?	2400	35**	163**	Spruce, Alder, Birch	80	-	-	-	-	-	-	No	4	-	No

* Actual den site not found or too difficult to enter.
** 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?

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.

Table 54. History of use of individual black bear dens by radio-marked black bears, 1980/81 - 1983/84 (blanks indicate no data available, den not revisited and no radio-marked bear there).

Den No.	Den Type	Flooded	Location***	80/81	81/82	82/83	83/84
2	Dug	Yes	W	B301 female w/2@0	Vacant	Vacant	
4	Dug	Yes	W	B289 female w/3@0	B289 female w/2@1	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
10	Nat	No	D	B303 male	B303 male	B303 male	
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	-	Yes	W	B323 male			
21	Dug	Yes	W	B327 female w/2@1(B329,F)	B329 female w/o	Collapsed	
32	Nat	No	D		B328 female w/1@1	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		
39	Dug	No	DS		B348 male	Vacant	
40	-	Yes	D		B324 male		
43	Dug	No	D		B317 female w/o		
49	-	Yes	W		B323 male		
51*	Nat	No	W		B346 male	B323 male	B346 male
50	Dug	No	W		B301 female w/2@1	Vacant	
55	Dug	No	W		B349 female w/o		
57	Dug	Yes	W		B302 male	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	
69	Dug	No	D			B317 female w/2@0	
70	Dug	No	W			B301 female w/2@0	
71	Dug	No	DS			B365 male	

Table 54. (Continued)

Den No.	Den Type	Flooded	Location***	80/81	81/82	82/83	83/84
72	Nat	No	W			Unmarked BKB	
73	Nat	Yes	W			B327 female w/2@0	
74	Dug	No	W			B349 female w/2@0	
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	
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	
88	Nat	No	DS			B375 female w/2@0	B375 female w/?
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/?
93 spring	Nat	No	DS			B374 female w/3@0	
95	Nat	Yes	W			B360 male	
96	Nat	Yes	W			B346 male	
97	Dug	No	W			B354 female w/1@1	
98	Nat	Yes	W			B359 male	
99	Dug	No	W			B363 female w/o	
100	Nat	No	W			B358 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:

60 Dens identified to date throughout entire study area (reused dens not counted more than once).
31(51.7%) dug dens, 22(36.7%) natural cavity dens, 7(11.6%) Unknown cavity type.

Watana dens (N=26)		Devils Canyon dens (N=21)		Downstream dens (N=13)	
Dug	15(57.7%)	Dug	7(33.3%)	Dug	9(69.2%)
Natural	8(30.8%)	Natural	10(47.6%)	Natural	4(30.8%)
Unknown	3(11.5%)	Unknown	4(19.1%)	Unknown	0(0.0%)
Flooded	15(57.7%)	Flooded	1(4.8%)	Flooded	0(0.0%)
Not flooded	11(42.3%)	Not flooded	20(95.2%)	Not flooded	13(100.0%)

Table 55. History of den use by individual radio-marked black bears, 1980/81 - 1983/84.

		1980/81			1981/82			1982/83			1983/84*		
Bear No	Sex	Cavity Type	Den#	Assoc**	Cavity Type	Den#	Assoc**	Cavity Type	Den#	Assoc**	Cavity Type	Den#	Assoc**
287	M	Nat	7	w/o	Nat	7	w/o	Dead----------					
289	F	Dug	4	w/3@0	Dug	4	w/2@1	Dug	81	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----------		
302	M	Dug	57	w/o	Shed----------								
303	M	Nat	10	w/o	Nat	10	w/o	Nat	10	w/o	Dead----------		
304	M	Nat	13	w/o	Dug	35	w/o	Shed----------					
317	F	Dug	11	w/2@1	Dug	43	w/o	Dug	69	w/2@0			
318	F	Dug	12	w/1@1	Nat	33	w/o	Dug	68	w/2@0	Shed----------		
319	M	-	62	w/o	Dead----------								
321	F	Nat	8	w/2@0	Dug	34	w/o	Nat	7	w/o			
322	M	Nat	18	w/o	Shed & Dead----------								
323	M	-	20	w/o	-	49	w/o	Nat	51	w/o	Dead----------		
324	M	Nat	9	w/o	Dug	40	w/o	Nat	9	w/o	Nat	9	w/o
325	F	Nat	6	w/o	Nat	9	w/o	Shed----------					
327	F	Dug	21	w/2@1	Dug	58	w/o	Nat	73	w/2@0	Dead----------		
328	F	Nat	19	w/2@0	Nat	32	w/1@1	Shed----------					
329	F	Dug	21	w/mom & sibling	Dug	65,21	w/o	Dug	80	w/o			
330	M	Dug	12	w/o	Dead----------								
343	M				Dug	38	w/o	Nat	66	w/o			
346	M				Nat	51	w/o	Nat	96	w/o	Nat	51	w/o
348	M				Dug	39	w/o	Dead----------					
349	F				Dug	55	w/o	Dug	74	w/2@0	Shed----------		
354	F							Dug	97	w/1@1			
358	M							Nat	100	w/o			
359	M							Nat	98	w/o			
360	M							Nat	95	w/o			
361	F							Dug	75	w/4@0			
363	F							Dug	99	w/o			
365	M							Dug	71	w/o	Dead----------		
367	F							Dug	82	w/o	Dead----------		
369	F							Dug	67	w/o			
370	F							Dug	83	W/2@0	Missing----------		
372	F							Dug	84	w/3@0	Missing----------		
374	F							Nat	92	w/3@0	Dead----------		
375	F							Nat	88	w/2@0	Nat	88	w/?

(continued)

Table 55. (Continued)

		1980/81			1981/82			1983/83			1983/84*		
Bear No.	Sex	Cavity Type	Den#	Assoc**	Cavity Type	Den#	Assoc**	Cavity Type	Den#	Assoc**	Cavity Type	Den#	Assoc**
376	F							Dug	91	w/3@0			
377	F							Nat	85	w/o			
378	F							Dug	90	w/2@0			
379	F							Nat	19	w/3@0	Dead----------		
387	M												
401	M												
402	F												
404	F										Nat	92	w/?
405	F												
406	F												
408	M												
409	F												
410	F										Dead----------		
411	F												

* most 83/84 Data are unavailable

** Associations are at time of emergence

Table 56. 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	1982 Entrance			1983 Emergence			Days in Den		
		Min.	Max.	Mid.	Min.	Max.	Mid.	Min.	Max.	Mid.
289	F	28 Sep	6 Oct	2 Oct	10 May	15 May	13 May	216	230	223
303	F	29 Sep	20 Oct	10 Oct	4 May	10 May	7 May	196	223	210
317	F	20 Sep	29 Sep	24 Sep	10 May	23 May	17 May	223	245	234
318	F	6 Oct	15 Oct	10 Oct	10 May	23 May	17 May	207	229	218
321	F	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	6 Oct	15 Oct	10 Oct	4 May	10 May	7 May	201	216	209
329	F	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	29 Sep	6 Oct	2 Oct	10 May	18 May	14 May	216	231	224
354	F	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	6 Oct	15 Oct	10 Oct	10 May	23 May	17 May	207	229	218
363	F	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	6 Oct	15 Oct	10 Oct	10 May	19 May	15 May	207	225	216
369	F	6 Oct	15 Oct	10 Oct	25 Apr	4 May	30 Apr	192	210	201
370	F	6 Oct	15 Oct	10 Oct	4 May	10 May	7 May	201	216	209
372	F	29 Sep	6 Oct	2 Oct	10 May	19 May	15 May	216	232	224
375	F	29 Sep	6 Oct	2 Oct	25 Apr	4 May	30 Apr	201	217	209
376	F	6 Oct	15 Oct	10 Oct	25 Apr	4 May	30 Apr	192	210	201
377	F	29 Sep	6 Oct	2 Oct	4 May	10 May	7 May	210	223	217
378	F	20 Sep	29 Sep	24 Sep	4 May	10 May	7 May	217	232	225
379	F	N. D.	N. D.	N. D.	4 May	10 May	7 May	-	-	-
301	F	N. D.	N. D.	N. D.	4 May	10 May	7 May	-	-	-
374	F	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 57. Black bear den entrance and emergence dates, winter of 1983/84.

