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N O R T H S L O P E G R I Z Z L Y B E A R S T U D I E S

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Project Progress Report
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JOB PROGRESS REPORT (RESEARCH)

State: Alaska

Cooperators: Harry V. Reynolds and John Hechtel

Project No.: W-21-2 Project Title: Big Game Investigations

Job No.: 4.14R Job Title: Structure, Status, Reproductive Biology, Movement, Distribution, and Habitat Utilization of a Grizzly Bear Population

Period Covered: July 1, 1980 through June 30, 1981

SUMMARY

Specific aspects of grizzly bear population biology in the western Brooks Range were studied during 1981. These included age at 1st production of offspring, length of reproductive life, litter size, reproductive interval, and mortality of young. During 1977-81, the mean litter size for 49 litters was 2.00 per (range 1.63 to 2.50) year. This variability illustrates the importance of long-term studies to set harvest levels for bears. Mean reproductive interval in this area will be at least 4.0 years. Mortality rates for offspring accompanied by marked adult females remained high: cub mortality 46%, yearling mortality 11%, and 2-year-old mortality, 16%. To examine causes of cub mortality, 3 females with cubs were kept under intensive observation from 8 May to 15 June. The 2 females which remained near their dens during the first 2 weeks after emergence also stayed close to their cubs. These sows were successful in raising cubs until at least September. In contrast, the other female left her den shortly after emergence and occasionally left her cubs on talus slopes while she foraged as far as 4 km away. By September, only 1 of her 3 cubs survived.

Key words: Alaska, cub mortality, grizzly bears, litter size, population biology, reproductive interval.

CONTENTS

BACKGROUND

The brown/grizzly bear (Ursus arctos) populations inhabiting the mountains and foothills of the Brooks Range are very susceptible to the impacts of increased human population, to development, and to overexploitation by hunting. In this region, the grizzly is at the northern extent of its range. Consequently, food availability during summer is short, reproductive potential low, home ranges large, and little cover is available (Crook 1971, 1972; Reynolds 1974, 1976, 1980; Reynolds et al. 1976). Exploration and development of oil and mineral resources can only be expected to continue. Improved access will probably increase bear-human conflicts. Confrontations could result in depletion of grizzly populations unless pertinent population information is gathered.

Investigations of grizzly bears conducted in the central Brooks Range have included those by Rausch (1969) on dentition and Crook (1971, 1972) on survey techniques, distribution, and abundance. In the eastern Brooks Range, survey techniques, population discreteness, denning characteristics, movement, and population characteristics were studied (Quimby 1974; Quimby and Snarski 1974; Reynolds 1974, 1976; Reynolds et al. 1976).

In the western Brooks Range, intensive studies designed to provide baseline information on grizzly bear population structure, reproductive biology, movement characteristics, and habitat utilization were conducted in 1977 and 1978 (Reynolds 1978). In 1979, these studies continued on a much-reduced scale and included investigations of grizzly bear predation on caribou (Rangifer tarandus) (Reynolds 1980). These studies have addressed many of the information gaps in the knowledge of grizzly bear ecology in the Brooks Range.

Some questions concerning arctic grizzly bear biology require long periods of study because these bears are long-lived and exhibit low reproductive rates. Fieldwork during 1980 and 1981 was directed toward those aspects of bear biology which require long-term investigation. Those aspects include: factors affecting age at first production of young, the reproductive interval, causes of cub mortality, survival rates, emigration of

young bears, and impacts of human disturbance including gas and oil exploration and development. Because the population size has been established and the majority of bears in the study area are marked, much of these additional data can be collected with minimum effort and expense.

OBJECTIVES

To determine the movement patterns, structure, size, status, reproductive biology, denning characteristics, and mortality rates of the grizzly bear population, and to assess potential effects of human disturbance on grizzlies in the western Brooks Range. During this reporting period, the major research effort was directed toward determining the reproductive biology and mortality rates for the population.

PROCEDURES

During 1977 through 1981, intensive studies were carried out in a 5,200 km^2 (2,000 mi^2) area in the mountains and foothills of the western Brooks Range. The approximate boundaries of the study area were the following: Archimedes Ridge (69°10'N latitude) on the north, the Kokolik River on the west, the crest of the Brooks Range on the south, and a line running from Thunder Mountain to the Utukok River (160°15'W longitude) on the east (Fig. 1).

During 1977-79, baseline data were collected on population size, structure, movement patterns, habitat utilization, and denning characteristics. Parameters describing productivity, especially reproductive interval and survival of young, must be recorded over a 5- to 10-year period to be accurate. Field investigations during 1980-81 were oriented toward studying these long-term aspects of reproductive biology. In addition, data were collected regarding migration, changes in movement and home range use, as well as fidelity to areas used in denning. This information was determined from observations of radio-collared or individually marked bears (Appendix A). Since baseline information for the study population was described previously (Reynolds 1978, 1980, 1981), this report will contain only data gathered in 1981 or, where appropriate, information which substantially affects previous calculations.

During 1981, fieldwork was again conducted from the base camp at Driftwood Creek airstrip near the Utukok River. Observations were made from 5 May through 14 June, on 9 July, and 19-22 September. To determine causes of cub mortality, 2 field crews made intensive observations of radio-collared females with cubs and followed these family groups on foot. In addition, all radio-collared females with cubs were located daily by aircraft, weather permitting. Oversummer survival of all radio-collared bears, including family groups, was assessed from observations made during September.

