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Aspects of Grizzly Bear Population Ecology in Mount McKinley National Park

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INTRODUCTION

Scientific knowledge of grizzly bears, *Ursus arctos*, in interior and northern Alaska and, more particularly, in Mount McKinley National Park, is based on work of Dixon (1938), Murie (1944, 1961) and Sheldon (1930).

The long-term objectives of this study include: (1) determination of population composition, density and mobility for given units of range, which will allow comparisons of protected and hunted populations; (2) development of an accurate census method; (3) determination of as many of the bear's range requirements as possible; (4) filling as many gaps in the factual knowledge of the grizzly's life history as possible.

DESCRIPTION OF STUDY AREA

The study area is roughly the north side of the Alaska Range in the eastern half of Mount McKinley National Park.

The physiographic setting of Mount McKinley National Park is well described in Wahrhaftig (1958). The Park lies astride the Alaska Range and the associated fault-valley and perimeter mountain chains, stretching from the Nenana River west approximately 150 km and varying in width from about 37 km to about 60 km. Most of the peaks in the eastern half of the Park are less than 2,000 m in height. Above 1,400 m there is a great deal of bare rock and ice. North of the main part of the Alaska Range and paralleling the high peaks, is a broad valley which is a functional part of a major fault system. The valley floor is approximately 1,000 m msl and is about 10 km in maximum north-south width. The low mountains north of the valley are rounded with slopes covered by rather open vegetation; the peaks in this range are from 1,200 m to 1,500 m msl. The east end of the Park is drained by rivers spaced at about 5- to 10-km intervals and flowing north or northwesterly (see Figure 1).

The climate of Mount McKinley National Park is variable; on the north side of the Alaska Range it is primarily continental but not as severe as that of the interior lowlands. Summer daily mean temperature is about 10° C to 15° C, but freezing and even snow may occur in any month. Persistent snow generally occurs by October and dissipates from the lowlands and unshaded portions of the foothills by mid- to late May. Snow may remain on north-facing slopes and in some deep beds almost the entire summer. There is much perennial snow along the crest of the Alaska Range. Annual precipitation is about 35 cm. During the summer, the time of greatest concern to this study, the weather tends to be extremely variable from day to day, year to year, and place to place. Wind frequently blows about 16 km per hour, and heavy rain squalls

Fig. 1 Grizzly bear study areas in Mr. McKinley National Park.

and sunshine frequently occur in neighboring valleys. It is seldom hot enough to preclude using spotting scope magnifications of 20X or 30X.

There is little forest cover in the Park. In the intermontane valley most tree cover occurs as isolated stands of white spruce, *Picea glauca,* on southern slopes of the lower range of mountains (the 'outside range') and more extensively along major rivers. The valley bottom itself and most mountain slopes are covered with shrubs, mostly willow, *Salix* spp. and tundra vegetation. Most of the tundra is relatively dry or very dry. North of the outside range there are extensive areas of wet sedge-tussock tundra. The broad, flat valley bottoms are covered by wide gravel bars of braided streams; these support patches of vegetation. Dixon (1938) and Murie (1944) have provided more extensive descriptions of the Park.

METHODS

Ground observations were made from early or mid-June through August in 1957-1959 and from late May through early September in 1973. Most aerial observations were made in late April and in September and October.

The major portion of the eastern half of the Park on the north side of the Alaska Range was divided into an intensive and an extensive study area, based on frequency and thoroughness of coverage. Open country, low vegetation, and approximately 128 km of road, mostly in the intermontane valley, permitted effective and efficient searching for bears.

Two basic approaches were used. The first was simply to drive along the road or hike through the back country searching for bears. Once bears were found, they were watched ideally from the closest possible distance that would permit observation while minimizing the possibility of detection of the observer. At times, observation distances were a few tens of meters, but many observations were made from a kilometer or more. An attempt was made to visually identify family groups or individuals in order to associate information with particular bears and to provide a basis for a population estimate.

The second basic approach was in connection with specific attempts to determine the density of bears within the study area. In such cases the road was driven slowly through the entire study area during the course of a single day. Stops were made frequently to search the landscape very thoroughly with spotting scopes. All bears seen were recorded and, when possible, identified as individuals.