Bear ID	Sex	1983 Entrance			1984 Emergence			Days in Den		
		Min.	Max.	Mid.	Min.	Max.	Mid.	Min.	Max.	Mid.
G289	F	5 Oct	24 Oct	10 Oct						
G317	F	26 Sep	5 Oct	1 Oct						
G321	F	26 Sep	5 Oct	1 Oct						
G324	M	15 Sep	27 Sep	21 Sep						
G329	M	5 Oct	24 Oct	15 Oct						
G343	M	5 Oct	24 Oct	15 Oct						
G346	M	16 Sep	27 Sep	22 Sep						
G354	F	27 Sep	5 Oct	1 Oct						
G358	M	5 Oct	24 Oct	15 Oct						
G359	M	5 Oct	24 Oct	15 Oct						
G360	M	5 Oct	24 Oct	15 Oct						
G361	F	5 Oct	24 Oct	15 Oct						
G363	F	5 Oct	24 Oct	15 Oct						
G369	F	5 Oct	24 Oct	15 Oct						
G375	F	26 Sep	5 Oct	1 Oct						
G376	F	5 Oct	24 Oct	15 Oct						
G377	F	15 Sep	26 Sep	21 Sep						
G378	F	5 Oct	24 Oct	15 Oct						
G387	M	5 Oct	25 Oct	15 Oct						
G401	M	5 Oct	24 Oct	15 Oct						
G402	F	26 Sep	5 Oct	1 Oct						
G404	F	26 Sep	5 Oct	1 Oct						
G405	F	5 Oct	24 Oct	15 Oct						
G406	F	5 Oct	25 Oct	15 Oct						
G408	M	5 Oct	25 Oct	15 Oct						
G409	F	26 Sep	5 Oct	1 Oct						
G411	F	5 Oct	24 Oct	15 Oct						
	Mean	2 Oct	16 Oct	8 Oct						
	"S"	6.6	10.6	8.3						
	n	27	27	27						

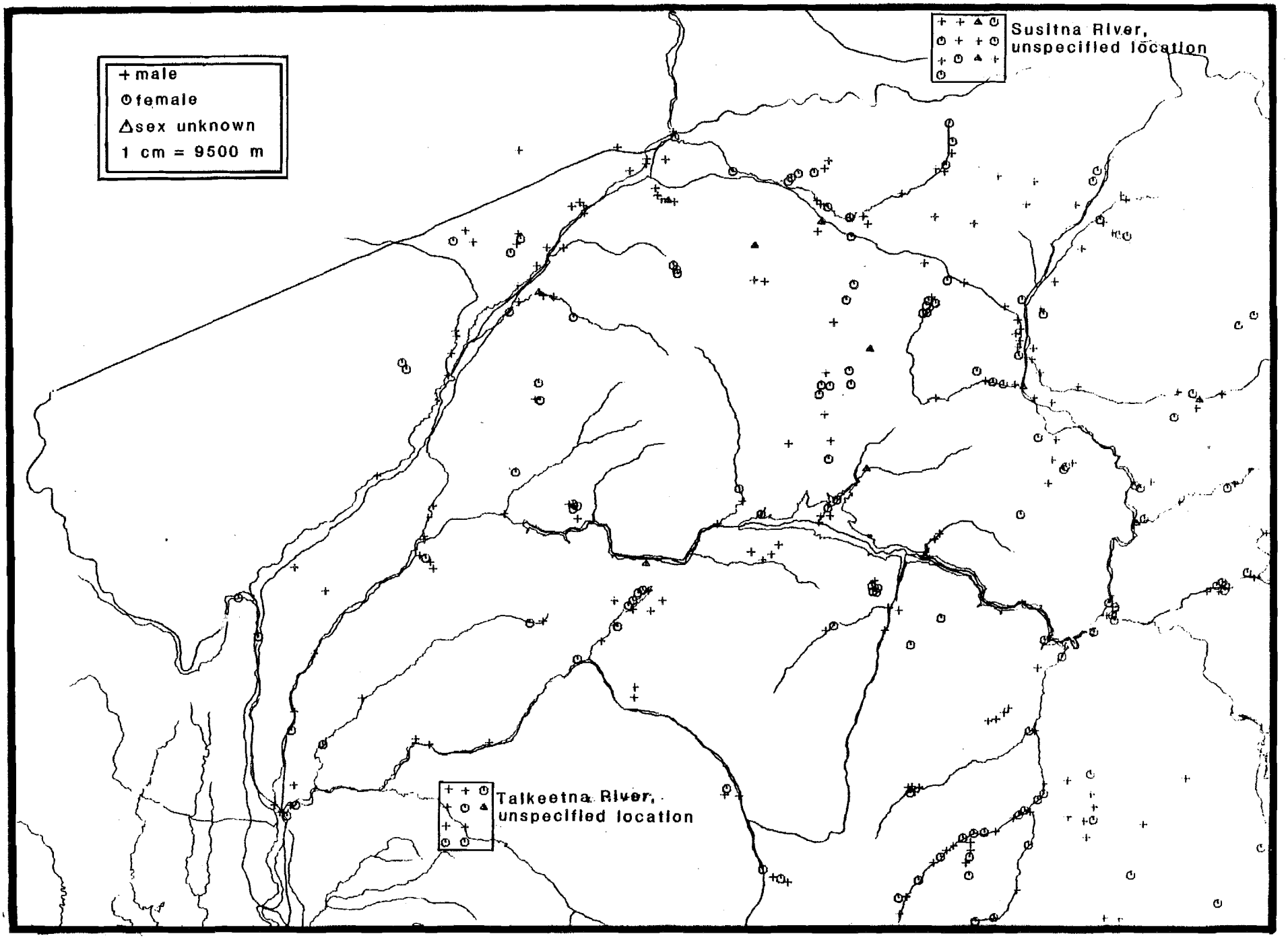

Figure 1. Approximate kill locations of 351 brown bears reported killed by hunters in the period 1961–1982 in the Susitna Study Area.

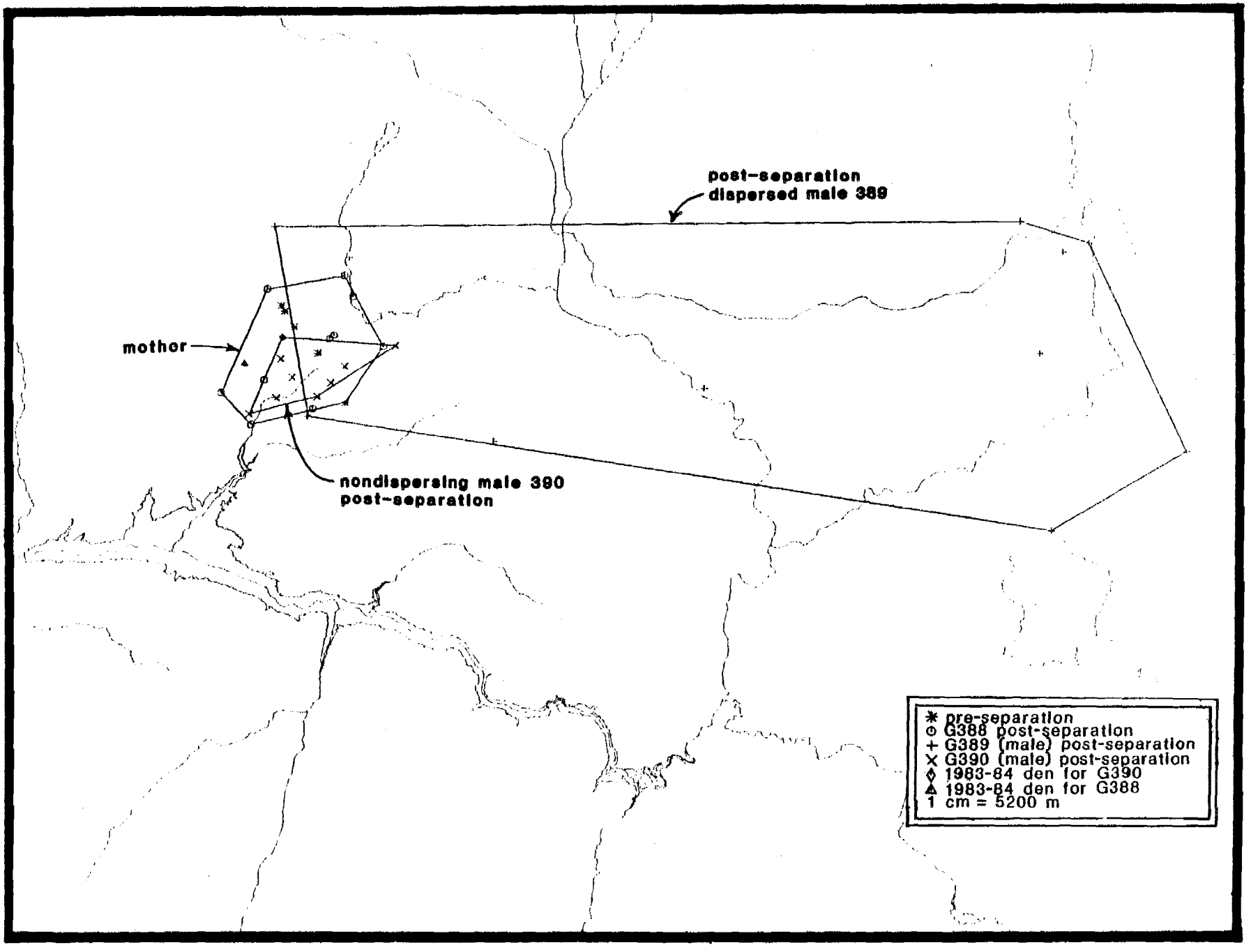

Figure 2. 1983 home ranges of female G388 and 2-year-old male offspring G389 and G390.