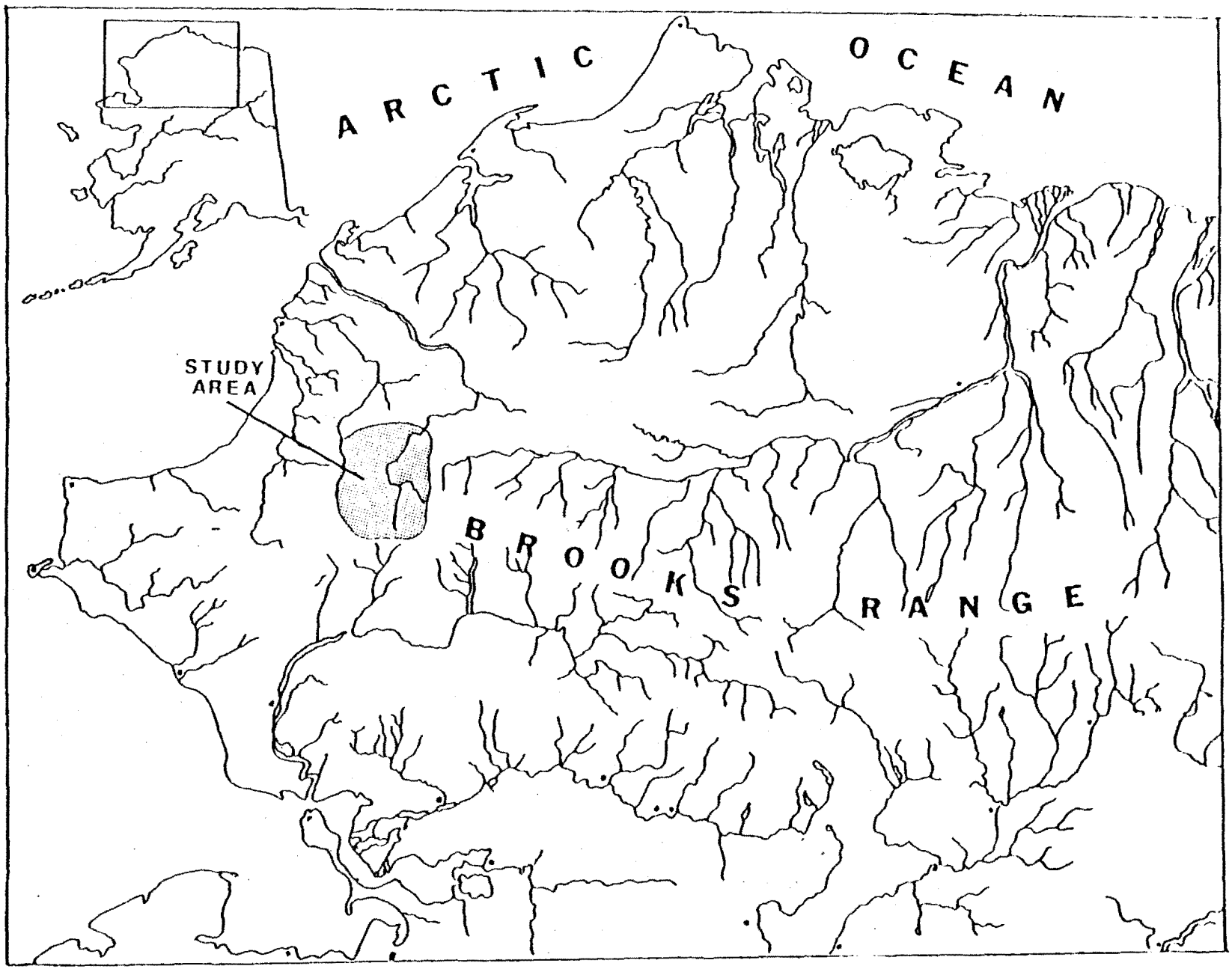

Figure 1. Grizzly bear study area in the western Brooks Range.

FINDINGS AND DISCUSSION

Reproductive Biology

During 1980-81, special effort was made to monitor changes in the reproductive status of previously marked females. The reproductive history of 45 potentially productive females confirm patterns reported in past reports (Table 1; Reynolds 1978, 1980, 1981).

Reproductive rates for bears depend upon age at 1st production of young, length of productive life of females, length of the reproductive cycle or reproductive interval, and average litter size (Craighead et al. 1974). In Alaska, the age at sexual maturity for brown/grizzly bears has ranged from 3.5 to 6.5 years on the Alaska Peninsula and Kodiak Island (Hensel et al. 1969; Glenn et al. 1976) and 6.5 to 12.5 years in the eastern Brooks Range (Reynolds 1976). In southwestern Yukon Territory, Pearson (1972) concluded females are first capable of conception at 6.5 years, but in northern Yukon Territory, age at 1st conception was 7.5 years. In Yellowstone National Park, Craighead et al. (1969) reported females bred at 4.5 to 8.5 years and had their first cubs the following spring. Moreover, they observed that some 3.5-year-old females copulated, but none were accompanied by cubs the following spring.

The average age of females at their 1st production of young during 1977-79 was calculated at 8.4 years (n= 11; Reynolds 1980). During 1980, 5 additional observations were made which resulted in a calculated mean age of 8.1 years (Reynolds 1981). During the 1981 season, only 1 observation could change this value. Female No. 1087 bred for the 1st time as a 5-year-old; however, whether she will produce her 1st litter as a 6-year-old will not be known until 1982. Calculations are based on actual observations and extrapolations; the results represent minimum values. Actually, 1st breeding and production of offspring is probably more closely related to the nutritional status and weight of a female than to age. Subsequent litters and survival of cubs is also likely tied to nutrition. Adequate data to substantiate this relationship will be difficult to obtain in the western Brooks Range because of the high costs of capture operations; however, the relationship has been shown for black bears (Ursus americanus) in Minnesota (Rogers 1976) and Idaho (Beecham 1980, Reynolds and Beecham 1980).

Litter sizes ranged from 1 to 3. The mean size of 49 litters over the 5-year period was 2.00 but ranged from 1.63 to 2.50 among years (Table 2). Such variability has far-reaching management implications because litter size may greatly affect the calculations of productive capacity. For example, using the 1980 litter size of 1.63, calculation of the reproductive rate for the population yields a mean rate of 0.40 cubs/adult female/year. If, on the other hand, the 1981 litter size of 2.50 was used, the mean reproductive rate would be 0.62 cubs/adult female/year, an increase of 53% over the 1980 figures. Further,

Table 1. Reproductive history and litter size for female grizzlies in the western Brooks Range.[a]

