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ECOLOGY OF BROWN BEARS INHABITING THE COASTAL PLAIN AND ADJACENT FOOTHILLS AND MOUNTAINS OF THE NORTHEASTERN PORTION OF THE ARCTIC NATIONAL WILDLIFE REFUGE

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Ecology of brown bears inhabiting the coastal plain and adjacent foothills and mountains of the northeastern portion of the Arctic National Wildlife Refuge.

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Abstract: A total of 145 brown bears (Ursus arctos) were captured and marked in May, June, and July 1982-1985 on the coastal plain and adjacent foothills and mountains of the northeastern portion of the Arctic National Wildlife Refuge (ANWR). Radio-transmitters were attached to a total of 113 different bears during this time period and these bears were monitored through denning (October-November) each year. More males were captured in age classes 5.5 years of age or less, while females were more abundant in age classes 6.5 years old and older. No natural mortalities occurred among sample bears in 1982, however, 10 apparent mortalities occurred among 17 young bears (cubs and yearlings) in 1983. In 1984, 13 of 24 young bears were apparent mortalities, and in 1985, 18 of 40 young bears were apparent mortalities. Reasons for these high mortality rates in 1983 (58.9%), 1984 (54.2%), and 1985 (45.0%) among young bears is unknown. Four mortalities were recorded during 1985. An adult female (19.5-year old) and an adult male (20.5-year old) died over winter of exposure and drowning, repectively. Two bears (a 13.5-year old female and a 3.5-year old male) were shot by hunters. Brown bears were observed feeding on caribou (Rangifer tarandus) carcasses (adults and calves) on 6 occasions in 1982, on 15 occasions in 1983, on 20 occasions in 1984, and on 31 occasions in 1985. Preliminary analysis of radio-relocation data indicate that brown bears appear to shift habitat use patterns to coastal areas in June and early July to coincide with occupancy of those habitats by calving and post-calving caribou. Emerged from winter dens occurred in late occurred in late April and throughout May in 1983 and 1985, but was confined to late April through mid-May in 1984, with early emergence of males and non-parturient females and later emergence of females with cubs of the year. Elevations of den sites averaged 816 $\pm$ 61m(SE) in 1983, 966 $\pm$ 46m(SE) in 1984, and 964 $\pm$ 64m(SE) in 1985. Aspects of den sites were predominantly southeast facing slopes (mean aspect, 1983 = 145°$\pm$20°SE; 1984 = 150°$\pm$18°SE; 1985 = 146°$\pm\pm$ 18°SE). Slope of den sites averaged 54$\pm$ 4%SE in 1983, 56$\pm$ 2%SE in 1984, and 58$\pm$ 3%SE in 1985. In October and November, bears moved south into foothill and mountainous habitats to den. Only two bears in each year denned on the coastal plain and foothill habitats in the 1002c study area in 1983, 1984 and 1985.

Ecology of brown bears inhabiting the coastal plain and adjacent foothills and mountains of the northeastern portion of the Arctic National Wildlife Refuge.

Brown bears (Ursus arctos) are year-round residents of the Arctic National Wildlife Refuge (ANWR) and use the coastal plain of ANWR during portions of their life cycle. Knowledge specific to ecology of brown bears using the coastal plain of ANWR are limited (U.S. Fish & Wildlife Service 1982). Impending petroleum exploration of the coastal plain and the potential impacts of this activity upon brown bears using the coastal plain requires expanded knowledge of brown bear ecology in the area. Of specific concern is the potential for disturbance during denning, which is postulated to have adverse effects of brown bear populations (Watson et al. 1973, Harding 1976). A study of brown bear ecology was initiated in 1982. The objectives of this study were as follows:

1. Determine location of denning and ecology of denning for brown bears using the coastal plain of ANWR.

2. Determine seasonal habitat use patterns of brown bear using the coastal plain of ANWR.

3. Determine seasonal interrelationships between brown bears and other wildlife species, especially caribou (Rangifer tarandus), occupying the coastal plain and adjacent foothills and mountains of the northeastern portion of ANWR.

4. Determine the structure, size, status, and reproductive biology of brown bear populations on the northern slope of the eastern Brooks Range.

This project is a cooperative effort between the U.S. Fish and Wildlife Service (USFWS) and the Alaska Department of Fish and Game (ADFG).