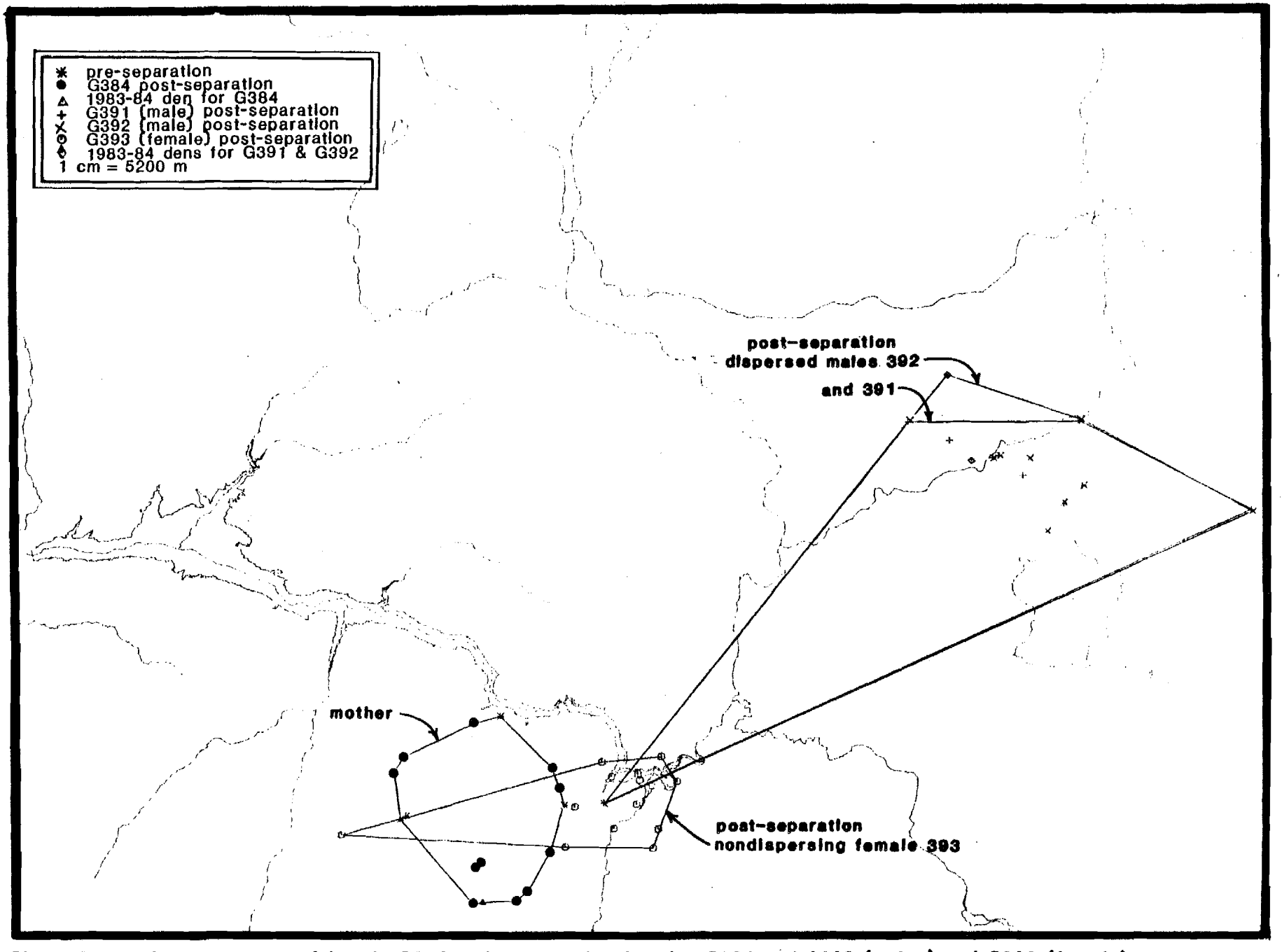

Figure 3. 1983 home ranges of female G384 and 2-year-old offspring G391 and G392 (males) and G393 (female).

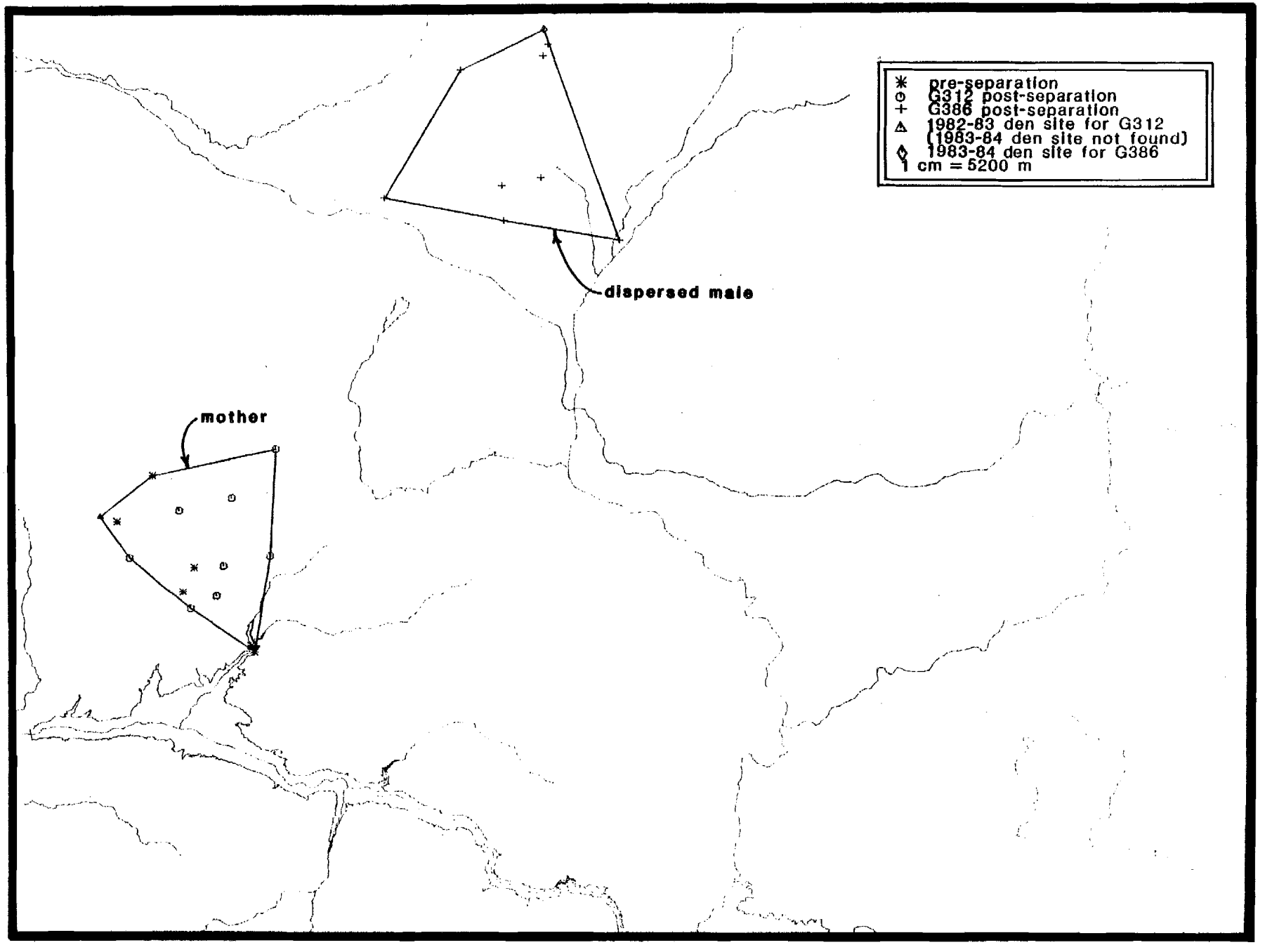

Figure 4. 1983 home ranges of female G312 and 2-year-old male offspring G386.

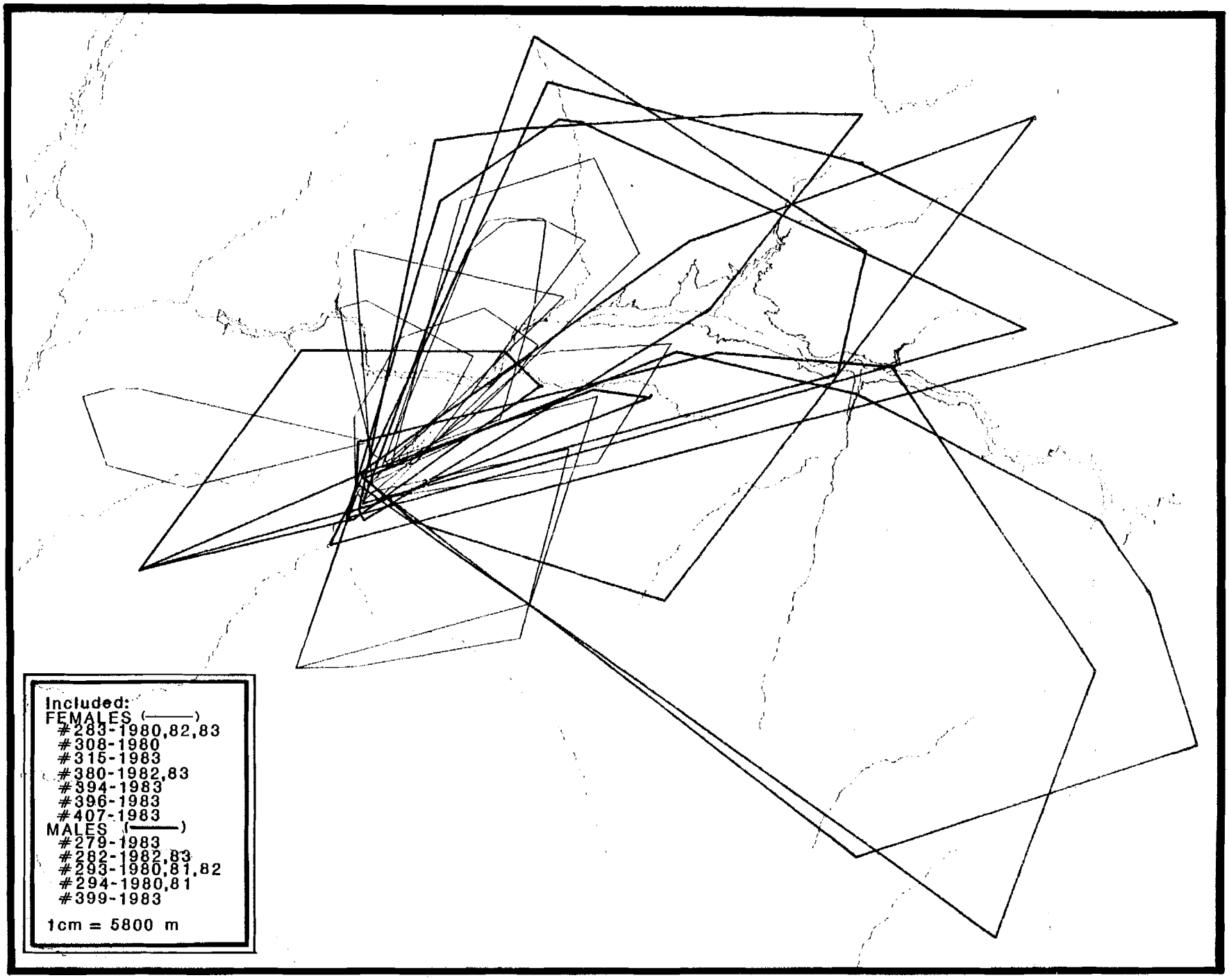

Figure 5. Annual home ranges of bears documented as using Prairie Creek salmon runs. Area incorporated for 7 females = 2,164 sq. km, for 5 males = 7,216 sq. km, for both sexes = 7,894 sq. km.