In connection with a study of vehicular impact on animals along the road system during 1973, students recorded observations of all animal species from tour and shuttle buses as well as from our own vehicle. A minimum population estimate of grizzlies for that summer incorporated these data. A series of plots established for the traffic impact study provided additional density estimates.

Supercub aircraft, capable of relatively slow, low-level flight, were used frequently. Observations during calm weather were made from altitudes of 30 m to 150 m; the general strategy of flying varied but frequently involved very detailed and thorough coverage of each major drainage including small side valleys whenever feasible.

To ascertain the minimum number of families in the population, I conservatively applied a series of tests to each family unit, i.e. a sow with young. Five

principal criteria were used: number of young, their age, location, description, and timing. Only when potential duplicates were eliminated was a family treated with individual status. The tests for individual status of the families were applied on a within-year and between-year basis.

Single bears were tested for duplication in much the same way but with obviously less confidence when long time intervals occurred between sightings. The same procedure was followed for both families and singles, counting as distinct *only* those for which the probability of duplication was either zeroed or reduced to an extremely low level. The population estimates are therefore truly minimal.

RESULTS

Density

The estimate of minimum density varies between years from 0.026 to 0.041 bears/km^2 or 24 to 38 km^2 per bear (Table 1). Estimates are based on the entire study area with no attempt being made to eliminate unutilized habitat. In both 1959 and 1973, density levels appear to be relatively high; in 1973 several people knowledgeable about bears commented that there were a great many bears in the Park. Judging from the subjective impressions of individuals who have observed the Park closely for 20 years or more, I believe that the densities observed in 1959 and 1973 are near the upper end of the range that one can expect in this area. There is no basis for believing that the population maintained a constant density level between 1959 and 1973. The estimates relating to singles are considerably more conservative than those for families due to the greater potential for identification of different families.

Table 2 provides a summary of the density of sows with families and their young for the intensively worked portion of the study area. Observed densities for the same characteristics in the extensive portion of the study area generally range from one-quarter to three-quarters of the value for the intensive area. Much of the difference is due to lower effort in the extensive area; some of the difference may be due to variation in habitat quality. If the figures derived from the intensive sub-area are expanded by a factor appropriate to the relation of the size of the intensive sub-area to the size of the

TABLE 1 MINIMUM ESTIMATES OF GRIZZLY DENSITY BASED ON TOTAL STUDY AREA (INTENSIVE PLUS EXTENSIVE PORTIONS), EASTERN MOUNT McKINLEY NATIONAL PARK, ALASKA.

Year	No. Different Bears	Bears Per		Area Per Bear	
		km^2	mi^2	km^2	mi^2
1957	52	.026	.067	38.5	14.9
1958	66	.033	.085	30.5	11.8
1959	83	.041	.106	24.4	9.4
1973	76	.038	.097	26.3	10.3

TABLE 2 MINIMUM NUMBERS AND DENSITY OF GRIZZLY BEAR FAMILIES IN INTENSIVE STUDY AREA ONLY, MOUNT McKINLEY NATIONAL PARK, 1957-1959 AND 1973.

	$\bar{x}$	Range	s^2	s.e.$\bar{x}$	C.V.
No. females with young	9.0	7-12	4.67	0.735	24.0
Density females with young/ km^2	0.01	0.008-0.014	7×10^{-6}	0.026	26.3
No. young (total) with females	16.25	13-20	10.92	0.908	20.3
Density young (total) with females/km^2	0.019	0.015-0.023	15×10^{-6}	0.031	20.3
No. females with cubs	3.75	3-5	0.917	0.489	25.5
Density females with cubs/ km^2	0.005	0.004-0.006	9.1×10^{-7}	0.015	20.1
No. cubs with females	7.25	5-9	4.25	0.718	28.4
Density cubs with females/ km^2	0.008	0.006-0.010	4.3×10^{-6}	0.023	25.0
No. females with yearlings	4.0	2-7	4.67	0.735	54.0
Density females with yearlings/km^2	0.005	0.002-0.008	6.3×10^{-6}	0.025	52.6
No. yearlings with females	7.0	4-12	12.67	0.943	50.8
Density yearlings with females/km^2	0.008	0.005-0.014	16.3×10^{-6}	0.0317	48.9
No. females with two-yr-olds	1.25	1-2	0.250	0.354	40.0
Density females with two-yr-olds/km^2	0.001	0.001-0.002	2.5×10^{-7}	0.011	40.0
No. two-yr-olds with females	2.0	1-3	0.667	0.452	40.9
Density two-yr-olds with females/km^2	0.002	0.001-0.004	15.8×10^{-7}	0.018	56.0