Bear no.	Age[b] in 1981	Offspring no.	Reproductive history and litter size[c] 1977	1978	1979	1980	1981	Comments
1085[d]	22.5		B	B	NB?	NB	UN	offspring prior 1977
1086[d]	19.5	1087, 1164; 2UM	2 yrlg	2 2yr	2 3yr/B	2 cubs	UN	mortality: entire family 1980
1087	5.5	none				NB	B	offspring of no. 1086
1089[d]	8.5	2UM	NB	B	2 cubs	UN	UN	no offspring prior 1977
1090[d]	20.5	3UM	3 yrlg	3 2yr	3 3yr/?B	UN	UN	probable mortality
1092	12.5	1093	1 cub	1 yrlg	1 2yr	B	B	
1095	10.5	none	?B	?B	UN	UN	UN	no offspring prior 1977
1097	12.5	2UM	B	B	2 cubs/B	2 cubs/B	3 cubs	no offspring prior 1977
1100	10.5	2UM	NB	B	2 cubs/B	B	UN	no offspring prior 1977
1102	6.5	1180, 1181	NB	NB	?B	2 cubs	B	no offspring prior 1977
1104	13.5	1101?, 1102?; 1UM; 1177	2 2yr?/B	1 cub/B	1 cub	1 yrlg	1 2-yr	1101, 1102 probable offspring
1105	11.5	1UM; 1173, 1174	B	B	1 cub/B	2 cubs	2 ylgs	no offspring prior 1977
1106	13.5	1107, 1108, 1109	3 cubs	2 yrlg	dead			mortality: 1 yrlg 1978; 1106 (& 2 2yr?) 1979
1110	28.5	1160, 1161	B	2 cubs	2 yrlg	2 2yr	2 3-yr	offspring prior 1977
1111	18.5	1112, 1113; 3UM	2 4yr/B	B	3 cubs/B	UN	UN	
1118	21.5	2UM	B	2 cubs	2 yrlg	UN	UN	offspring prior 1977
1119	10.5		B	B	UN	UN	UN	offspring prior 1977
1121[d]	15.5	1122, 1123	2 cubs	2 yrlg	2yr/B2 cubs	UN		
1127[d]	26.5		B	UN	UN	UN	UN	offspring prior 1977
1128	11.5	1129; 3UM cubs	1 yrlg/B	3 cubs	UN	UN	UN	
1130	25.5	2UM	2 cubs	1 yrlg	UN	UN	UN	mortality: 1 cub/yrlg 197778
1134[d]	18.5	1135, 1136, 1137	3 yrlg	2 2yr	2 3yr/B?	cubs?/B?	B	mortality: 1 2yr 1978
1138[d]	24.5	1151, 1152, 1153	2 2yr, 1 yrlg	2 3yr, 1 2yr	UN	UN	UN	possible adoption of young
1139	14.5	1140, 1141	B	2 cubs	2 yrlg	2 2yr/B	3 cubs?	
1142	17.5			B	UN	UN	UN	offspring prior 1978
1143	12.5	1144, 1UM	2 cubs	2 yrlg	2 2yr	UN	UN	
1146	17.5	1145, 1UM	12 yrlg	1 2yr	1 3yr/B	UN	UN	probable yrlg mortality

Table 1. Continued

Bear no.	Age[b] in 1981	Offspring no.	Reproductive History and Litter Size[c] 1977	1978	1979	1980	1981	Comments
1154	15.5	1155	1 cub	1 yrlg	1 2yr	1 3yr/B cubs		
1156	9.5	none		B	UN	UN	UN	no offspring prior 1978
1158	10.5	none		B	UN	UN	UN	no offspring prior 1978
1166	11.5	none		UN	?B	B	3 cubs	no offspring prior 1978; mortality: 2 cubs 1981
1167	12.5	1168		B	1 cub	B	B	lost cub fall 1979/spring 1980
1169	12.5	1170, 1171		UN	B	2 cubs	B	mortality: offspring 198081
1176	19.5	none		UN	UN	B	2 cubs	
1178	14.5	1179	B	12 cubs	12 yrlg	1 2yrl 3-yr/B		
UM		2UM	2 cubs	2 yrlg	UN	UN	UN	
UM		3UM	B	3 cubs	UN	UN	UN	possible mortality: 1 cub 1978
UM		2UM	B	2 cubs	2 yrlg	UN		
UM		2UM	B	2 cubs	12 yrlg	1 2yr		
UM		2UM	2 cubs	UN	UN	UN		
UM		1162, 1163	2 yrlg	2 2yr/?B	UN	UN		
UM		3UM	3 yrlg	UN	UN	UN		
UM		2UM	2 2yr UN	UN	UN			
UM		3UM		B	3 cubs	UN		
UM		2UM	B	2 cubs	2 yrlg	2 2yr		

[a] Designations are as follows: UM=unmarked; UN=unobserved; B=bred during that season; NB=did not breed; cub, yrlg, 2yr, 3yr=female accompanied by cub, yearling, 2yearold, or 3yearold young; cub/B=cubs lost prior to breeding season, subsequent breeding by female; yrlg/B, 2yr/B, etc.=offspring weaned, then subsequent breeding by female.

[b] These ages were determined from cementum annuli during the year of capture, but the ages reported here include years subsequent to the bear's capture. However, in cases of bears known or presumed dead, the data listed represent their ages when last known to be alive.

[c] Litter sizes should be viewed as minimum since mortality to other offspring may have occurred prior to observation.

[d] Presumed dead. No sightings were made within known home ranges after repeated intensive searches.

Table 2. Litter sizes for grizzly bears in the western Brooks Range, 1977-81.

	Age of offspring when first observed or captured					
Year	Cubs/litters	Ylgs/litters	2-yr/litters	3-yr/litters	Total	Litter size
1977	15/8	16/7	2/1	2/1	35/17	2.06
1978	17/8	0	0	0	17/8	2.13
1979	15/8	2/1	0	0	17/9	1.89
1980	13/8	0	1/1	0	14/9	1.63
1981	15/6	0	0	0	15/6	2.50
	75/38	18/8	3/2	2/1	98/49	
mean litter size	1.97	2.25	1.50	2.00	2.00	

if reproductive rates were calculated using high litter sizes found during 1 or 2 years, levels of sustained yield would be overestimated, possibly resulting in overharvest of bear populations. These differences illustrate the importance of gathering such information from long-term studies prior to setting appropriate harvest levels.