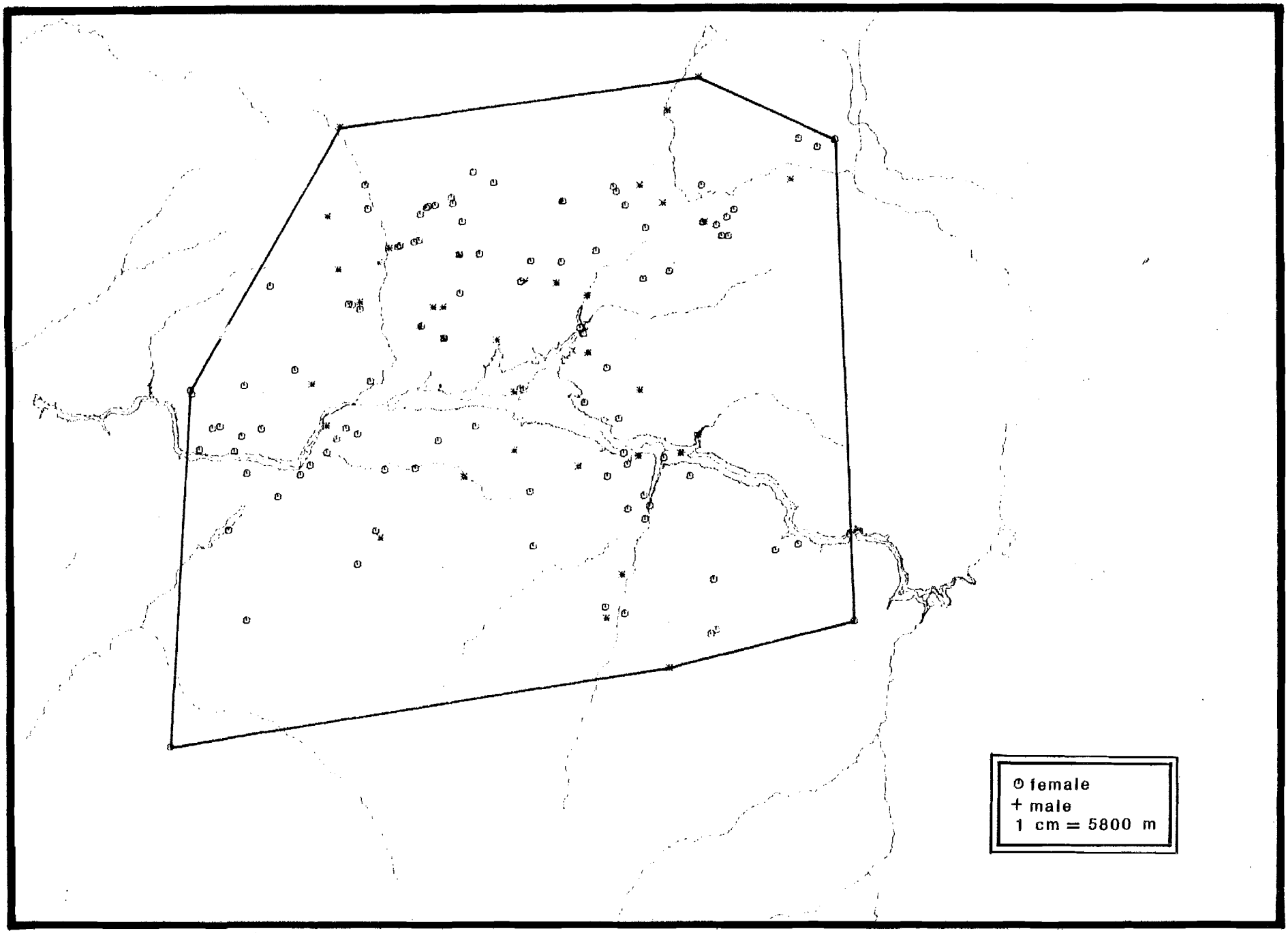

Figure 6. Area occupied by 13 female (100 points) and 5 male (37 points) radio-collared brown bears during May and June 1983. Polygon = 4,391 sq. km. (Maternal females not included.)

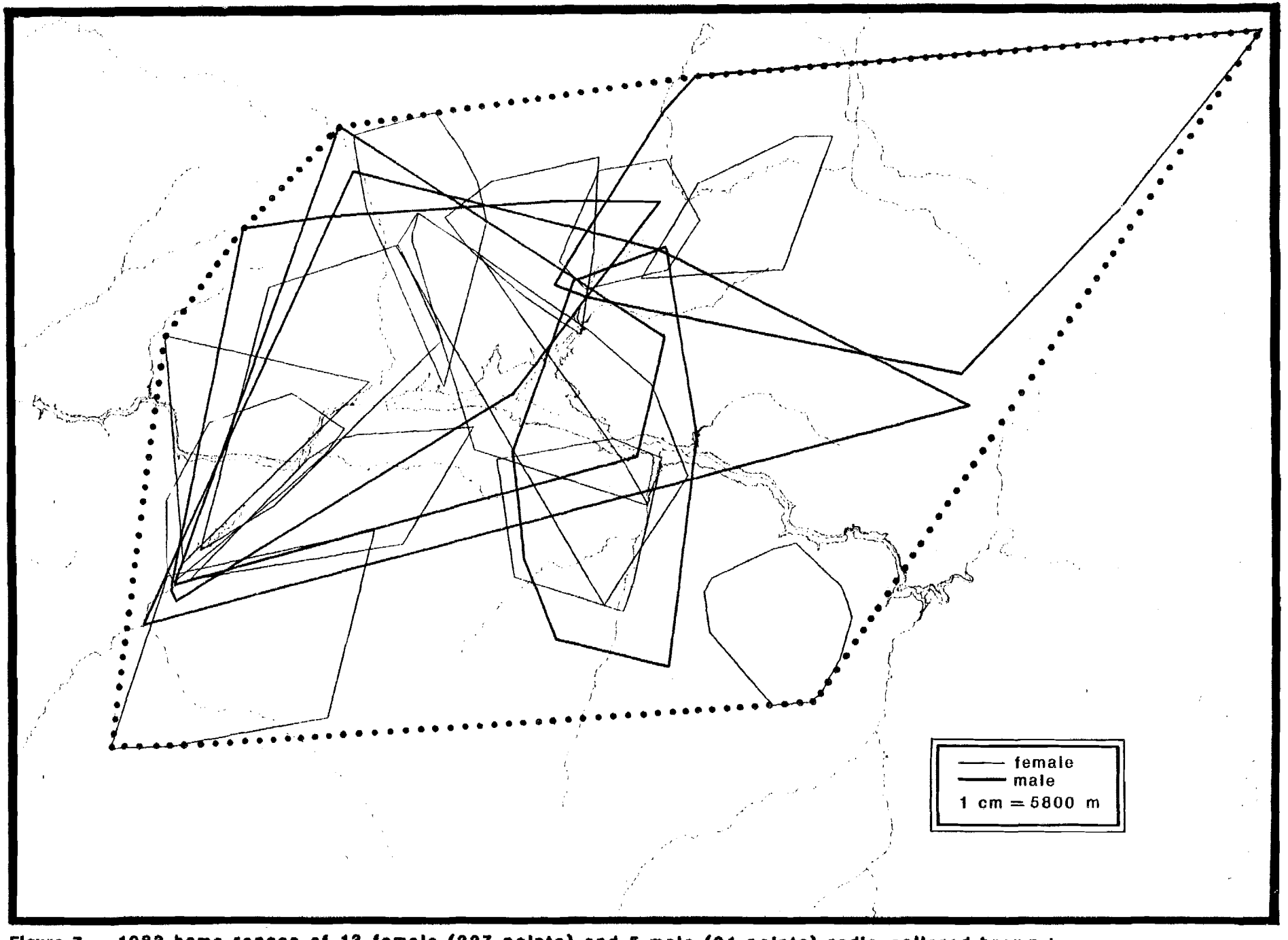

Figure 7. 1983 home ranges of 13 female (227 points) and 5 male (91 points) radio-collared brown bears. Inclusive polygon = 6,568 sq. km. (Maternal females not included.)