Methods and Materials

The study area is located between the Canning River and the Canadian border, and extends southward to the Brooks range. A detailed description of the study area was presented in the Initial Report - Baseline Study of the ANWR Coastal Plain (U.S. Fish and Wildlife Service 1982).

Field work was based at Barter Island and extended from 19 April through 7 November 1985. Bears were captured between 21 May and 15 June using a Bell 205B Jet Ranger helicopter. Fixed-wing aircraft were used to locate bears and direct the helicopter and capture crew to the site. Capture procedures followed standard helicopter immobilization techniques used on brown bears in northern Alaska (Reynolds 1974, 1976). M-99 (Etorphine, 1mg/ml, D-M Pharmaceutical) was injected into the rump using Cap-Chur equipment (Palmer Chemical and Equipment Co., Douglasville, GA). Bears recovered after the antidote (M50-50, Dipremorphine, 0.2 mg/ml, D-M Pharmaceutical, Rockville, MD) was administered intravenously (same dosage as M-99) and intramuscularly in the rump at 1/2 the dosage M-99. Certain bears (large males, etc.) were immobilized with the sernylan (phencyclidine hydrochloride, Bio-Centic Laboratories, St. Joseph, MO)

and acepromazine maleate (Ayerst Labs, New York) using the Cap-Chur equipment. Young bear (cubs) were captured by hand and were injected with sernylan and acepromazine for handling and processing. Captured animals were measured, weighed, tattooed for permanent identification, ear-tagged, and marked with color-coded visual ear flags (Reynolds 1974). In addition, certain bears were fitted with collars containing radio-transmitters (Telonics, Inc., Mesa AZ). Young age animals were fitted with expandable breakaway collars. These animals will be recaptured annually and the collars replaced. Also, young bears (3-4 years) of radio-collared females were captured and collared in late May to document disruption and dispersal of the family unit during the breeding season.

The two vestigial premolars of the lower jaw were extracted for age determination based on cementum layering (Mundy and Fuller 1964, Stoneburg and Jonkel 1966, Craighead et al. 1970). Teeth were sectioned, stained and mounted for reading as described by Glenn (1972). Whole blood was collected from femoral arteries using Vacutainers (Bection-Dickinson, Rutherford, NJ) for serological study by ADFG personnel.

Movements and range size were determined by aerial surveys using fixed-wing aircraft to relocate radio-collared bears. Radio-relocations were attempted on a weekly basis; however, inclement weather and extensive movements of radio-collared bears increased intervals between relocations to 7-10 days. Attempts were made to visually observe each bear during a relocation; however, terrain, cover, and weather conditions did not always permit visual observation. Therefore, when visual relocations were not possible, radio-fixes were determined by triangulation or by abrupt changes in radio-signal strength. Radio-relocations and fixes were recorded in 1:36,360 scale topographic maps and other relevant information was recorded on form sheets.

Radio-relocations will be digitized and computer graphic techniques will be used to analyze home range and species interrelationships. Movement distances between consecutive radio-relocations will be measured using computer Geographic Information System techniques. Winter dens were located by relocating radio-collared bears throughout October and early November. During these den surveys. dens of non-radio-collared bears were often sighted and their locations were recorded on 1:63,360 scale topographic maps.

Movement and home range data will be used to determine seasonal shifts in range use and an attempt will be made to relate these shifts to food availability. Concurrent observations of other species (especially caribou) will be used to evaluate the interrelationship between brown bear and their potential prey species. Upon completion of an extensive vegetation mapping effort in the study area (Walker et al. 1982, U.S. Fish and Wildlife Service 1982) the locational information for brown bear will be integrated into the digital data base of vegetation/land cover types. These integrated data sets will be examined statistically to determine habitat correlates. These data will be used to evaluate the suitability of using Landsat-derived land cover maps for identifying and assessing brown bear habitat in arctic Alaska. Movement, range size and habitat use data analyses are ongoing and will be presented in a final report.

Data on various parameters of den sites were recorded at the time of denning (October-November) and at the time of emergence in the spring (April-May). Each den site was visited in mid-summer (July) and the vegetation and soil characteristics of the site were documented. Variables measured during the 3

den sample periods were based on den site studies of arctic fox (Chesmore 1969), brown bear (Craighead and Craighead 1972), Harding 1976, Reynolds et al. 1976, Vroom et al. 1980) and black bear (Johnson and Pelton 1980, Tietje and Ruff 1980).