total area in a manner generally similar to the method used by Martinka (1974), the estimates for the characteristics presented in Table 2 are on the average about 36% higher than those based on a summation of the data from the two sub-areas; this average difference would be substantially lower but for the large difference in those estimates associated with yearlings.

As was mentioned earlier, a series of plots was censused during the summer of 1973. The plot on Sable Pass (20.7 km^2), a notoriously good bear area, had the highest counts. Means based on five counts were as follows: $\bar{x}$ no. bears/check = 6.57, $\bar{x}$ no. families/check = 1.86, $\bar{x}$ no. bears/km^2 = 0.32, $\bar{x}$ no. families/km^2 = 0.09.

TABLE 3 AGE COMPOSITION AND STATUS OF ALL GRIZZLIES OBSERVED AND CONSIDERED DISTINCT, MOUNT McKINLEY NATIONAL PARK, ALASKA (TOTAL STUDY AREA).

	Cubs		Yearling		Two-Yr-Olds with Sow		Adults plus Two-Year or Older not with Sow				
							Excluding Sows with Young		Including Sows with Young		
	n	%	n	%	n	%	n	%	n	%	Total
1957	13	25.0	7	13.5	4	7.7	15	28.8	28	53.8	52
1958	20	30.3	6	9.1	1	1.5	24	36.4	39	59.1	66
1959	8	9.6	17	20.5	3	3.6	39	47.0	55	66.3	83
1973	15	19.7	12	15.8	7	9.2	23	30.3	42	55.3	76
Mean Number & Weighted % of total	14.0	20.2	10.5	15.2	3.8	5.4	25.25	36.5	41.0	59.2	69.25

Age and Sex Composition and Status

Table 3 presents crude average age composition data for all grizzlies observed in the total study area. The average proportion of cubs and yearlings was similar to the Glacier National Park population (Martinka 1974); the proportion of females with young was slightly lower in Mount McKinley National Park. Due to obvious problems with determining the sex of single adult bears, no attempt has been made to estimate the mature male fraction of the observed population. There is also a distinct possibility that mature males utilize somewhat different range than sows with cubs and are thus under-represented in the observed segment of the population.

At this point there is no possibility of deriving cohort-specific or horizontal life tables from the data; both the lack of multiple sequences and the effect of very small sample sizes preclude this.

Litter Size Relationships

Sixty-three litters were observed during the 4 years of intensive observations. The 4-year mean numbers of young per family at the time of observation was 1.81 for cubs, 1.83 for yearlings, and 1.67 for two-year-olds (4-year averages), suggesting very low mortality during the period of intensive maternal care, i.e. the first 18 months of life. Five litters were seen that each had three young. These McKinley data are well within the range reported by Mundy and Flook (1973) and Martinka (1974) and slightly lower than those in the heavily hunted population studied by Troyer and Hensel (1964).

Martinka (1974) suggested that mean litter sizes might be biased toward larger litters in some positive correlation with age of the young; he felt that larger young were more visible and consequently litters of older young would be more likely to be counted completely. This may be true when vegetation is dense and/or observation time is short, atypical conditions at McKinley. Apparent increases there in mean litter size with increasing age are almost certainly associated with small and rather variable samples and represent artifacts.

The mean proportion of cubs in the McKinley population can only be considered a very tentative estimate of crude birth rate in the absence of firm evidence of population level and age structure stability.