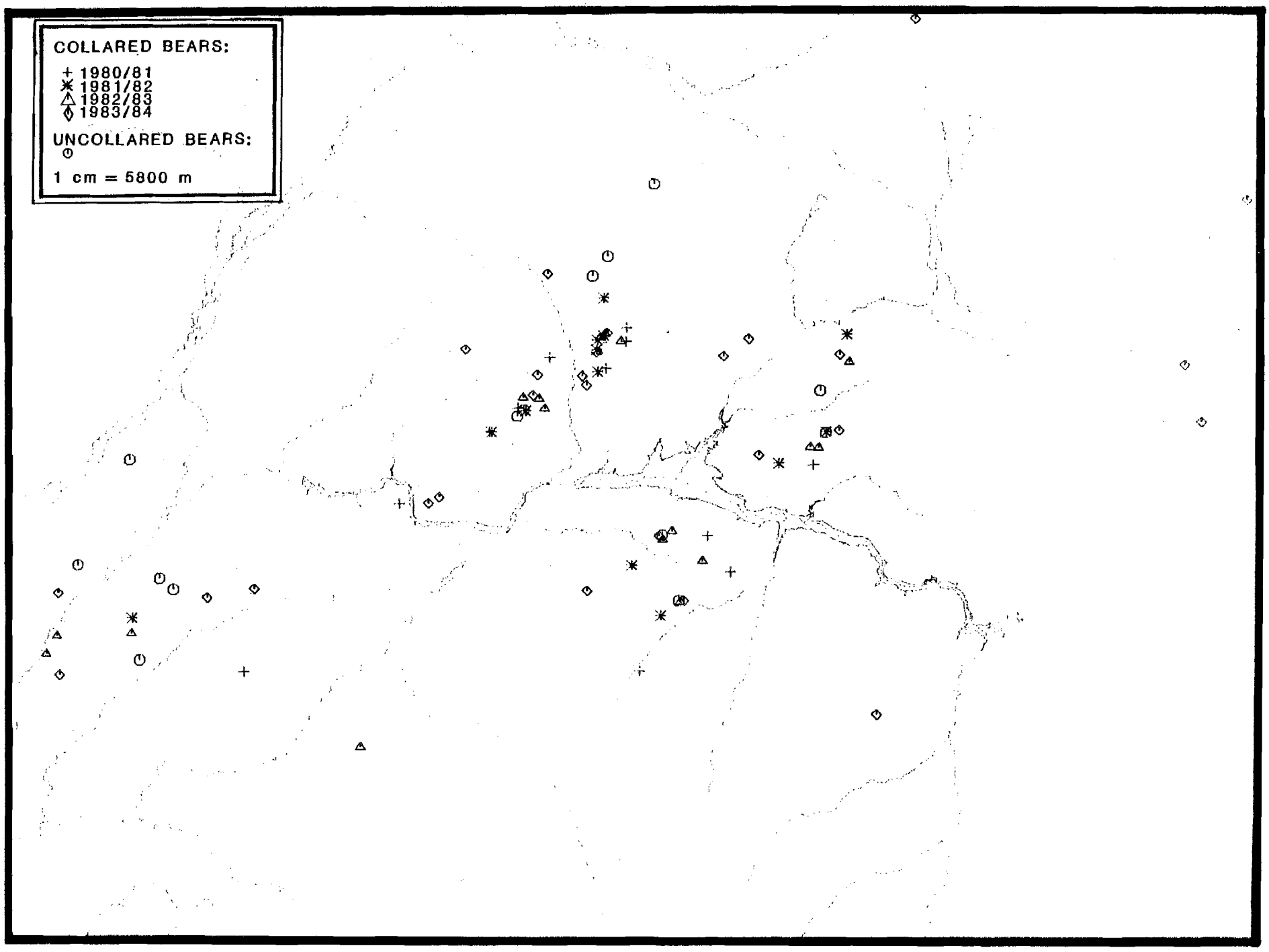

Figure 8. Location of brown bear den sites, 1980–1983.

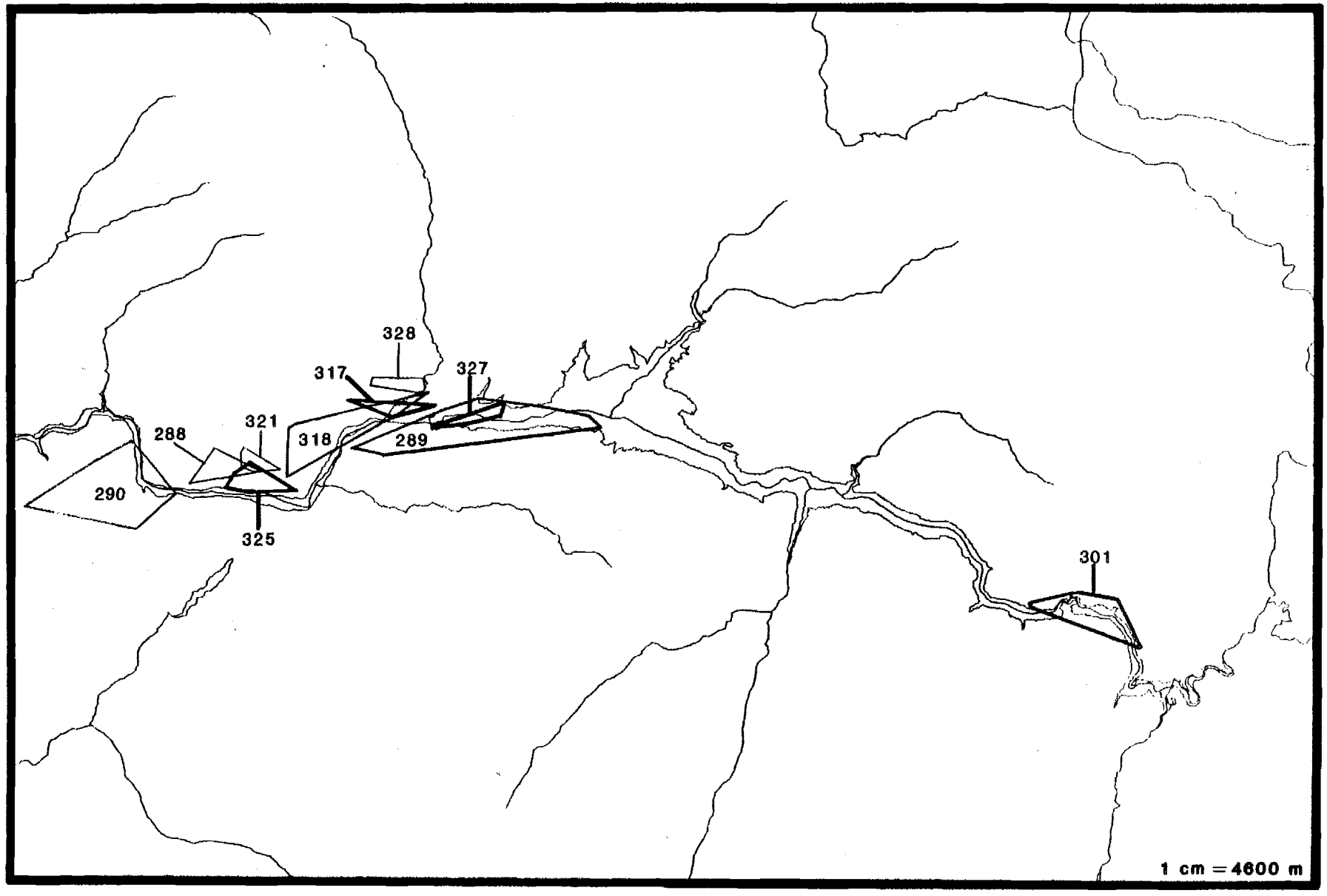

Figure 9. Annual home ranges in 1980 of adult female black bears.