The reasons for variations in litter size were not determined. Inclusion of cohorts older than cubs-of-the-year in calculations did not result in low litter sizes since older cohorts displayed litter sizes similar to, or larger than, cub cohorts. Since many litters were not observed until early June, prior cub mortality could result in low litter sizes. However, evidence from family groups observed shortly after emergence from winter dens indicates that the great majority of cub mortality results in deaths of entire litters, not a reduction in litter size (Reynolds 1981). The most reasonable explanation for differences in yearly litter size is that cub production is dependent on the nutritional state of females, which may vary according to yearly differences in food availability and quality, or even winter den conditions affected by weather.

Reproductive interval is the time between breeding by a female and weaning of her offspring, regardless of subsequent production of young. The mean reproductive interval was 4.03 years from 1977-79 and at least 4.0 years during 1980-81. Of 8 females accompanied by 2- or 3-year-old offspring, only 2 weaned their young as 2-year-olds and then bred. Of the 6 others, 4 will have intervals of at least 4 years, 1 of at least 5 years, and 1 of at least 6 years.

Mortality

During 1981, 7 mortalities were documented: a hunter killed 4.5-year-old male No. 1155 in the upper Wulik River drainage; female No. 1166 lost 2 of her 3 cubs between 9 July and 19 September; and females Nos. 1169 and 1102 lost their offspring between mid-June or July 1980 and early May 1981, respectively. The dens of the latter 2 bears were not located, so we could not determine if the cubs died during winter dormancy. Female No. 1102 may have been nutritionally stressed. She was the youngest bear observed with cubs in this study; in addition, she weighed only 95 kg (210 lb) on 18 August 1980, compared to weights of 120 kg (265 lb) and 113 kg (250 lb) for 2 other females with offspring captured during August.

Two other mortalities may have occurred but were not verified. Both were females (23.5 and 28.5 years) which were not located in their established home ranges after intensive aerial searches.

Most observed mortality of cubs-of-the-year occurred from 1 to 4 weeks after emergence from maternal dens (Table 3). Although the highest number of cubs was lost during 1979, this same degree of cub mortality could have occurred in 1980. Adult females No. 1134, 1100, and 1166 probably bred in 1979 but were not seen

Table 3. Known mortality of the offspring of female grizzly bears in the western Brooks Range, 1977-1981.

Adult female bear	Number of offspring in litter	Number of offspring lost	Age of offspring lost*	Last date young observed	1st date young observed missing	Comments
1097	2	2	cub	5/9/79	5/15/79	1097 observed breeding 6/7/79
1097	2	2	cub	5/3/80	6/18/80	1097 observed breeding 6/18/80
1100	2	2	cub	5/5/79	6/29/79	1100 observed breeding 6/29/79
1104	1	1	cub	5/28/78	6/8/78	Male 1099 25 yds away on 6/8; 1104 bred again in 1978
1105	1	1	cub	5/22/79	5/31/79	1105 observed breeding 5/31/79
1111	3	3	cub	5/5/79	7/11/79	1111 not resighted again
UM	3	1	cub	8/11/78	9/12/78	Wolf seen harassing UM]/3 cubs;
1166	3	2	cub	7/9/81	9/19/81	UM]/2 cubs later seen in same vicinity
1102	2	2	cub or yrlg	8/20/80	5/12/81	
1130	2	1	cub or yrlg	6/30/77	8/2/78	
1167	1	1	cub or yrlg	9/18/79	6/10/80	1167 observed breeding 6/22/80
1169	2	2	cub or yrlg	7/18/80	5/7/81	
1106	3	1	yrlg	4/20/78	5/20/78	Runt yearling found dead at den site
1134	3	1	yrlg or 2yr	9/16/77	5/18/78	
1146	2	1	yrlg or 2yr	7/21/77	6/6/78	
1106	2	2	2-yr-old		5/4/79	1106 probably killed by male 1099; young not sighted again, presumed killed

* Designations are: cub, cub of the year; yrlg, yearling; 2-yr, 2-year-old.

with young after 9 June 1980 when observations began. Therefore, during 1980 it may have been possible that these females produced cubs and lost them before observations began. However, observations made during 1981 indicate that females seen without offspring in early spring did not lose young after emerging from winter dens; instead, either offspring were not produced or they died in dens during winter. For example, 3 females which bred in 1980 and were presumed pregnant did not have offspring by 7 May 1981 and were not near den sites. This contrasts to 4 other females with cubs or yearlings which were still in or close by dens on the same date. Therefore, we assumed the following: 1) females with offspring in early May should have been in or near den sites and 2) females away from dens had not emerged from winter dormancy with cubs.

Cubs sustain the highest mortality rate; most mortality in that age class occurs to entire litters (Table 4). In yearling and 2-year-old age classes, however, mortality rates are lower and usually involve only 1 member of the litter.

The causes of all cub mortality in this study have not been determined. Cannibalism by adult males has been documented in the Brooks Range (Reynolds 1974, 1976, 1978, 1980), elsewhere in Alaska (Troyer and Hensel 1962; Glenn et al. 1976), and in Canada (Mundy and Flook 1973; Pearson 1975, 1976). However, the comparative extent of cannibalism in cub mortality has not been established. Some mortality probably occurs within winter dens. Other cub deaths could result from disease, natural accidents, or sibling rivalry.

To better understand causes of cub mortality, 3 females with cubs were placed under intensive observation from early May until mid-June 1981. Two of these family groups were watched by ground-based crews on a 24-hour basis, weather permitting; the 3rd was observed daily from aircraft. Two of the 3 exhibited similar strategies of movement and protection of offspring; the 3rd showed a different and less successful strategy.

Female No. 1097 emerged from her den with 3 cubs on 12 May and stayed within 2 km of the den until 8 June when she moved about 5 km east. During this time, the cubs rarely strayed beyond 300 m of the sow and were usually closer. Although solitary bears and breeding pairs were seen in the vicinity of this family group, no aggressive interactions were observed. By 9 July, the family had moved 14 km east to the north slope of a butte and were observed with all 4 members in the same vicinity on 19 and 22 September.