At each den site, two 30.5-m bisecting lines were established, with 1 line along the axis of the slope (up-slope line) and the other line (cross-slope line) perpendicular to the first. The den site was located at the midpoint of each line (the bisection point) in the manner described by Reichelt (1973). A sharpened surveyor's pin was lowered vertically to ground line at 30.5 cm intervals along each line and the point contact and the plant nearest to the pin at ground level was recorded at each point (200 total points per den site). Species composition data will be analyzed using analysis of variance and linear correlations analysis. Analysis of vegetational data is ongoing and will be presented in a final report.

Spring snow depths at each den site were recorded. Soil samples were taken at all ample locations to determine soil texture (Brady 1974). Regression analyses will be used to determine interrelationships between snow depth, soil texture, permafrost depths, and aspects. These data will be useful in more clearly defining denning habitat in the study area.

Results and Discussion

A total of 50 brown bears were captured and marked between 23 June and 3 July 1982 and 30 bears were captured and marked between 28 May and 16 June 1983. In addition, 11 bears captured in 1982 were recaptured in 1983 and refitted with new radio-collars (Table 1). Between 21 May and 15 June 1984, 23 new bears were captured and marked and 34 previously collared bears were recaptured and refitted with new radio-collars (Table 1). Between 13 June and 10 July 1985, 42 new bears were captured and marked and 25 previously collared bears were recaptured (Table 1). A total of 113 different bears were fitted with radio-collars during 1982-1985. Distribution of capture locations for the 76 bears captured in 1985 are depicted in Fig. 1.

Average weights of captured adult bears from 1982-1985 were comparable to weights of adult bears 9in the interior of the southern Yukon Territory (Table 2). It should be noted that weights recorded in other studies were for bears captured throughout the year, and included fall captured bears which are considerably heavier than bears captured in the spring (Pearson 1976). Bear captured in the current study were limited to spring and early summer capture periods.

Productivity

Age structure of 115 captured bears and 23 associated unmarked young (Fig. 2) that were theoretically alive in late winter 1985 indicated a preponderance of males in age classes 5.5 years or less (32 males versus 15 females, plus 23 unidentified bears), while females predominated in age classes 6.5 years and older (39 females versus 29 males). Immature bears (4.5-years old or less) comprised 46.4% of the theoretical population in the late winter of 1984, with cubs, yearlings, 2.5-year old, 3.5-year old, and 4.5-year old comprising 18.8%, 10.1%, 4.3%, 5.8%, and 7.2% respectively. Adults comprised 53.6% of the

Table 1. Physical characteristics of brown bears captured on the Arctic National Wildlife Refuge, Alaska, May, June and July 1982-1985. (Measurements shown in cm, except as noted).

