Third International Conference on Bears

Paper 23

Population Characteristics of the Arctic Mountain Grizzly Bear

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INTRODUCTION

The reduction in numbers and in the range of the grizzly bear in North America has been well documented (Stebler 1972; Cowan 1972; many others). Viable populations unaffected by man occur only in the remote mountains of western and northern Canada, and in Alaska. Concern for the future of those remaining populations precipitated the ecological studies that started in the early 1960s. No studies were made or even planned on the Arctic populations until the threat of a major development scheme focused attention on that area. Preliminary studies have expressed concern for the species while attempting to calculate distribution and abundance within the region (Calef & Lortie 1971; Renewable Resources, 1971, 1973; Watson *et al.* 1973).

The specific objectives of this study were to obtain more precise information on the population parameters of the Arctic Mountain grizzly in a representative study area in northern Yukon. The number of animals, their movement patterns and seasonal habitat utilization, productivity, and food habits were investigated to assess the impact of the construction and operation of a pipeline facility through the area.

It has been speculated that denning sites could be a limiting factor for grizzly bears, particularly in areas with high permafrost (Pearson 1972). It has also been observed in other areas that grizzly dens are sometimes concentrated on specific sites (Hensel 1968; Pearson 1968). In this study special emphasis was placed on locating active grizzly dens and describing their site characteristics.

STUDY AREA

The study area consisted of approximately 3367 sq. km (1300 sq. miles) in the Barn Mountains of northern Yukon (Figure 1). The area was selected as representative of the Arctic mountains which supported relatively dense grizzly populations (Watson *et al.* 1973).

The study area contained parts of four physiographic units: Arctic Coastal Plain; Arctic Plateau; Richardson Mountains; and British Mountains (Bostock 1948). The rugged area of the Artic Plateau, standing midway between the British and Richardson mountains, provided the core of the study area.

The Arctic Coastal Plain, and similar lowlands extending up river valleys into the mountains, are poorly drained and thus very wet during the summer (Wahrhaftig 1965). Large fields of cotton grass (*Eriophorum angustifolium*) occur on those marshy meadows along with various other sedges (*Carex* spp).

River, stream and lake banks supported dense thickets of willow (*Salix* spp.). Willows also occurred in shallow depressions at higher elevations where