Similarly, female No. 1176 and her 2 cubs were not observed farther than 300 m from her den site between 7 and 23 May. Like No. 1097, she continued to use her den for shelter and protection during the 1st 1-2 weeks after emergence. From 24 May-1 June, the family group moved about 3 km northwest; then they crossed the Utukok River and moved an additional 5 km north to Archimedes Ridge. During 5-14 June, they moved from 0-6 km daily but stayed

Table 4. Mortality rates for age classes of offspring accompanied by marked female grizzlies, 1977-81.

Age class	Young/litters in early spring	Young/litters in fall	Mortality rate of age class
Cubs[a] (1st year)	46/24	25/14	46%
Yearlings[a] (2nd year)	26/13	23/13	11%
2-year-olds[b] (3rd year)	12/7	10/6	17%

[a] When it was unknown whether a mortality occurred between age classes (i.e., between cub and yearling), it was assigned to the younger age class. This included 6 deaths of cubs or yearlings and 2 of yearlings or 2-year-olds.

[b] Of the 3 young accompanying female No. 1138 at capture, Nos. 1151 and 1152 were 2-year-olds and No. 1153 was a yearling. This "mixed" litter was presumably the result of an adoption by No. 1138, but which offspring were adopted is unknown. For purposes of this table, the 2 oldest were placed in the 2-year-old category, but the youngest was not included in the yearling cohort.

on the south slopes of Archimedes Ridge. By 19 September, the family group was still intact and using the same general vicinity.

In contrast, female No. 1166 with 3 cubs left her den site on 8 May after a large (presumably male) bear approached the den entrance, stayed nearby for 23 min, and then left. By 9 May, she moved 3.8 km west to a steep, talus slope, remaining until 15 May. On 16 May, the family group moved along the talus slope 6.5 km northeast and stayed in that vicinity until 28 May when aggressive interactions took place nearby between a breeding pair and another male. During this period, No. 1166 began a new behavioral pattern of leaving the 3 cubs near the talus slope while she foraged in the valley north of the ridge. At first, she did not venture beyond 300 m, but by 5 June she ranged 4 km north of the cubs' location. When she returned to her cubs on 5 June, only 2 were observed. After this date, she was not seen separated from her cubs again, but intensive observations ceased after 8 June, so the pattern may have persisted. By 19 September, No. 1166 was accompanied by only 1 cub.

The behavior of No. 1166 differed from that of Nos. 1097 and 1176 in several ways. She did not stay near the den for 7-10 days after emergence, while the other 2 females did. She traveled more often and for greater distances than the other females. And she left her cubs in 1 location while she foraged in another. None of these differences in behavior could be directly tied to cub mortality since the loss of cubs was not directly observed. Additional study of cub mortality may show what relationships exist.

Movement and Home Range

Movements during 1981 were plotted based on the relocations of radio-collared bears. Sightings indicated there were no substantive movements outside the home ranges used during 1977-80 (Reynolds 1980, 1981).

Two cases of movement outside the study area have been documented for young-age males. A 4-year-old male, which was weaned as a yearling and recaptured as a 3-year-old in the study area, was observed at a mining camp 120 km (75 mi) southwest of the study area in 1980. Similarly, in 1981, a 4-year-old male which had been weaned the year before was shot by a hunter 110 km (70 mi) west. It was not known whether these bears had emigrated and begun to establish home ranges out of the study area.

On the other hand, some young-age bears remain in the study area. One young-age female (No. 1087) and 1 male (No. 1164) were observed within or adjacent to their maternal home range 2 years after weaning.

RECOMMENDATIONS

This study resulted in a collection of baseline data important to understand grizzly bear populations in northwestern Alaska and the potential impacts of human disturbance on grizzly populations in the Arctic. However, additional information is needed. A technique for comparing the known density of bears in the study area with densities throughout the Brooks Range should be developed and tested. Observation of marked bears should be continued to improve the accuracy of reproductive data, allow calculation of long-term population productivity, and better determine survival rates and causes of mortality of young-age and mature grizzlies.

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LITERATURE CITED

Beecham, J. J. 1980. Population characteristics, denning and growth patterns of black bears in Idaho. Ph.D. Thesis. Univ. of Montana. 101pp.

Craighead, J. J., M. G. Hornocker, and F. C. Craighead, Jr. 1969. Reproductive biology of young female grizzly bears. J. Reprod. Fert. Suppl. 6:447-475.

_____, J. R. Varney, and F. C. Craighead, Jr. 1974. A population analysis of Yellowstone grizzly bears. Montana For. and Conserv. Sta. Bull. 40. School of Forestry, Univ. of Montana, Missoula. 20pp.

Crook, J. L. 1971. Determination of abundance and distribution of brown bear (Ursus arctos) north of the Brooks Range, Alaska. M.S. Thesis, Univ. of Alaska, Fairbanks. 78pp.

_____. 1972. Grizzly bear survey and inventory. Unpubl. mimeo rep. 38pp.

_____, J. W. Lentfer, J. B. Faro, and L. H. Miller. 1976. Reproductive biology of female brown bears, Ursus arctos, McNeil River, Alaska. Pages 381-390 in M. Pelton, J. Lentfer, and E. Folks, eds. Bears--their biology and management. IUCN New Ser. 40.

Glenn, L.P., J.W. Lentfer, J.B. Faro, and L.H. Miller. 1976. Reproductive biology of the female brown bear (Ursus arctos), McNeil River, Alaska. pp. 381-390 In Bears--their biology and management. M. Pelton, J. Lentfer, and E. Folk (eds.). IUCN New Series.

Hensel, R. J., W. A. Troyer, and A. W. Erickson. 1969. Reproduction in the female brown bear. J. Wildl. Manage. 33(2):357-365.

Mundy, K. R. D., and D. R. Flook. 1973. Background for managing grizzly bears in the national parks of Canada. Can. Wildl. Serv. Rep. No. 22. 35pp.

Pearson, A.M. 1972. Population characteristics of norhtern interior grizzlies in the Yukon Territory, Canada. pp. 32-35 In Bears--their biology and management. Herrero (ed.). Morges, IUCN publication new series 23.