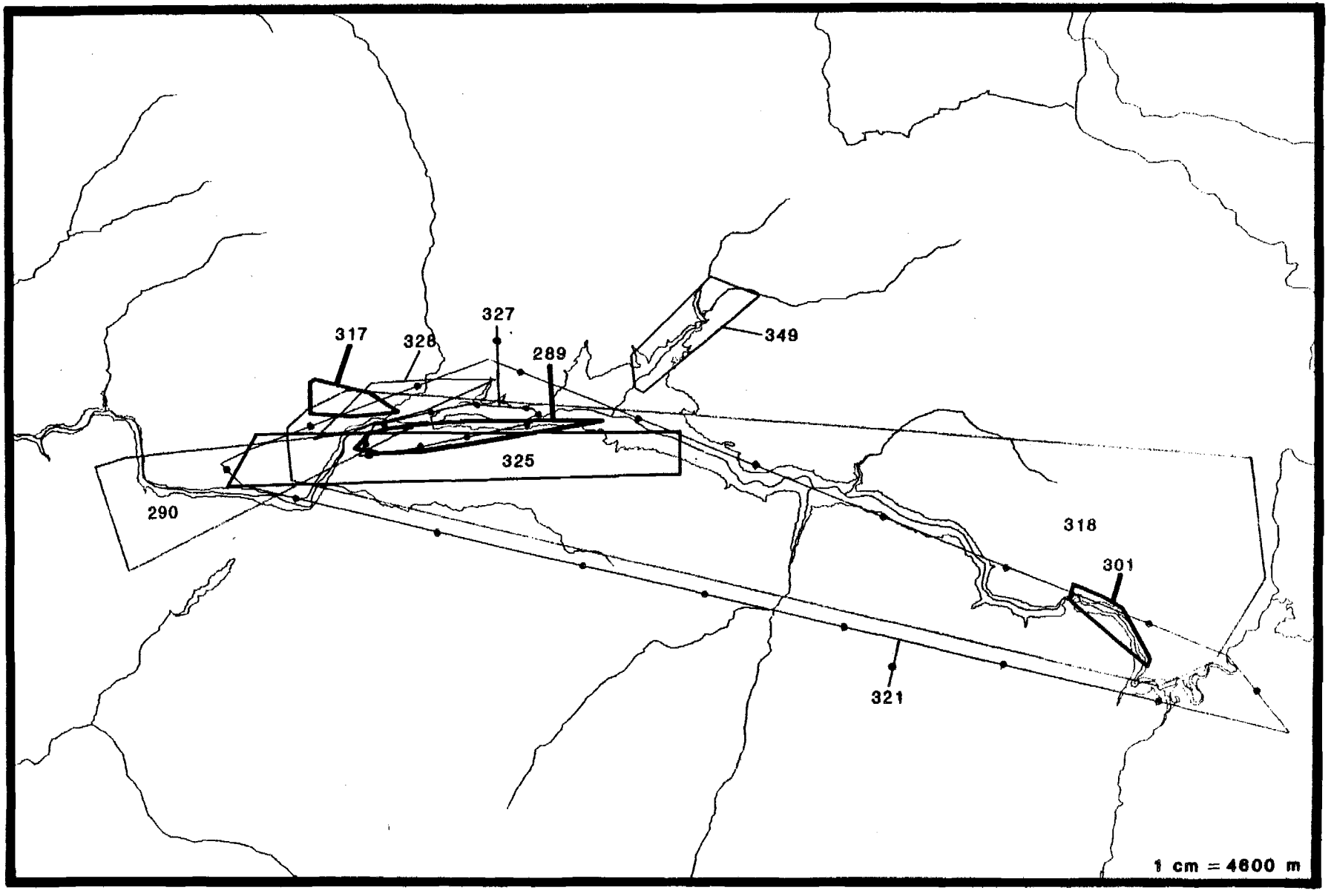

Figure 10. Annual home ranges in 1981 of adult female black bears.

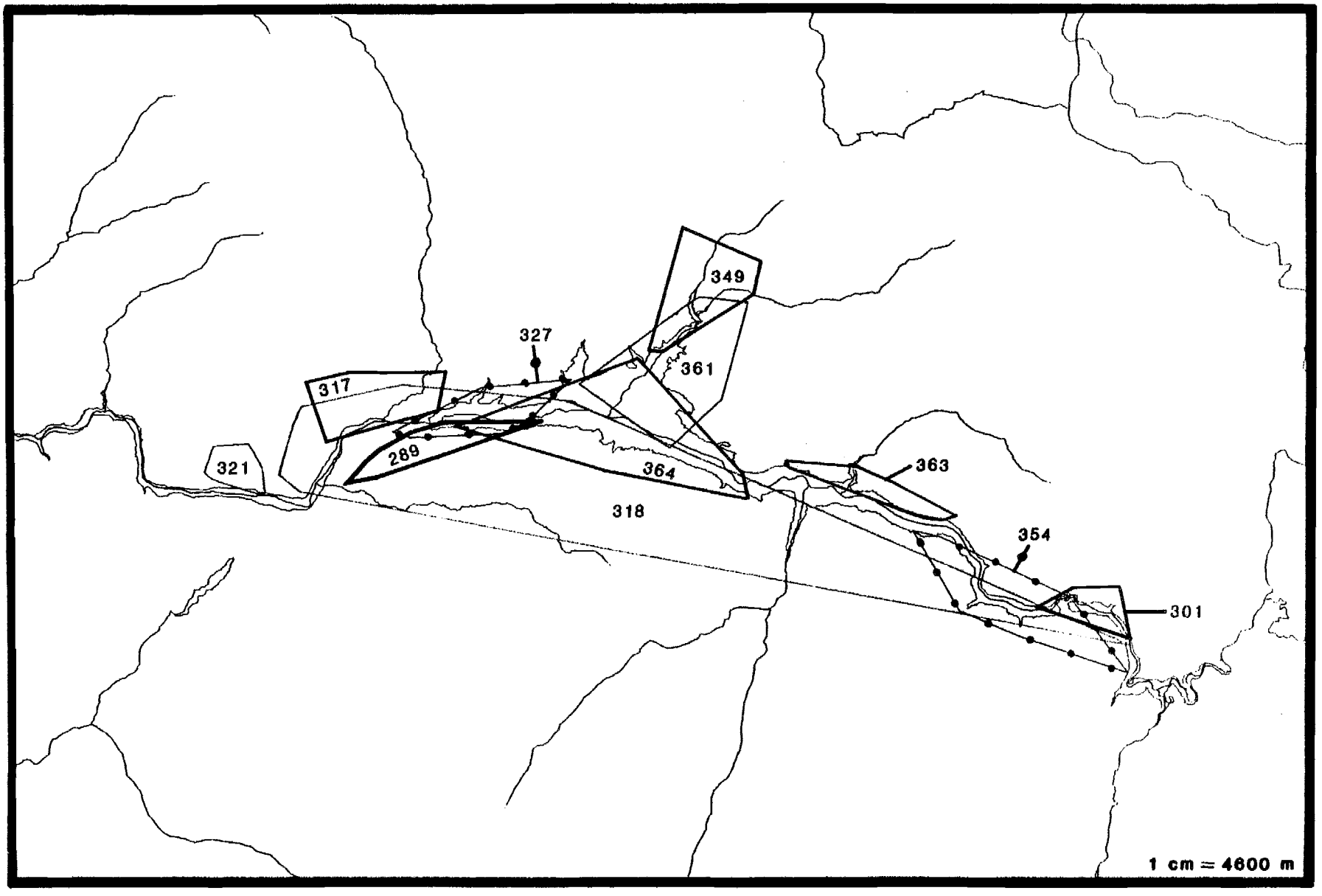

Figure 11. Annual home ranges in 1982 of adult female black bears.

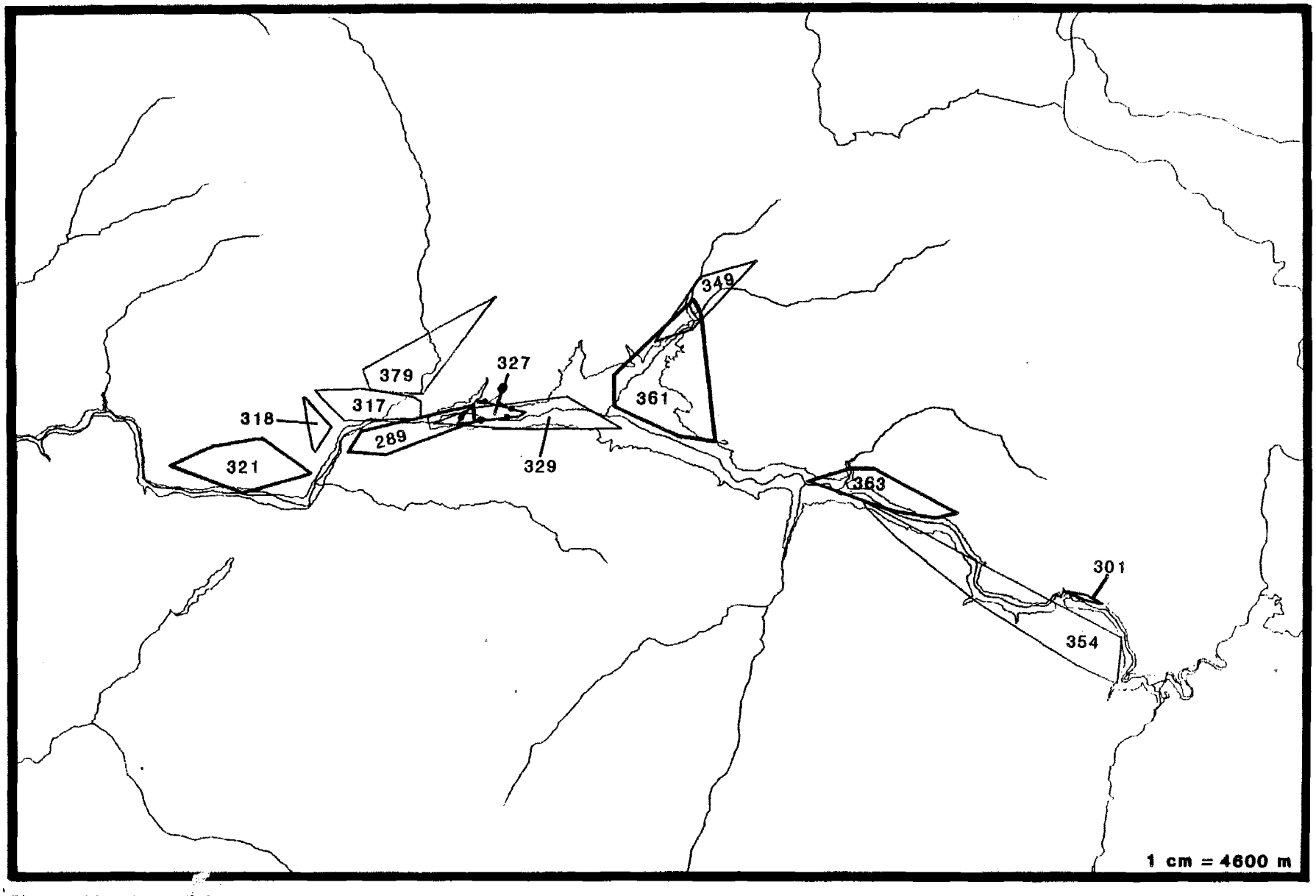

Figure 12. Annual home ranges in 1983 of adult female black bears.