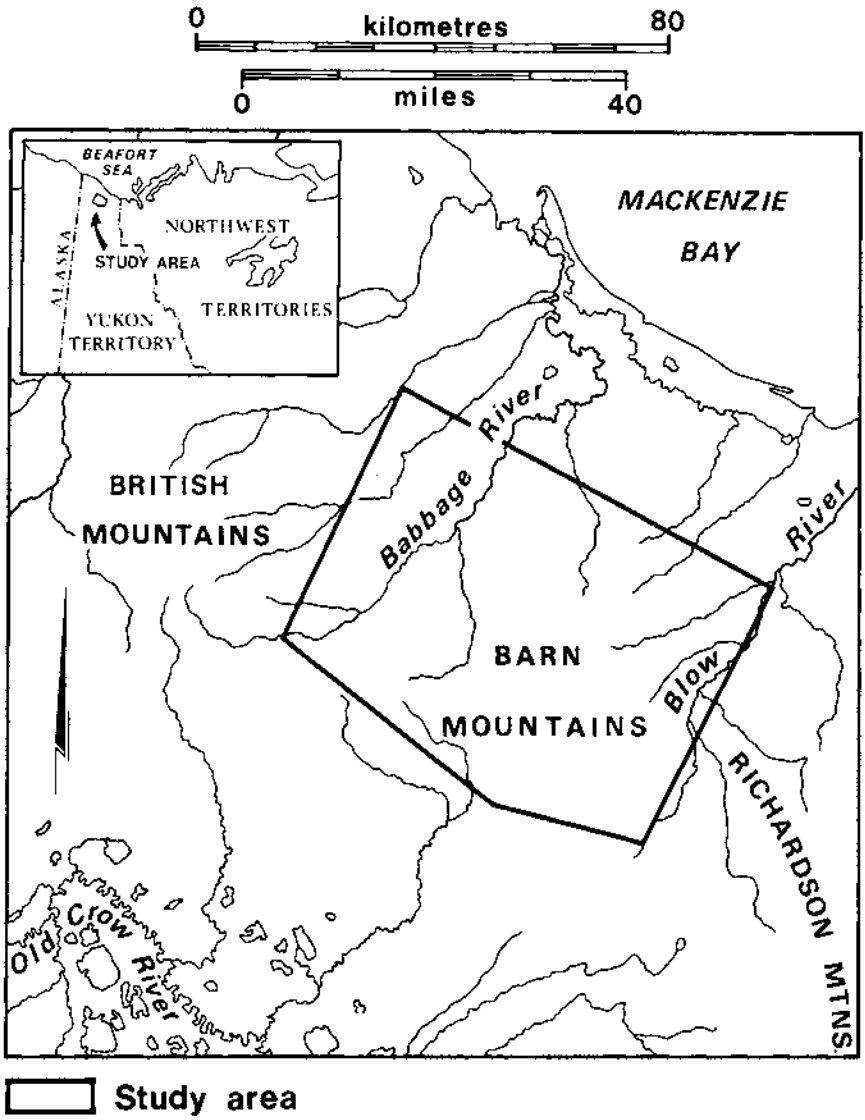

Fig. 1 Study area in the Barn Mountains (Arctic Coastal Plateau) of Yukon Territory.

snowpatch communities were developed. Higher, better drained areas supported a variety of grasses, herbs and shrubs, prominent among which were crowberry (*Empetrum nigrum*), blueberry (*Vaccinium* spp.), dwarf birch (*Betula glandulosa*), saxifrages (*Saxifraga* spp.), poppies (*Papaver* spp.), louseworts (*Pedicularis* spp.), vetches (*Oxytropis* spp.), and grasses (*Calamagrostis* spp.).

METHODS

The population was studied by marking individual bears with specific coloured

tags that facilitated subsequent visual identifications (Pearson 1975). An immobilizing drug, Sernylan (Parke Davis & Co.), was administered to each animal by a Capchur dart fired from a pursuing helicopter (Pearson 1975). Both the Bell 47G3-B2 and 206B helicopters were used for the tagging operation.

Transmitter collars were affixed to selected animals. The signal was in the 40.680 MHz frequency range with 10 Khz between units. Pulsed transmissions between 1 and 6 per second were emitted. Transmitting devices, receivers and accessories were prepared by the Bio-electronics Section, Canadian Wildlife Service, Ottawa (Pearson 1975). A survey grid was established to monitor the entire northern Yukon. A variety of airplanes was used. Flight lines were 8.045 km (5 miles) apart and the initial tracking was done at 1219-1524 meters (4000-5000 ft) altitude. When a signal was received the exact location of the animal was established by low level search until a maximum signal or a visual sighting was obtained. The area was covered at least once a week and all sightings marked on 1:250,000 scale topographic maps. Minimum home range polygons were drawn for animals for which four or more sightings were obtained (Pearson 1975)

Den sites were located by searching the area for radio signals in November after the animals were established in their den chambers. Den sites were recorded on maps, photographs of each area were taken and, wherever possible, markers were established.

Any faeces that could be accurately dated were collected and dried for further analysis. The dried faeces were segregated into component parts in the laboratory and the contents recorded.

The occurrence of tagged female grizzlies were plotted on a map of the area. Observations of other identifiable females (e.g. sow with young groups) were also recorded and a preliminary population estimate calculated for the area (Pearson 1975).

Immobilized animals were weighed and measured and a premolar tooth was removed from each. The teeth were sectioned and stained and the cementum annulations counted in order to determine the age of each animal.

RESULTS AND DISCUSSION

Drug Dosages and Reactions

A noticeable difference was observed during the course of the season in the amount of Sernylan required to immobilize the animals. Table 1 shows the average dosage used and the average time for the drug to take effect for each of the four capture periods. Seasonal differences in the reaction of grizzlies to Sernylan have been recorded previously (Pearson 1975). It is not known whether the differences were caused by a seasonal change in physiological tolerance or by a change in the animal's rate of absorption of the drug. Although the 3.81 cm (1.5 inch) needles were used in the September period, there was a chance that the drug could still have been injected into adipose or other poorly vascularized tissue.

Weights and Measurements

The body weights of grizzlies increased dramatically from spring to fall. The average weights of grizzlies handled during the four capture periods can be seen in Table 1. Examples of individual increases in weight of animals handled

TABLE 1. AVERAGE DOSES OF PHENCYCLIDINE HYDROCHLORIDE WITH TIME TO TAKE EFFECT AT DIFFERENT SEASONS OF THE YEAR FOR GRIZZLY BEARS IN BRITISH MOUNTAINS, Y.T.