_____, 1975. The northern interior grizzly bear (Ursus arctos L.) Can. Wildl. Serv. Rep. No. 34. 86pp.

_____, 1976. Population characteristics of the arctic mountain grizzly bear. Pages 240-260 in M. Pelton, J. Lentfer, and E. Folk, eds. Bears--their biology and management. IUCN New Ser. 40.

Quimby, R. 1974. Grizzly bear. Arctic Gas Biol. Rep. Ser. No. 24, Chapter. 2. 97pp.

_____, and D. J. Snarski. 1974. A study of furbearing animals associated with gas pipeline routes in Alaska. Arctic Gas Biol. Rep. Ser. No. 6, Chapter 2. 102pp.

Rausch, R. L. 1969. Morphogenesis and age related structure of permanent canine teeth in the brown bear (Ursus arctos L.) in Arctic Alaska. Z. Morph. Tiere 66:167-188.

Reynolds, D. G., and J. Beecham. 1980. Home range activities and reproduction of black bears in west-central Idaho. Pages 403-409 in C. J. Martinks and K. L. McArthur, eds. Bears--their biology and management. Bear Biol. Assoc. Conf. Ser. No. 3. U.S. Gov. Print. Off.

Reynolds, H. 1974. North Slope grizzly bear studies. Alaska Dep. Fish and Game, Fed. Aid Wildl. Restoration Rep. Proj. W-17-6, Jobs 4.8R-4.11R, Juneau. 27pp.

_____. 1976. North Slope grizzly bear studies. Alaska Dep. Fish and Game, Fed. Aid Wildl. Restoration Rep. Proj. W-17-6 and 7, Jobs 4.8R-4.11R, Juneau. 20pp.

_____. 1978. Structure, status, reproductive biology, movement, distribution, and habitat utilization of a grizzly bear population in NPR-A. Final Rep. NPR-A 105(c) Studies to USFWS. Mimeo rep. 41pp.

_____. 1980. North Slope grizzly bear studies. Alaska Dep. Fish and Game, Fed. Aid Wildl. Restoration Rep. Proj. W-17-11, Jobs 4.14-4.15R, Juneau. 75pp.

_____. 1981. North Slope grizzly bear studies. Alaska Dep. Fish and Game, Fed. Aid Wildl. Restoration Rep. Proj. W-21-1, Job 4.14R, Juneau. 27pp.

_____, J. A. Curatolo, and R. Quimby. 1976. Denning ecology of grizzly bears in northeastern Alaska. Pages 403-410 in M. Pelton, J. Lentfer, and E. Folk, eds. Bears--their biology and management. IUCN New Ser. 40.

Rogers, L. L. 1976. Effects of mast and berry crop failures on survival, growth, and reproductive success of black bears. Trans. N. Am. Wildl. Nat. Resour. Conf. 41:431-438.

Troyer, W. A., and R. J. Hensel. 1962. Cannibalism in brown bear. Anim. Behav. 10:231.

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APPENDIX A. Capture and marker characteristics of 101 bears in the western Brooks Range, 19771980.

Bear no. and sex	Cem. age	Date of capture	Bear wt. (lbs)	Location	Drug dosage	Ear tags (left/right)	Marking
1081M	5.5	5/24/77	175	Utukok R.	2.6/H	889/890	P/O
	7.5	9/17/79	430	N. Meat Mtn.	M/O	17827/17826	P/O
	8.5	7/7/80	380	Disappointment Cr.	2.8	504/503	1590 P/O
		8/15/80	400	Utukok R.	3.0/L	504/503	1590 P/O
1082M	13.5	5/25/77	370	Kokolik R.	2.0/O	892/893	O/G/O (removed)
		6/13/77	365	Kokolik R.	2.3/O	892/893	0948
		6/25/77	380	Kokolik R.	2.7/O	892/893	1077/1127
		8/10/77	--	Kokolik R.	2.7/L	892/893	
	14.5	6/27/78	425	Kokolik R.	2.8/L	892/893	1580/1570 Bk 1640/1680
	15.5	6/28/79	480	Kokolik R.	M/O	313/312	1420/1007
	16.5	8/17/80	520	Kokolik R.	5.0/L	538/539	0998 dB/P
1083M	7.5	5/25/77	265	Utukok R.	2.0/O	894/895	plaque
		6/2/77		Utukok R.	2.6/L	894/895	0998 Bk
	8.5	7/2/78	360	Utukok R.	2.7/O	894/895	0998 Bk
	9.5	6/30/79	355	Utukok R.	3.4/H	894/-	1023
1084M	7.5	5/26/77	220	Utukok R.	M/L	897/896	P/P
		6/2/77		Driftwood Cr.	2.2/L	897/896	0898 (lost) Bk/W
1085F	19.5	5/27/77	280	Meat Mtn.	M/L	899/898	1050
1086F	16.5	5/29/77	205	Meat Mtn.	2.0/L	205/206	1102/1152
		6/24/77	235	Meat Mtn.	1.3/L	205/206	
		8/8/77	265	Driftwood Cr.	1.9/O	205/206	
	18.5	9/16/79	400*	N. Meat Mtn.	M/L	205/206	1074.5/1410
1087F	1.5	5/29/77	31	Meat Mtn.	0.13/O	207/208	/G
	3.5	6/30/79	170	Meat Mtn.	1.1/O	314/208	1480 Bk/
	4.5	7/7/80	205	Meat Mtn.	M/O	506/505	1440 lB/Bk
1088M	4.5	5/31/77	270	Eskimo Hill	2.0/O	210/209	0923
1089F	4.5	6/1/77	122	Adventure Cr.	M/0	214/213	0973 (removed)
		6/10/77	126	Adventure Cr.	1.7/O	243/240	W/W
1090F	18.5	6/1/77	220	Utukok R.	M/H	215/216	0750
1091M	19.5	6/4/77	350	Utukok R.	3.0/H	217/218	0825
1092F	8.5	6/4/77	220	Ilingnorak Ridge	2.2/O	227/226	0775
	11.5	8/19/80	320	Ilingnorak Ridge	4.0	549/548	1000 O/G
1093F	0.5	6/4/77	38	Ilingnorak Ridge	0.1/O	228/229	lB/-
1094M	4.5	6/5/77	175	Meat Mtn.	2.0/H	225/230	lB/dB
1095F	6.5	6/5/77	200	N. Meat Mtn.	1.5/O	231/233	O/W
1096M	7.5	6/5/77	325	Meat Mtn.	2.6/O	236/237	0848
	8.5	6/28/78	395	Utukok R.	2.8/O	774/775	1596/1590 lB 1660/1700
	9.5	6/28/79		N. Meat Mtn.	M/H	774/775 & 893	/lB
	10.5	8/17/80	505	Meat Mtn.	4.2/L	536/537	0973 O/lB
1097F	8.5	6/5/77	225	Meat Mtn.	1.8/O	235/234	0874
	8.5	6/19/77		Utukok R.	1.4/O	235/234	0874
	11.5	7/6/80	300	Utukok R.	1.8/O	510/511	1470 Pp/P
		8/16/80	270	Utukok R.	5.1M/L	510/511	1470/1430 Pp/P

APPENDIX A. Continued.