Bear number	Sex	Cementum age	Weight (lbs./kg)	Total length	Body length	Hind foot	Neck	Girth	Head width	Head length	Shoulder height	Upper left canine	Lower left canine	General capture location	Date
1056	M[a]	20.5	365/166	181	129	29	74	126	22.5	35.7	118	3.9	3.2	Old Man Cr.	28 June 1982
1056	M[a]	22.5	350/159	-	-	-	68	130	22.6	35.6	-	-	-	Niguanak R.	10 June 1984
1072	M[a]	12.5	270/123	187	-	-	72	116	21.7	34.5	-	-	-	Jago R.	18 June 1985
1182	F[a]	15.5	170/77	170	92	27	57	92	18.3	34.0	104	3.0	2.7	Jago R.	23 June 1982
1182	F[a]	17.5	200/91	-	-	-	56	-	19.9	33.3	-	-	-	Jago R.	13 June 1984
1183	F	0.5	14/6	74	34	18	22	35	9.4	15.6	41	0.3	0.3	Jago R.	23 June 1982
1184	F	0.5	14/6	72	35	13	22	36	9.2	16.0	46	-	-	Jago R.	23 June 1982
1185	F[a]	18.5	215/98	163	99	27	57	99	19.5	31.0	103	2.8	2.8	Aichilik R.	23 June 1982
1185	F[a]	20.5	220e/100	-	-	-	57	95	19.6	31.5	-	-	-	Aichilik R.	21 May 1984
1186	M[a]	6.5	205/93	155	99	28	57	102	17.9	32.2	97	3.3	3.0	Siksikpalak R.	23 June 1982
1186	M[a]	7.5	250e/113	174	102	31	63	104	18.6	31.6	113	3.4	3.1	Kongakut R.	10 June 1983
1187	F[a]	6.5	168/76	147	93	24	52	99	17.0	29.8	98	3.1	2.9	Egaksrak R.	23 June 1982
1187	F[a]	7.5	180e/82	158	96	28	56	102	17.0	27.6	107	3.0	2.8	Siksikpalak R.	10 June 1983
1188	M[a]	4.5	285/129	201	95	22	67	110	19.5	36.0	102	1.5	1.5	Kongakut R.	23 June 1983
1188	M[a]	6.5	350e/159	-	-	-	68	121	20.5	36.4	-	-	-	Kongakut R.	13 June 1984
1189	F[a]	5.5	- -	168	94	26	55	99	17.1	32.1	100	3.4	2.8	Kongakut R.	23 June 1982
1189	F[a]	6.5	230/104	170	40	28	57	101	17.7	33.1	107	3.0	3.0	Turner R.	13 June 1983
1189	F[a]	7.5	185/84	-	-	-	-	-	-	-	-	-	-	Turner R.	21 May 1984
1189	F[a]	7.5	- -	-	-	-	-	-	-	-	-	-	-	Turner R.	9 June 1984
1190	F[a]	7.5	220/100	171	109	24	58	102	18.1	31.9	97	3.1	2.8	Turner R.	24 June 1982
1190	F	9.5	- -	-	-	-	-	-	-	-	-	-	-	Clarence R.	10 June 1984
1191	M	0.5	19/9	69	42	15	26	43	10.2	15.7	46	-	-	Turner R.	24 June 1982
1192	M	0.5	20/9	88	33	14	25	43	9.8	16.5	41	-	-	Turner R.	24 June 1982
1193	F[a]	8.5	190/86	177	90	19	63	114	21.0	32.5	68	2.8	2.8	Clarence R.	24 June 1982
1194	M[a]	11.5	305/138	191	99	23	74	116	21.0	37.0	41	3.8	3.3	Clarence R.	24 June 1982
1194	M[a]	13.5	380/172	-	-	-	83	122	21.7	37.7	-	-	-	Turner R.	9 June 1984
1195	M[a]	4.5	210/95	174	83	22	62	-	18.4	32.2	80	3.4	3.2	Kongakut R.	24 June 1982
1196	M[a]	6.5	- -	155	78	25	62	104	17.0	30.3	98	3.0	2.9	Ekaluakat R.	24 June 1982
1196	M[a]	7.5	220e/100	175	86	25	66	99	18.0	31.2	104	3.1	3.1	Siksikpalak R.	11 June 1983
1197	F[a]	8.5	190/86	163	92	27	57	100	19.2	30.9	96	2.9	3.0	Jago R.	24 June 1982
1197	F[a]	10.5	200/91	-	-	-	58	103	19.5	31.5	-	-	-	Aichilik R.	9 June 1984
1198	M[a]	5.5	205/93	167	89	29	60	107	16.9	33.0	94	3.5	3.1	Sadlerochit R.	25 June 1982
1198	M[a]	6.5	245/111	184	118	30	65	108	19.1	33.5	111	3.6	3.3	Akootoaktuk R.	10 June 1983
1199	M[a]	6.5	220/100	175	86	30	61	100	18.8	33.0	103	3.2	3.3	Katakturuk R.	25 June 1982
1200	M[a]	13.5	335/152	189	90	32	76	120	22.5	35.5	108	3.4	3.2	Katakturuk R.	25 June 1982
1200	M[a]	15.5	380/173	-	-	-	71	-	22.8	35.6	-	-	-	Marsh Cr.	12 June 1984
1201	F	5.5e[b]	190/86	159	80	28	62	97	18.3	31.1	92	2.8	2.7	Katakturuk R.	25 June 1982
1202	F[a]	16.5	215/98	160	97	24	60	109	18.2	31.6	98	3.1	2.8	Marsh Cr.	25 June 1982
1202	F[a]	18.5	- -	-	-	-	-	-	-	-	-	-	-	Nularvik R.	21 May 1984
1203	M	1.5	30/14	90	51	16	33	53	11.0	18.6	57	0.6	1.0	Marsh Cr.	25 June 1982
1203	M[a]	3.5	- -	-	-	-	-	-	-	-	-	-	-	Nularvik R.	21 May 1984
1204	M	1.5	55/25	97	64	19	39	75	12.2	21.5	68	1.0	1.2	Marsh Cr.	25 June 1982
1204	M[a]	3.5	- -	-	-	-	-	-	-	-	-	-	-	Nularvik R.	21 May 1984

Table 1 (Continued.)