Month	Sex	Sample Size	Mean Body Wt. (kg)	Average Dose (kg)	Time to Take Effect (min)
May	♀	11	72	3.1	5.0
	♂	10	153	2.4	6.6
July	♀	3	110	2.6	5.7
	♂	3	142	2.2	8.8
August	♀	6	120	3.3	18.4
	♂	2	157	2.6	11.0
September	♀	11	145	4.2	35.0
	♂	10	195	3.5	17.5

both in spring and fall were: adult ♂-83 kgs in 110 days; imm. ♂-65 kgs in 112 days; imm. ♀-51 kgs in 104 days; adult ♂-60 kgs in 110 days; imm. ♂-16 kgs in 35 days; adult ♀-35 kgs in 62 days while lactating. The Arctic Mountain grizzly was capable of assimilating energy from the tundra ecosystem and converting it into what was likely adipose tissue. The autumn weights of the Arctic Mountain grizzlies were greater than weights found in Northern Interior grizzlies of the same age (Pearson 1975). However, spring weights, which would more closely represent actual body size, were nearly equal. It is hypothesized that natural selection in the Arctic Mountain grizzly has favoured animals that add extra fat in the fall enabling them to survive more rigorous winter conditions.

Food Habits

Thirty-nine faeces samples were collected from the study area in 1973. Ten were collected in late May, five in mid-July, eight in mid-August, and sixteen in mid-September. Table 2 presents the results of identification of food items in faeces during each of the four collecting periods. If a food item was present only in trace amounts it was not included in the listing.

TABLE 2. PERCENTAGE BY FREQUENCY OF OCCURRENCE FOR FOOD ITEMS IDENTIFIED IN 39 GRIZZLY SCATS FROM THE NORTHERN YUKON

		Food Item			
Date	n	Berries	Grass	Roots	Animal Matter
May	10	50	30	50	0
July	5	0	100	0	0
August	8	75	87	0	25
September	16	69	38	31	31

During the late May period grizzlies utilized berries, roots and some grasses. The berries were from crowberry and the roots from eskimo potato (*Hedysarum alpinum*). In mid-July all the faeces collected were composed of 100 percent grasses. In August crowberries and grasses occurred in about equal amounts. The animal matter found in two samples consisted of the remains of ground squirrels (*Spermophilus undulatus*). In September berries were still the most common food item. Crowberry was found exclusively in 73 percent of the samples containing berries, soapberry (*Shepherdia canadensis*) was found exclusively in 20 percent and the two were found together in the remaining 7 percent. Grasses were the second most common food item in September, followed closely by roots and animal matter. Surprisingly, most of the animal matter identified was from ground squirrels, with caribou material noticeably absent. Unknown bird remains were found as a trace occurrence in one faeces.

Two food items were prominent by their absence. The nearly complete lack of caribou remains was unexpected and obviously not precisely representative of the situation. It is postulated that caribou meat would be ingested and digested rapidly by the bears. A bear would remain near a carcass until all of the meat was consumed and faeces containing the caribou remains would be concentrated around the carcass. Most of the grizzlies we captured were not near carcasses and a greater preponderance of vegetable matter would be expected in the faeces.

The absence of berries of *Vaccinium* in the faeces is also difficult to explain. Tissue slides were made to try to determine whether some *Vaccinium* remains had been incorrectly identified as crowberry but none was found. Although quantitative measurements were not made, there appeared to be a low production of *Vaccinium* berries in 1973. Whether *Vaccinium* forms an important food source for the Arctic Mountain grizzly will be known only after further investigation of the food habit patterns during other years.

No indications of grizzly bears fishing for arctic char (*Salvelinus alpinus*) were found in any of the Yukon coastal rivers used by that fish.

Movements and Home Range

During 1973, radiotelemetry collars were affixed to 23 different grizzly bears. There were 152 subsequent locations recorded which provided information on movements and on the calculation of minimum home range sizes.

The data do not substantiate the suggestion made by Watson *et al.* (1973) that the movements of the Arctic Mountain grizzly bears are related to the movements of the barren-ground caribou (*Rangifer tarandus*). In fact, during the June period when the caribou were moving as a unit to the north and west, some adult grizzlies were moving east and south. The movements may have been more nearly related to the breeding behaviour of the bears than to their utilization of the caribou herds. It is believed that the presence of a grizzly near concentrations of caribou could be ascribed to the local attraction of a food source within the bear's home range. That observation does not, however, discount the possibility that some bears, particularly males, have learned to feed on carrion or even prey on caribou and are dependent upon the caribou herds as a year-round food source. The larger home ranges of the male bears would allow them to remain with a caribou herd for many days and still not desert their traditional movement patterns.