Bear no. and sex	Cem. age	Date of capture	Bear wt. (lbs)	Location	Drug dosage	Ear tags (left/right)	Marking
1098M	3.5	6/8/77	108	Utukok R.	1.2/H	238/239	O/lB
1099M	10.5	6/11/77	365	Utukok R.	3.2/O	245/244	1023
	11.5	6/27/78	450*	Kokolik R.	2.8/O	773/772	1610/1560 1640/1680
	12.5	6/26/79	450	Utukok R.	3.0/O	773/772	1540
1100F	6.5	6/11/77	200	Meat Mtn.	2.4/O	247/246	0973
	7.5	6/9/78	240*	Utukok R.	2.5/H	247/246	0973P
	8.5	7/1/79	220	Driftwood Cr.	1.9/O	246/247	1098 P
1101M	2.5	6/12/77	145	Utukok R.	1.2/L	249/248	G/W
1102F	2.5	6/12/77	125	Utukok R.	1.2/L	251/250	W/G
	3.5	6/18/78	140	Utukok R.	1.4/O	251/250	1470
	5.5	8/18/80	210	Kokolik R.	3.0	544/545	0750 W/G
1103M	8.5	6/12/77	320	Utukok R.	2.6/H	253/252	1002 broken
	9.5	6/12/78		Utukok R.	M/H	253/252	1510
1104F	9.5	6/12/77	215	Utukok R.	1.6/O	255/254	0800
		6/17/77		Utukok R.	1.2/L	255/254	0800
	12.5	7/10/80	250	Nimwutik Cr.	1.5/L	517/518	1520 P/G
1105F	7.5	6/13/77	225	Kokolik R.	1.5/O	257/256	1098
		6/26/77	245	Tupikchak Mtn.	1.5/L	257/256	1098/1148
	8.5	6/28/78	285	Kokolik R.	1.7/L	257/301	1620/1630
	10.5	7/10/80	260	Iligluruk Cr.	1.8/O	522/521	0972 W/O
1106F	11.5	6/14/77	210	Adventure Cr.	1.5/H	258/259	0724
1107F	0.5	6/14/77	6.5	Adventure Cr.	none	none	none
1108F	0.5	6/14/77	20	Adventure Cr.	none	/260	/W
1109F	0.5	6/14/77	18	Adventure Cr.	none	261/	W/-
1110F	24.5	6/15/77	245	Ilingnorak Ridge	M/H	262/263	lB/P/lB
	25.5	7/1/78		Ilingnorak Ridge	1.9/L	262/263	1074.6 dB
	26.5	6/30/79	235	Ilingnorak Ridge	1.7/H	262/263	0725
1111F	14.5	6/18/77	240	Colville R.	1.7/O	269/268	0700
1112M	4.5	6/18/77	250	Colville R.	1.7/O	267/266	dB/G
1113F	4.5	6/18/77	150*	Colville R.	1.5/O	270/271	G/dB
1114M	16.5	6/19/77	450	Utukok R.	1.7/L	273/272	O/G/O
1115M	5.5	6/22/77	175	Meat Mtn.	1.5/H	275/274	dB/O
1116M	5.5	6/23/77	175	Utukok R.	1.5/O	276/277	O/dB
1117M	19.5	6/23/77	315	Driftwood Cr.	M/O	279/278	Pp/W/Pp
1118F	17.5	6/23/77	185	Driftwood Cr.	1.3/H	281/280	W/Pp
1119F	6.5	6/24/77	190	N. Meat Mtn.	1.7/L	282/283	O/P
1120M	16.5	6/24/77	390	N. Meat Mtn.	2.6/O	284/285	Pp/lB/Pp
1121F	11.5	6/25/77	245	Kokolik R.	M/H	287/286	1079/1128
1122M	0.5	6/25/77	30	Kokolik R.	0.12/O	/288 /G	
1123F	0.5	6/25/77	27	Kokolik R.	0.12/O	289/-	G/-
1124M	17.5	6/26/77	360	Tupikchak Mtn.	2.6/O	291/290	dB/W/dB
1125F	3.5	6/27/77	145	Utukok R.	1.4/H	/292	/W
1126M	13.5	6/28/77	345	Kokolik R.	2.7/O	293/294	O/W/O
1127F	26.5	6/28/77	295	Kokolik R.	1.5/L	295/	P/W/P
1128F	7.5	6/30/77	240*	Tupikchak Mtn.	1.8/O	297/296	P/P/P
1129F	1.5	6/30/77	90	Tupikchak Mtn.	0.5/O	299/298	P/P

APPENDIX A. Continued.