Mating

Grizzly males were observed in close association with females on numerous occasions, and in some cases the same pair was observed over an extended period of time. My seasonally earliest sighting of a pair, 30 May 1959, also involved attempted copulation. In 1959, one pair apparently remained together from 1 June until 12 July, with only one sighting out of eight involving the boar only. This boar maintained a triangular relationship from 28 June until 4 July; the original sow was not recognized after 12 July, and the boar was seen with the second female on 16 and 17 July. This second female was seen several times after that through early August but without the male; apparently either mating had occurred or she had become unreceptive about the third week of July. Other pairs were watched over periods of a few days to a week and a half.

Actual copulation, as determinable from a distance, was seen 16 June 1957 (N. J. Reid, pers. comm.; between 0800 and 0900), 26 June 1958 (seen from

aircraft, 0600), and 7 June 1959 (1331; undisturbed mounting lasted just over 20 minutes). Murie (1944) reports observations of copulation in McKinley Park on 20 May, 2 June, 10 June, and 18 June; he also reports pairs remaining together as long as 23 days.

DISCUSSION

Current Management Problems

The patterns and amount of human use of Mount McKinley National Park have changed drastically over the past 18 years. Prior to 1959, the only way to get a vehicle to the Park was to ship it on the Alaska Railroad. Perhaps three or four cars per day entered the Park and many visitors stayed several days or even several weeks. There was very little use of the country more than 2 km from the road. In 1959, the Denali Highway was connected to the Park road and traffic began a steady slow increase. Most visitors still arrived by train and the hotel at the railroad station at the east end of the Park has operated bus tours for many years, using up to four or more large buses depending on demand. The first summer with the new highway between Anchorage and Fairbanks open was 1972; the major portion of the traffic between those cities began to flow through the eastern end of the Park. Park visitation began to increase very rapidly. 'Back-country' use figures illustrate the general increase in visits to the Park and dramatically highlight the shift in use pattern. In 1972, there were approximately 4, 500 person-nights spent in the 'back-country'; this figure jumped to over 12, 000 in 1973. The potential for bear-human contacts is increasing rapidly as increasing numbers of visitors arrive and as a larger proportion of the visitors hike and camp off the road. Human injuries are increasing in frequency.

Hunting of grizzlies in the area surrounding the Park has been a rather long-standing practice. The area immediately east of the Park supports a resident population of grizzlies that can probably sustain regular hunting with a very low likelihood of significant effect on the Park's population. North of the Park the habitat appears less suitable for grizzlies, and there seems to be much lower probability that a substantial harvest can be supported without repeated recruitment from the protected population. The long narrow nature of the present Park makes the journey from the Alaska Range past the north boundary well within the range of possibility for a bear. The number of grizzly bears killed near the Park as recorded by the Alaska Department of Fish and Game are: 1969-9, 1970-9 and 1971-41. For the 3 years combined, the cumulative percent of the kill included in the above figures was: within 1. 6 km of the Park boundary, 6. 8%; 3. 2 km, 30. 2%; 6. 4 km, 46. 5%: 16 km, 57. 6%; 32 km, 75%. We hope to determine the source of the animals being taken in this boundary strip and any effects that such hunting may have on the Park population. This is an area where the National Park Service and Alaska Department of Fish and Game may need to engage in cooperative management.

The third major management problem currently facing the managers of Mount McKinley National Park results from the Alaska Native Claims Settlement Act which provides for possible extensions of the boundaries of the Park. The National Park Service collected public reaction to the original proposals and presented a final impact statement late in 1974. One possibility is extending the boundary to the north to include areas considered by many to be critical winter range for moose, wolves and other Park animals. Some of these lands may be used by grizzlies during early spring and late fall. The potential

addition would certainly provide considerable buffering from hunting since the proposed boundary is 32 km north of the present one in the eastern half of the Park. The state of Alaska has selected land adjacent to the eastern one quarter of the north boundary and several cabin sites have been leased by private individuals. This area constitutes a major weakness in any attempt to contain the core of the Park's large mammal populations in the present or proposed boundaries.

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