Although logistical problems and the unreliability of the telemetry equipment

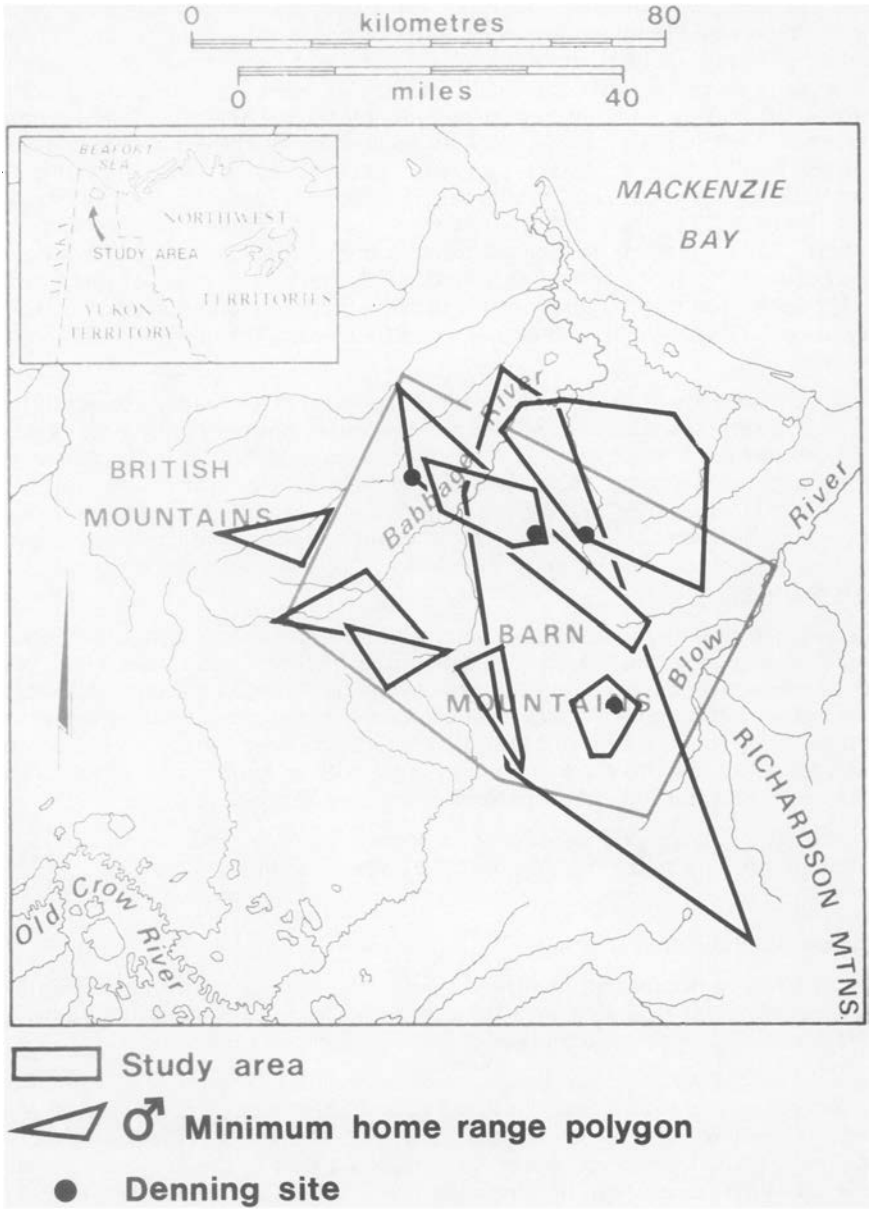

Fig. 2 Minimum home range polygons of male grizzly bear as determined by radio telemetry.

have prevented a clear analysis of the movements of the more mobile bears, movements of 106, 61 and 48km were recorded for individually marked adult animals.

The average minimum home range polygons calculated for nine adult male grizzlies (Figure 2) was 414 sq. km (160 sq. miles); similar calculations for