Bear no. and sex	Cem. age	Date of capture	Bear wt. (lbs)	Location	Drug dosage	Ear tags (left/right)	Marking
1130F	21.5	6/30/77	255	Elbow Cr.	1.9/O	300/900	O/O/O
1131M	8.5	7/1/77	235	Driftwood Cr.	2.5/H	3085/3086	G/O
1132F	2.5	7/2/77	67	Archimedes Ridge		1498/3082	lB/P
1133M	2.5	7/2/77	80	Archimedes Ridge		3088/1499	P/lB
	3.5	6/27/79	150	Utukok R.	1.4/O	310/309	P/lB
1134F	14.5*	7/5/77	230*	Utukok R.	2.0/L	3089/3090	0947 O
	17.5*	7/12/80	285	Utukok R.	2.8/H	526/527?	0943 Bk/G
1135M	1.5	7/5/77	57	Utukok R.		3091/3092	O/O
1136F	1.5	7/5/77	48	Utukok R.		3093/	O/-
1137F	1.5	7/5/77	58	Utukok R.		/3094	/O
1138F	23.5	8/10/77	250	Kantangnak Cr.	1.9/O	none	0898 O lost
	24.5	6/16/78	265	Kantangnak Cr.	M/L	759/758	dB/dB/dB
1139F	11.5	6/7/78	200*	Utukok R.	1.3/O	651/654	1549W
1140M	0.5	6/7/78	21	Utukok R.	none	/655	/O
1141F	0.5	6/7/78	16	Utukok R.	none	656/-	0/
	2.5	7/13/80	165	Utukok R.	2.1	532/533	1490 W/O
1142F	14.5	6/9/78	250*	Utukok R.	M/H	658/657	1520 Bk
1143F	9.5	6/9/78	210*	Utukok R.	1.8/H	704/705	lB/W
1144F	1.5	6/9/78	38	Utukok R.	0.4/H	717/718	Pp/G
1145F	2.5	6/10/78	95	Elbow Cr.	1.7/H	720/719	1457 lB/G
1146F	14.5	6/10/78	230*	Elbow Cr.	2.5/H	721/722	G/lB
1147M	3.5	6/10/78	205	Utukok R.	1.3/O	723/724	P/G
	5.5	7/10/80	305	Tupikchak Cr.	2.8/H	516/515	P/dB
1148M	6.5	6/10/78	205	Utukok R.	1.3/O	725/728	dB/W
1149F	4.5	6/11/78	180	Utukok R.	1.3/O	736/733	W/dB
1150M	5.5	6/16/78	185	Utukok R.	1.2/O	751/747	Bk/P
1151F	3.5	6/16/78	112	Kantangnak Cr.		752/753	Bk/Bk
1152M	3.5	6/16/78	142	Kantangnak Cr.		754/755	1450 O/Bk
1153F	2.5	6/16/78	70	Kantangnak Cr.		756/757	Bk/O
1154F	12.5	6/21/78	220	Tupik Cr.	1.8/O	760/761	W/O/W
1155M	1.5	6/21/78	75	Tupik Cr.	0.50/O	763/762	G/W
1156F	6.5	6/21/78	205	Kogruk Cr.	2.0/O	765/764	P/Bk
1157M	5.5	6/24/78	210	Driftwood Cr.	M/H	766/767	P/G/P
	6.5	6/30/79	275	Driftwood Cr.	2.4/H	766/767	Bk/P
1158F	7.5	6/24/78	180	Elbow Cr.	1.4/O	769/768	P/W
1159M	10.5	6/24/78	295	Driftwood Cr.	1.7/O	770/771	G/P
	12.5	8/16/80		Utukok R.	M/L	535/534	G/P
1160M	0.5	7/1/78	25	Ilingnorak Ridge	none	303/	dB/-
1161M	0.5	7/1/78	21	Ilingnorak Ridge	none	/302	/dB
1162M	2.5	7/1/78	95	Iligluruk Cr.	1.1/O	304/305	1490 lB/Bk
1163M	2.5	7/3/78	92	Iligluruk Cr.	M/H	306/307	1440 Bk/lB
1164M	3.5	5/7/79	185	Meat Mtn.	1.3/O	311/308	1498 G/Bk
	4.5	7/6/80	270	Meat Mtn.	1.9/O	512/311	1450 Bk/G
1165M	3.5	9/17/79	200*	N. Meat Mtn.	M/H	318/319	G/dB
1166F	10.5	9/18/79	390	N. Meat Mtn.	M/L	284/317	08980 dB/O
	11.5	7/7/80	265	Utukok R.	2.1/H	502/317	0772 lB/O
1167F	7.5	9/18/79	235	N. Meat Mtn.	2.8/H	271/315	1533 O/dB

APPENDIX A. Continued.

Bear no. and sex	Cem. age	Date of capture	Bear wt. (lbs)	Location	Drug dosage	Ear tags (left/right)	Marking
1168F	0.5	9/18/79	55	N. Meat Mtn.	0.60/O	274/296	eartags
1169F	11.5	7/5/80	290	Kokolik R.	2.2/L	513/514	1073 Bk/dB
1170F	0.5	7/5/80	34	Kokolik R.	0.10	114/112	dB/-
1171M	0.5	7/5/80	32	Kokolik R.	0.10	115/113	Bk/-
1172M	11.5	7/6/80	360	Utukok R.	3.2/H	509/508	W/lB
1173M	0.5	7/10/80	32	Kokolik R.	0.14	525/101	/O
1174F	0.5	7/10/80	28	Kokolik R.	0.14	501/507	O/-
1175M	7.5	7/12/80	400	Iligluruk Cr.	2.6	528/529	lB/lB
1176F	18.5	7/13/80	345	Utukok R.	2.0/0	531/530	0080 G/G
1177F	1.5	7/13/80	91	Nimwutik Cr.	0.38/L	520/519	G/G
1178F	13.5	8/18/80	250	Utukok R.	3.0	540/541	0898 lB/Bk
1179F	2.5	8/18/80	135	Utukok R.	1.4/L	542/543	lB/O
1180F	0.5	8/18/80	31	Kokolik R.	0.30/L	/547 /lB	
1181F	0.5	8/18/80	34	Kokolik R.	0.40/O	546/-	lB/-

* Estimate after close examination.

Marker designations:
Colors: P, pink; W, white; G, light green; O, orange; dB, dark blue; lB, light blue; Bk, black; Pp, purple.
Marker types:
One or 2 color combinations were used for ear flags; e.g., O/W is orange in left ear, white in right ear; /G is no flag, left; green, right. Three flag combinations were used in nylon rope collars; e.g., OOW is 2 identical clusters of OOW flags on opposite sides of the collar. Numbers, such as 1470, designate a radio collar with a frequency of 151.470 MHz; some radio collars were also marked with a flag and some transmitted more than 1 frequency.