Bear number	Sex	Cementum age	Weight (lbs./kg)	Total length	Body length	Hind foot	Neck	Girth	Head width	Head length	Shoulder height	Upper left canine	Lower left canine	General capture location	Date
1205	M	1.5	46/21	101	62	20	39	66	11.2	20.4	61	1.1	1.0	Marsh Cr.	25 June 1982
1205	M[a]	3.5	- -	-	-	-	-	-	-	-	-	-	-	Nularvik R.	21 May 1984
1205	M[a]	4.5	195/89	165	-	-	53	96	16.6	30.6	-	-	-	Tamayariak R.	18 June 1985
1206	F[a]	7.5	165/75	161	78	25	54	100	17.6	29.3	95	2.6	2.2	Hulahula R.	26 June 1982
1206	F[a]	8.5	190e/86	-	-	-	-	-	17.9	29.7	-	-	-	Itkilyariak Cr.	10 June 1983
1206	F[a]	10.5	185/84	157	-	-	51	96	18.0	29.4	-	-	-	Okpilak R.	4 July 1985
1207	M	5.5	190/86	157	104	28	61	93	18.8	32.2	109	3.7	3.5	Hulahula R.	26 June 1982
1208	F[a]	7.5	180/82	160	105	28	58	102	17.7	31.7	93	2.9	2.8	Old Man Cr.	26 June 1982
1208	F[a]	9.5	205/93	-	-	-	58	95	19.5	32.1	-	-	-	Hulahula R.	12 June 1984
1209	M	3.5	125/57	139	85	27	49	81	15.5	29.0	86	3.0	2.9	Hulahula R.	26 June 1982
1210	F[a]	3.5	151/69	154	83	23	53	94	16.7	29.3	91	2.6	2.6	Okpilak.R.	27 June 1982
1210	F[a]	4.5	175/79	156	90	26	55	92	18.0	30.0	99	2.7	2.6	Jago R.	10 June 1983
1210	F[a]	5.5	- -	-	-	-	58	92	18.1	31.1	-	-	-	Okerokovik R.	9 June 1984
1210	F[a]	6.5	215/98	166	-	-	55	123	19.0	31.3	-	-	-	Okerokovik R.	20 June 1985
1211	M[a]	4.5	152/69	143	81	27	53	91	15.8	28.0	84	3.0	2.9	Okpilak R.	27 June 1982
1212	F[a]	13.5	235/107	166	98	25	58	103	21.0	31.7	99	3.0	2.4	Old Man Cr.	28 June 1982
1212	F[a]	15.5	220/100	-	-	-	54	98	21.0	31.7	-	-	-	Okpirourak Cr.	13 June 1984
1213	F[a]	12.5	210/95	170	103	27	61	105	19.7	31.9	92	3.2	2.8	Marsh Cr.	28 June 1982
1213	F[a]	14.5	200/91	-	-	-	67	92	18.1	30.9	-	-	-	Katakturuk R.	7 June 1984
1214	F	2.5	80/36	109	66	22	44	74	14.0	24.6	74	1.2	1.7	Marsh Cr.	28 June 1982
1214	F[a]	3.5	115/52	143	77	26	45	76	14.8	27.7	86	2.3	2.6	Marsh Cr.	28 May 1983