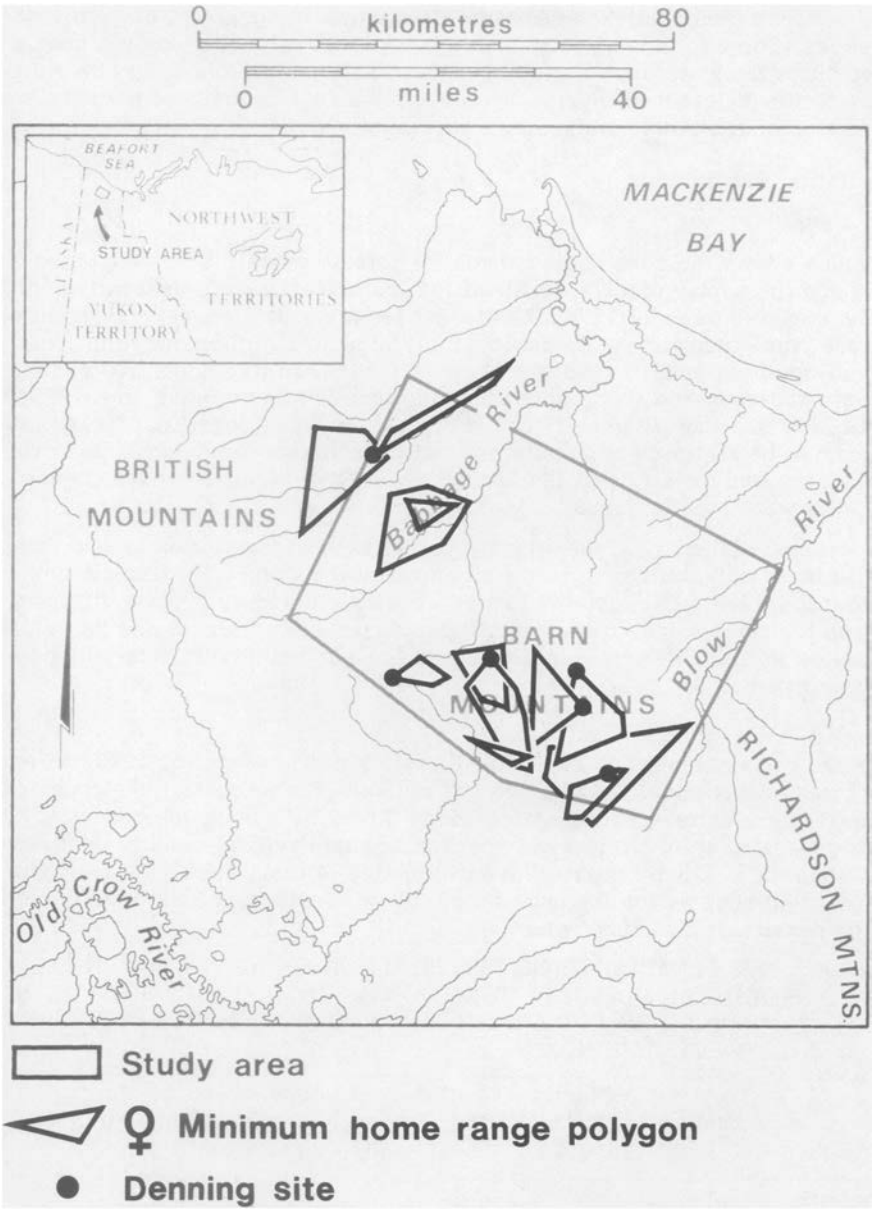

Fig. 3 Minimum home range polygons of female grizzly bear as determined by radio telemetry.

females (Figure 3) showed home ranges averaging 73 sq. km (28 sq. miles). Those areas were similar to the values of 111 square miles and 33 square miles respectively, found for the Northern Interior grizzly in south-western Yukon (Pearson 1975).

No long movements of female grizzlies were observed either during 1973 or from re-observation of animals tagged by Surrendi and Jorgenson in 1972. Additional evidence of the limited movements of female bears

was obtained from analyses of observation cards turned in by cooperating agencies. Some females, recognizable by unusual colouring or by family groups, were observed at various times throughout 1972 and 1973 and by several people working for different agencies. By carefully matching those observations an indication of restricted home range was obtained.

Population Parameters

(a) *Density*

Figure 4 shows the core home ranges for female grizzly bears captured during 1973 and the spring of 1974, or identified from analysis of observation cards. In the early summer of 1974, 27 different female grizzlies were resident on the 3367 km^2 study area. Assuming a 50 : 50 sex ratio there were at least 54 sub-adult and adult animals present. There were five cubs, five yearlings and six two-year-old young accompanying females on the study area. The total population was thus 70 grizzly bears or one per 48 sq. km. That figure is considered to be a minimum density estimate because of the superficial coverage of the area and the fact that the fate of seven other weaned two-year-olds on the area was not determined.

The estimated density of one grizzly per 48 km^2 is four times higher than the preliminary calculations for an area on the north slope of Alaska (Renewable Resources, 1973). Because the values were calculated by greatly different census techniques, it is possible that the variation is not real and that more grizzlies inhabit the Arctic mountains of Canada and Alaska than was previously estimated.

(b) *Sex and age distribution*

The sex ratio of adult and sub-adult grizzlies captured during 1973 and early 1974 was nearly equal (28 females : 27 males). The animals were captured through more or less random excursions through the area as opposed to the 1972 program, when effort was expended around areas of caribou concentrations and when the sex ratio heavily favoured males (4 females : 17 males). The 1973 results lent support for the use of a 50 : 50 sex ratio in calculations of population density on the study area.