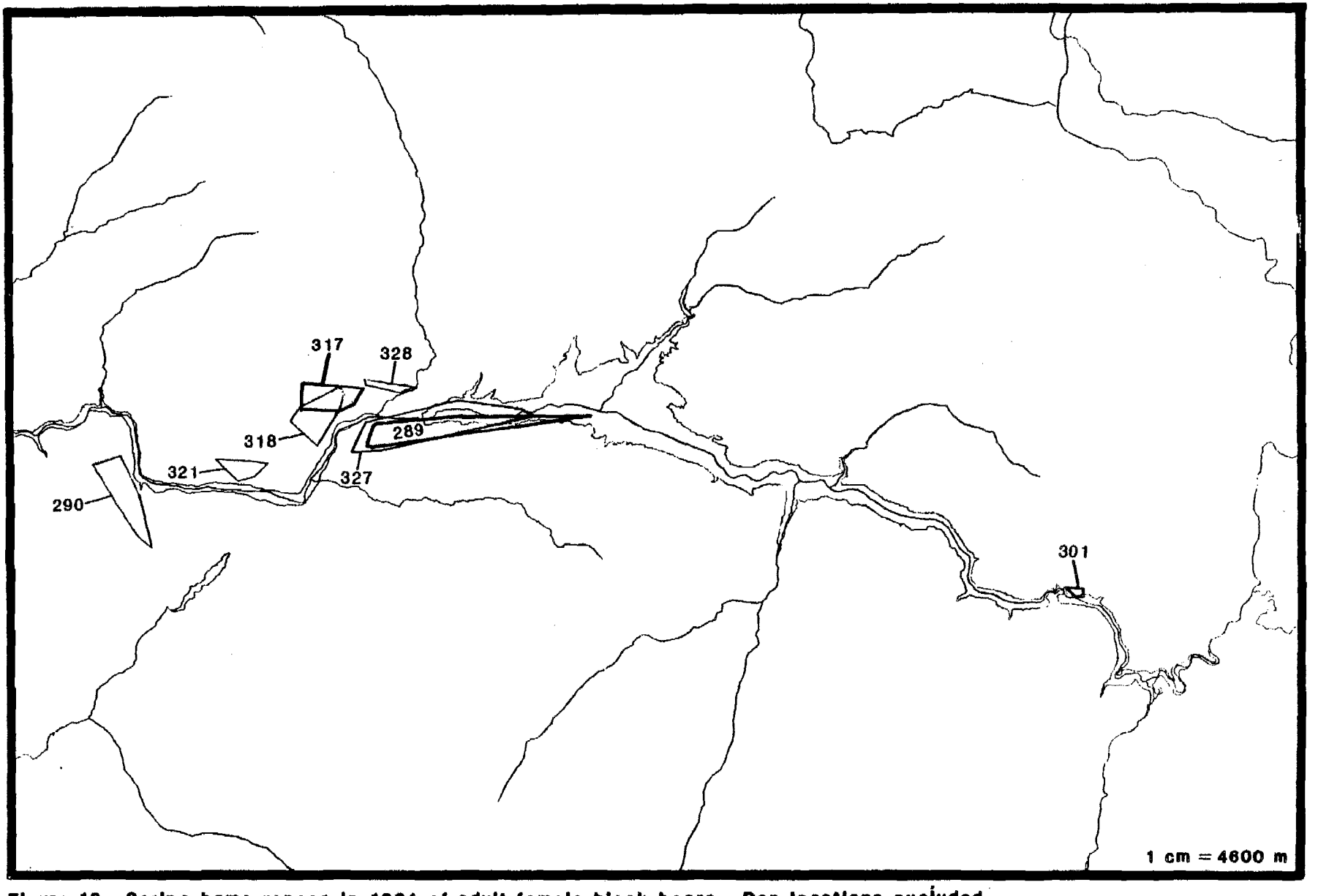

Figure 13. Spring home ranges in 1981 of adult female black bears. Den locations excluded.

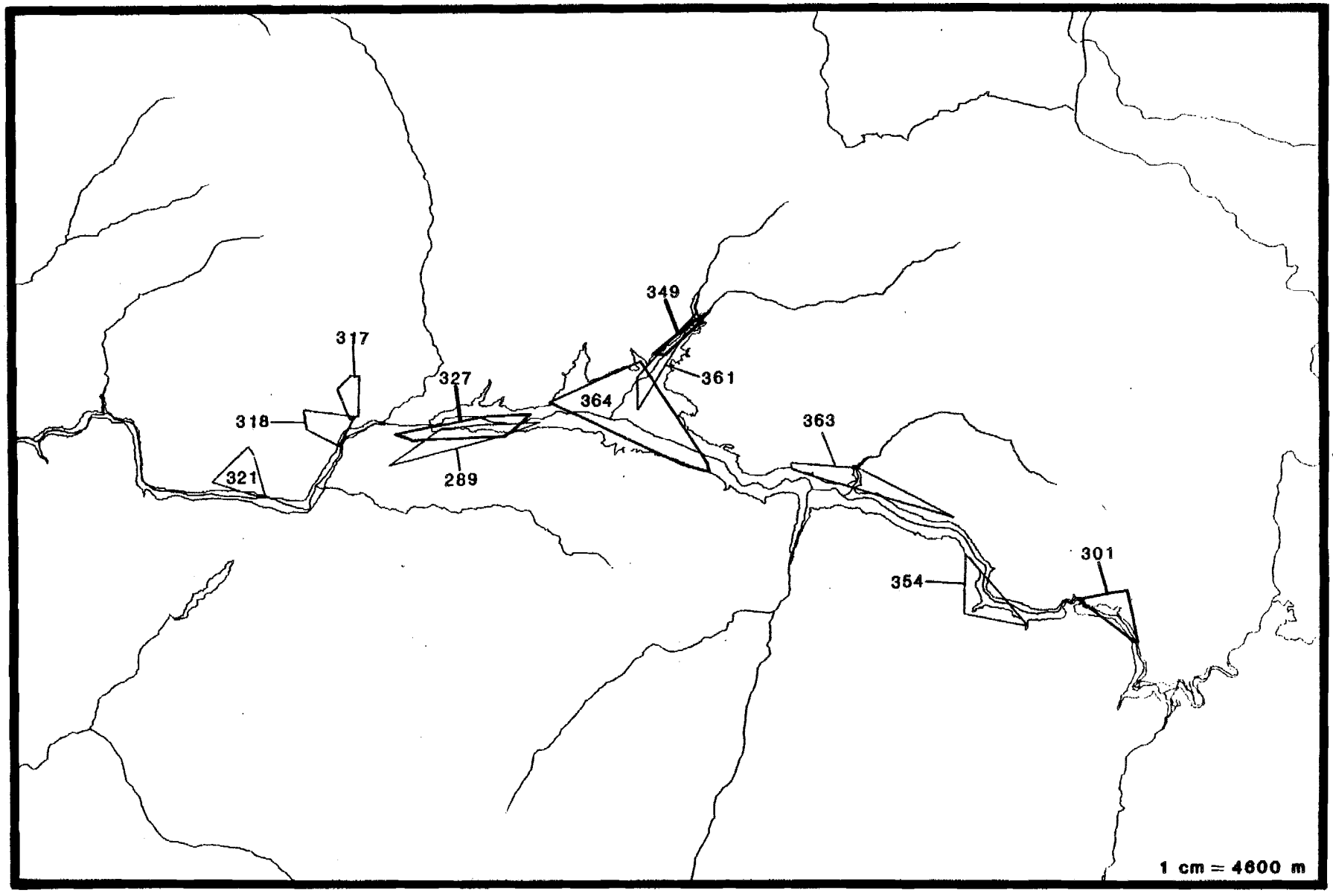

Figure 14. Spring home ranges in 1982 of adult female black bears. Den locations excluded.