1214	F[a]	4.5	175/79	-	-	-	51	84	17.2	30.6	-	-	-	Carter Cr.	12 June 1984
1214	F[a]	5.5	210/95	166	-	-	57	89	18.1	31.7	-	-	-	Sadlerochit R.	16 June 1985
1215	M	18.5	400/181	194	121	33	83	133	22.7	37.3	112	4.3	3.5	Jago R.	28 June 1982
1216	F[a]	5.5	195/88	163	102	26	65	107	17.5	28.9	100	2.6	2.7	Jago R.	28 June 1982
1216	F[a]	7.5	190/86	-	-	-	53	105	18.1	31.5	-	-	-	Hulahula R.	12 June 1984
1217	F[a]	12.5	250/113	150	107	30	58	98	18.8	29.9	103	2.7	2.5	Jago R.	29 June 1982
1217	F[a]	14.5	225/102	-	-	-	63	101	-	-	-	-	-	Okerokovik R.	6 June 1984
1218	M	2.5	144/65	154	93	29	48	87	14.6	27.7	88	2.3	2.5	Egaksrak R.	29 June 1982
1219	M	4.5	170/77	159	89	27	53	87	16.2	29.6	101	3.2	2.9	Jago R.	30 June 1982
1220	F	10.5	230/104	168	100	25	58	110	19.4	29.5	101	2.9	2.6	Jago R.	30 June 1982
1220	F[a]	11.5	235/107	163	88	26	66	102	20.3	30.9	109	3.0	2.6	Jago R.	8 June 1983
1220	F[a]	13.5	205/93	171	-	-	57	96	20.4	31.7	-	-	-	Jago R.	18 June 1985
1221	M[a]	3.5	150/68	145	80	26	50	96	15.8	27.3	88	2.8	2.9	Jago R.	30 June 1982
1222	M	3.5	120/54	148	82	25	47	87	15.2	26.2	91	3.0	2.7	Clarence R.	30 June 1982
1223	M	6.5	250/113	176	98	27	66	109	19.1	34.6	109	3.1	2.9	Kongakut R.	30 June 1982
1223	M[a]	7.5	245/111	182	97	28	63	99	19.2	33.5	108	3.0	2.7	Jago R.	10 June 1983
1223	M[a]	8.5	210/95	-	-	-	63	104	19.6	34.6	-	-	-	Okerokovik R.	6 June 1984
1223	M[a]	9.5	305/138	175	-	-	60	112	20.3	34.6	-	-	-	Aichilik R.	15 June 1985
1224	M	3.5	190/86	155	99	27	62	96	16.7	31.2	94	3.1	3.1	Beaufort L.	1 July 1982
1224	M[a]	6.5	320/145	196	-	-	66	109	20.3	35.2	-	-	-	Jago R.	15 June 1985
1225	M[a]	17.5	310/141	185	114	28	72	117	22.3	34.2	114	3.7	3.5	Sadlerochit R.	1 July 1982
1225	M[a]	19.5	390/177	-	-	-	67	119	22.4	34.1	-	-	-	Egaksrak R.	14 June 1984
1226	M[a]	10.5	385/175	203	116	28	78	135	22.9	36.8	123	4.1	3.3	Kongakut R.	2 July 1982
1226	M[a]	12.5	400/181	-	-	-	76	126	23.3	37.1	-	-	-	Kongakut R.	14 June 1984