TABLE 3. PRELIMINARY AGE DISTRIBUTION OF ARCTIC MOUNTAIN GRIZZLY BEAR POPULATION AS COMPARED TO RESULTS REPORTED FOR OTHER GRIZZLY BEAR POPULATIONS IN NORTH AMERICA.

Age Class	Kodiak Island	Glacier Nat. Park	Yellowstone Nat. Park (a)	(b)	Southwestern Yukon Territory	Barn Mtns.
Cubs	26	17	20	19	7	2
Yearlings	22	15	11		17	9
Total	48	32	31		24	11
Sub-Adult	27		26		32	20
Adult	25		43		44	69
Total	52	68	69		76	89

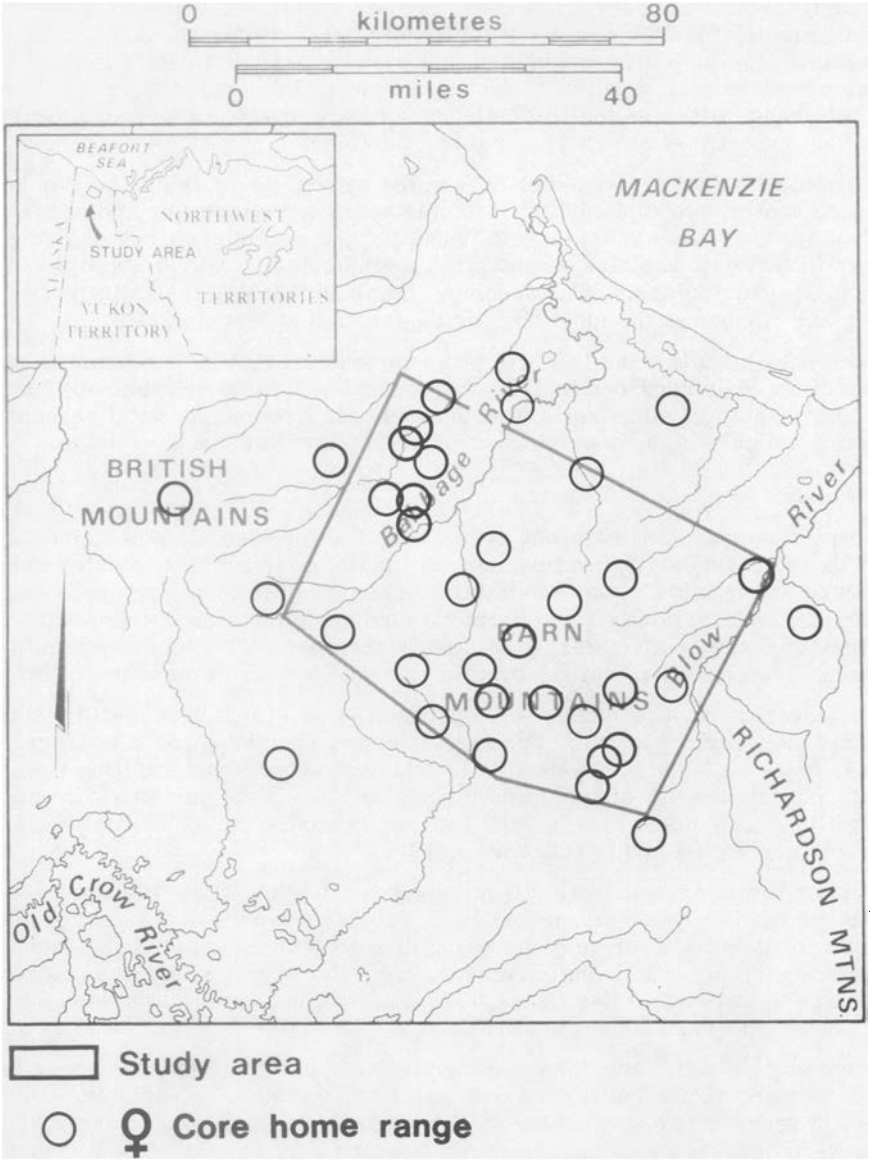

Fig. 4 Core home ranges of female grizzlies captured or positively identified on and adjacent to study area, 1973.

Surprisingly, of the nine young bears captured with sows, seven were female animals. That result was not considered representative of the population and it is postulated that a larger sample would result in a 50 : 50 sex ratio of young animals.

The ages of grizzlies handled during 1973 were determined from cementum annulations. Additionally, the age was estimated for each unweaned young animal seen on the study area, but not captured. Table 3 compared the population

composition determined from the 1973 studies with those reported from other grizzly studies. The most startling difference observed in the Arctic Mountain population was the low percentage of young and sub-adult animals in the population, a situation arising from the fact that many of the adult females seen were without young. Although the litter size was small, it was not significantly less than found in south-western Yukon (Pearson 1975).