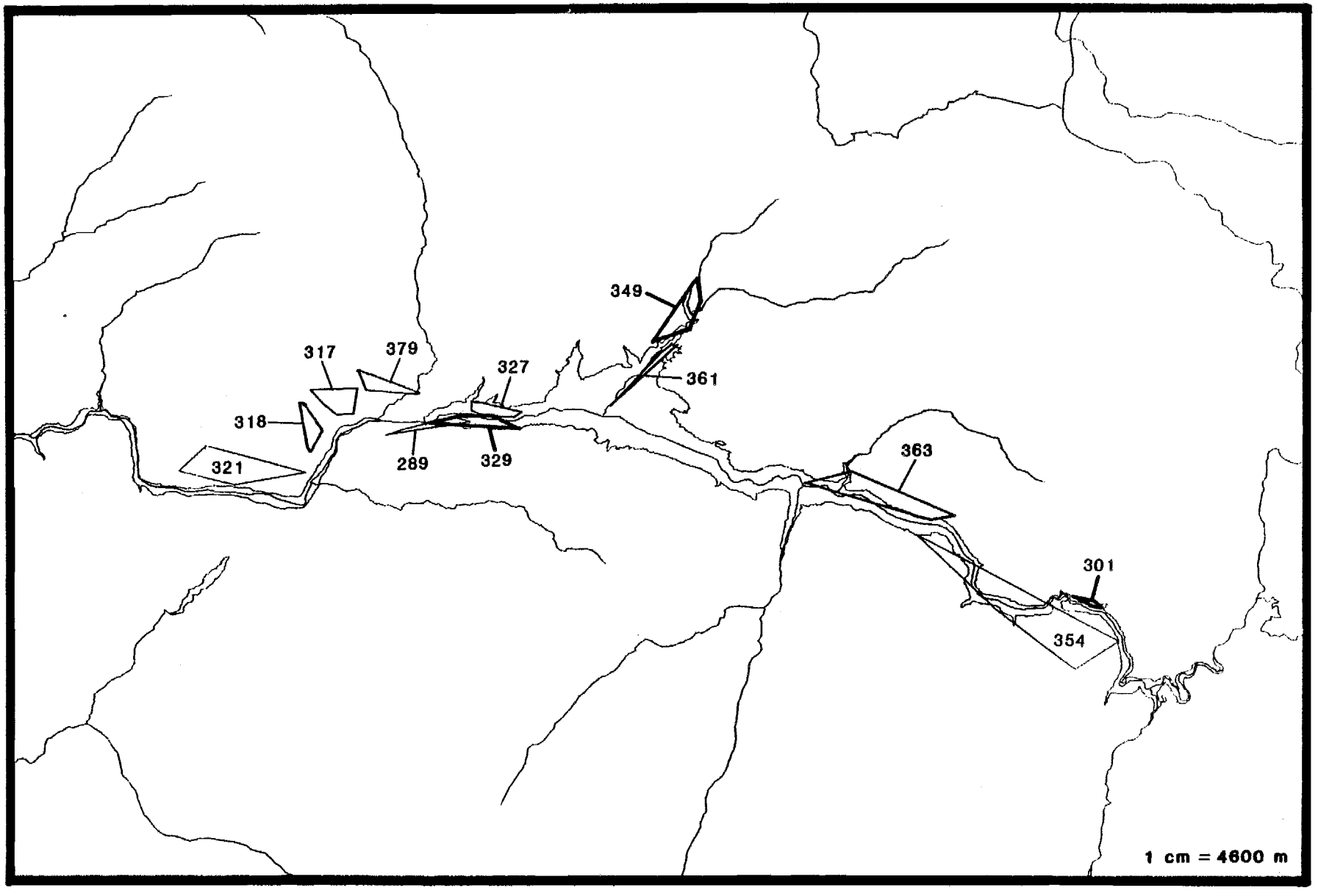

Figure 15. Spring home ranges in 1983 of adult female black bears. Den locations excluded.

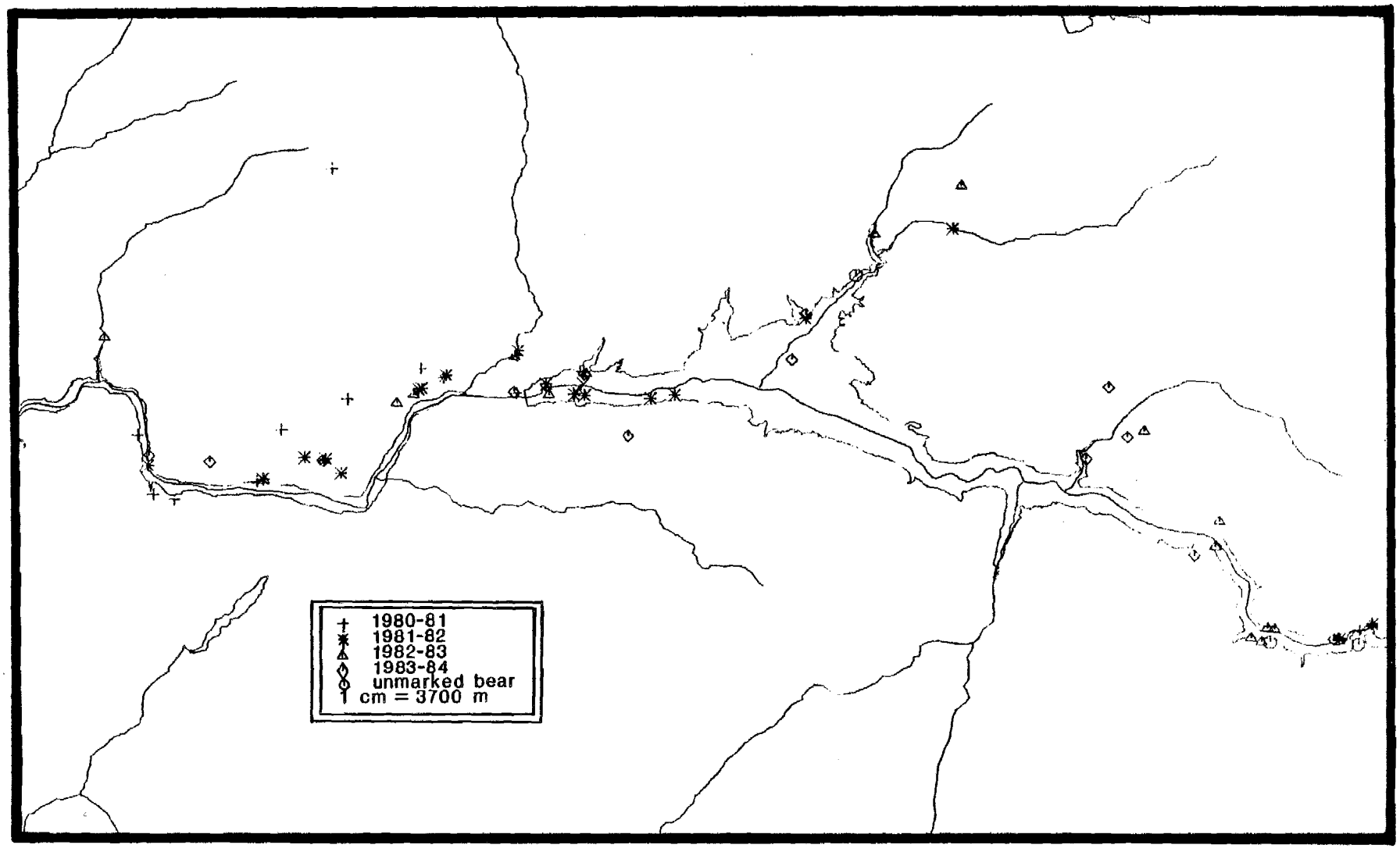

Figure 16. Black bear den sites, upstream study area.

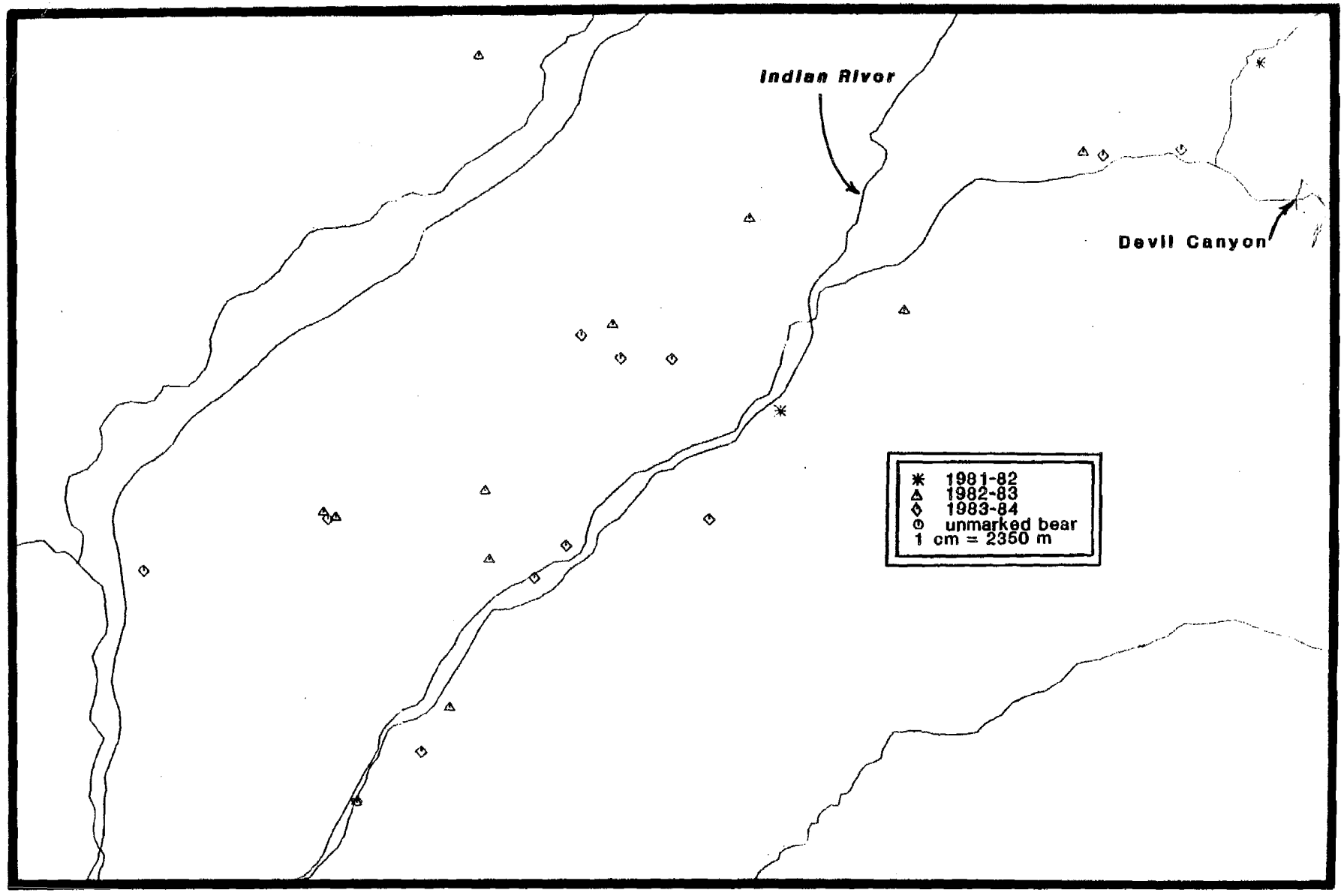

Figure 17. Black bear den sites, downstream study area.