The reason for the large number of females without young is difficult to determine. However, two captured adult female bears were lactating and showed rubbed areas around the teats, both indicating the recent presence of young. One of those sows was already in estrus as indicated by vulvar swelling and the obvious breeding display of an accompanying boar. A high mortality in the young age classes is the most obvious explanation at this time.

Preliminary results from the 1974 program suggest that the low number of young of the year recorded in 1973, was caused by a disproportionately large fraction of that age class remaining unobserved. Even so, the total percentage of young animals in the population remained below 20 percent.

(c) *Natality*

The breeding season had already begun when the first female was captured on May 25, 1973. On July 3, two instances of males accompanying females were observed and in mid-July a female in breeding condition was captured. Discontinuous observations did not permit a further delineation of those dates but they are earlier and later, respectively, than previous records for the breeding season of the Arctic Mountain grizzly (Renewable Resources, 1973).

The youngest record of successful reproduction was for a 9-year-old female who had one yearling in 1973. She must have bred in her seventh summer. Two 7-year-old females captured in late May showed vulvar swelling indicating estrus, but one 6-year-old captured during the same time period had no signs of swelling. The oldest female bear showing reproductive capability was a 21-year-old sow with a single cub, born in 1973.

The mean litter size, calculated from observations throughout the Arctic Mountain region of the Yukon throughout 1973, was 1.8 for cubs of the year (11 sows with 20 cubs) and 1.4 for yearling young (9 sows with 13 yearlings). Those figures were similar to results reported from the Arctic mountains of Alaska (Crook 1971; Renewable Resources, 1973) and similar to the low values for south-western Yukon (Pearson 1975).

The age of self-sufficiency of young Arctic Mountain grizzlies, and hence the age of weaning and frequency between litters appeared to be variable. One young bear 3.3 years of age was captured with a female in the spring of the year. They were observed separately later in the summer. One loose sow-young association was recorded in the spring when the young bear was 4.3 years of age. They also were later observed separately. Some young are weaned at 2.4 years of age, assuming a May or early June separation, as evidenced from a solitary 2-year-old captured in August. However, that animal, plus one 3-year-old captured in July, were the only solitary animals of those age classes captured. It is possible that the majority of the young stay with their mothers to at least 3.3 years of age, thus fostering a 4-year interval between litters. Females that lose their young before or during the breeding season come into estrus immediately.

(d) *Mortality*

Insufficient data exist to allow construction of population life tables showing

specific age mortality rates. However, the late percentage of adults in the population with the natality rate recorded would indicate a high mortality rate among young and sub-adult animals.

Past studies have suggested that such natality factors as disease, parasites and malnutrition, have little effect on the grizzly bears. Evidence has been presented of large grizzlies killing smaller ones (Troyer & Hensel 1962; Mundy & Flook 1973: Pearson 1975), and one confirmed case of this phenomenon was recorded in the Arctic Mountain population in 1973. A 6.5-year-old male, weighing 147 kgs, was killed by a much larger (272 kgs) 9.5-year-old male. The smaller animal wore a radio collar and was killed between September 20 and 27 along the Babbage River. The larger animal had eaten much of the carcass, cached the rest along the river bank, and remained close by in the willows. Although the larger animal was captured, no signs of physical damage were in evidence on its body.

Several other cases of suspected predation occurred but prima facie proof was not obtained.

Den Sites

In November, 1973, it was possible to locate the dens of 12 grizzlies because each was carrying a radio transmitter. The den opening was observed in five cases while the other seven were located only as to hillside or snowbank. One additional active den was found while searching for the telemetered animals. One den site was located in mid-summer and it was not known if it was active in the 1973-74 winter. One additional site was recorded by other CWS personnel in the area (DeBock, pers.comm., February, 1974).

The locations of the 12 dens for which the occupant had been identified are shown on Figure 5, along with the other observed sites. None was on the Arctic coastal plain even though some of the animals spent considerable time in that area immediately prior to denning. Reports of grizzlies along the Arctic coast in the early spring, particularly female-young groups, strongly suggest that some denning occurs there; however, none of the tagged animals for which dens were identified used it.

There did not appear to be any differences, either geographically or ecologically, between the denning areas chosen by male or female bears. All sites were within the home ranges already delineated for the individual bears, thus requiring no long migrations to suitable sites. The larger home ranges of the males allowed them a greater selection of sites without leaving their area of familiarity.

The average altitude of the den sites was 732 meters above sea level with a range from 427 to 1036m. It was considered that 11 of the 12 sites were sufficiently delineated to measure the aspect of the opening. Seven were within 45° of south, two within 45° of east, two within 45° of north, and one facing west. Angle of slope was not measured during the November flights. Wooden stakes marked in 1-foot intervals were placed in snow banks as close as possible to each den.

Visual inspection of the six sites where the den opening was located indicated different characteristics from dens found in south-western Yukon (Pearson 1975). There was no heavy shrub cover around the opening of four dens in the Arctic Mountains, although it did appear in two cases. Stability of the soil above the den cavity must be created by other factors. It is postulated that freezing of the active soil layer or actual permafrost may provide the cohesive-

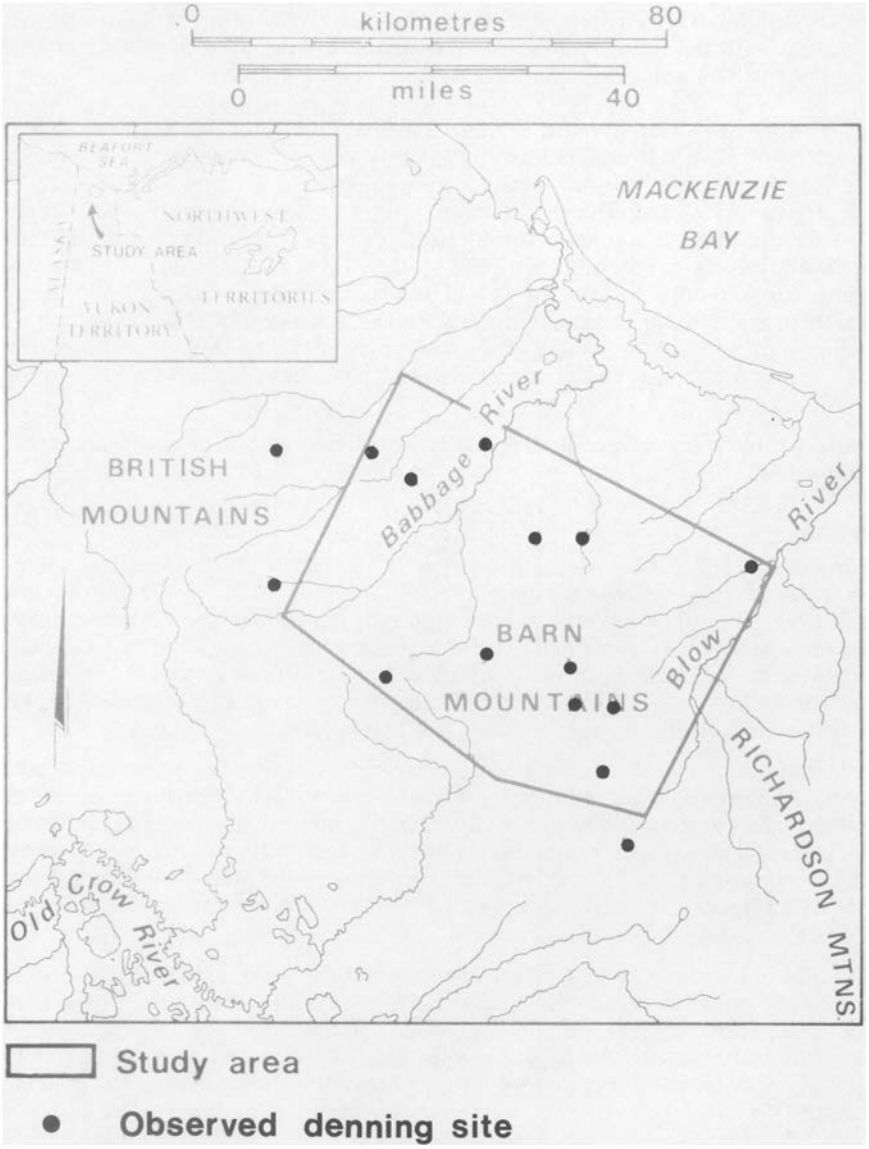

Fig. 5 Observed denning sites for grizzly bears on the study area.

ness that prevents the den from collapsing. If that is the case, it is expected that most of the dens collapse during the thaw period of the summer following excavation.

SUMMARY

The Arctic Mountain grizzly bear was studied on a 3367 square kilometer study area in the Barn Mountains of the Yukon territory during 1973 and 1974. A

seasonal change in the effect of Sernylan (*phencyclidine hydrochloride*) on the grizzlies was observed. The bears fed mainly on vegetable matter which varied with the season. Minimum home ranges of 414 km^2 for males and 73 km^2 for females were determined from radio-telemetry studies. A minimum population density of one grizzly per 48 km^2 was calculated. Preliminary information on the population parameters and dynamics are presented. Den sites were located and described.

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