Table 1 (Continued.)

Bear number	Sex	Cementum age	Weight (lbs./kg)	Total length	Body length	Hind foot	Neck	Girth	Head width	Head length	Shoulder height	Upper left canine	Lower left canine	General capture location	Date
1227	F[a]	13.5	255/116	176	120	33	61	113	20.3	32.9	97	3.4	3.0	Kongakut R.	2 July 1982
1227	F[a]	16.5	225/102	-	-	-	59	98	28e	38.0	-	-	-	Kongakut R.	13 June 1985
1228	M[a]	6.5	230/104	167	99	26	59	97	18.7	31.4	95	3.1	2.8	Okpilak R.	3 July 1982
1228	M[a]	9.5	275/125	178	-	-	63	101	20.6	32.8	-	-	-	Canning R.	16 June 1985
1229	M[a]	4.5	- -	143	92	29	53	102	16.2	30.2	109	4.0	3.5	Kongakut R.	3 July 1982
1229	M[a]	5.5	190/86	165	94	31	57	90	16.9	32.0	105	3.8	3.5	Turner R.	13 June 1983
1230	F[a]	7.5	170/77	163	93	25	54	96	17.9	30.3	99	2.9	2.6	Kongakut R.	3 July 1982
1230	F[a]	9.5	150/68	-	-	-	49	94	17.5	30.5	-	-	-	Kongakut R.	14 June 1984
1231	F[a]	2.5	75/34	129	65	23	45	67	14.1	25.6	75	2.6	2.8	Aichilik R.	28 May 1983
1231	F[a]	3.5	145/66	-	-	-	49	84	16.1	29.1	-	-	-	Angun R.	8 June 1984
1232	M[a]	2.5	85/39	136	75	24	47	69	14.4	26.8	90	2.1	2.4	Aichilik R.	28 May 1983
1232	M[a]	3.5	150/68	-	-	-	53	87	16.2	29.6	-	-	-	Angun R.	8 June 1984
1232	M[a]	4.5	220/100	168	-	-	58	100	16.6	32.0	-	-	-	Niguanak R.	19 June 1985
1233	M[a]	12.5	375e/170	186	104	32	63	110	22.4	33.4	109	3.8	3.2	Sadlerochit R.	28 May 1983
1234	F[a]	2.5	90/41	136	75	25	46	79	14.7	26.4	84	2.7	2.8	Turner R.	29 May 1983
1234	F	3.5	140/63	-	-	-	-	-	-	-	-	-	-	Turner R.	8 June 1984
1235	F[a]	2.5	95/43	138	74	24	43	69	14.6	27.4	85	2.7	2.8	Turner R.	29 May 1983
1235	F[a]	3.5	140/63	-	-	-	46	85	15.8	29.4	-	-	-	Kongakut R.	14 June 1984
1235	F[a]	4.5	155/70	153	-	-	50	102	16.8	30.3	-	-	-	Kongakut R.	19 June 1985
1236	F[a]	8.5	195/88	167	97	23	54	110	18.5	31.1	107	2.9	2.5	Okpilak R.	8 June 1983
1236	F[a]	10.5	235/107	175	-	-	60	108	18.6	31.5	-	-	-	Jago R.	8 June 1985
1237	F[a]	2.5	110/50	136	82	20	49	87	15.4	24.7	79	2.8	2.6	Okpilak R.	8 June 1983
1237	F[a]	4.5	180/82	158	-	-	56	100	17.5	27.7	-	-	-	Okpirourak R.	24 June 1985
1238	F	2.5	95/43	127	63	21	47	86	143.	23.8	76	2.6	2.6	Okpilak R.	8 June 1983
1239	F[a]	8.5	230e/104	167	83	27	60	116	19.1	32.5	105	3.2	2.6	Jago R.	8 June 1983
1239	F[a]	10.5	210e/95	-	-	-	63	98	27.0	37.0	-	-	-	Okerokovik R.	13 June 1985
1240	M[a]	6.5	228/103	165	103	30	59	102	18.3	32.9	108	3.7	3.1	Okpilak R.	9 June 1983
1241	M[a]	18.5	355/161	185	106	25	70	123	23.0	35.7	120	3.8	3.2	Okpilak R.	9 June 1983
1242	F[a]	5.5	160/73	163	88	24	53	111	16.2	29.5	101	3.1	3.0	Okerokovik R.	9 June 1983
1243	F[a]	11.5	235/107	170	92	28	59	109	18.4	32.4	110	3.0	2.8	Okerokovik R.	9 June 1983
1244	M[a]	11.5	310/141	194	115	25	73	117	21.0	33.0	105	3.2	2.7	Okerokovik R.	9 June 1983
1245	F[a]	14.5	215/98	168	94	28	58	99	19.1	33.4	109	2.9	2.6	Itkilyariak R.	10 June 1983
1245	F[a]	16.5	235/107	186	-	-	58	126	18.9	33.7	-	-	-	Sadlerochit R.	17 June 1985
1246	M[a]	10.5	340/154	190	107	31	70	113	21.1	35.8	126	3.6	3.1	Itkilyariak R.	10 June 1983
1246	M[a]	12.5	330/150	185	-	-	67	115	21.9	36.3	-	-	-	Limit Cr.	16 June 1985
1247	F[a]	18.5	220/100	174	100	27	61	109	19.4	31.4	110	3.0	2.3	Katakturuk R.	10 June 1983
1247	F[a]	20.5	215/98	170	-	-	55	97	19.0	31.3	-	-	-	Tamayariak R.	16 June 1985
1248	F[a]	10.5	180/82	158	88	25	55	93	19.1	30.7	92	-	-	Kongakut R.	12 June 1983
1248	F[a]	11.5	- -	-	-	-	59	89	18.6	30.6	-	-	-	Kongakut R.	11 June 1984
1248	F[a]	12.5	200/91	142	-	-	55	96	19.0	32.5	-	-	-	Kongakut R.	5 July 1985
1249	F	3.5	110/50	122	74	22	53	86	15.2	28.1	83	-	-	Kongakut R.	12 June 1983
1249	F[a]	4.5	130/59	-	-	-	48	84	16.0	28.5	-	-	-	Kongakut R.	10 June 1984
1250	M[a]	20.5	405/184	197	114	28	80	131	23.0	36.0	124	3.5	2.8	Turner R.	12 June 1983
1251	M[a]	19.5	330/150	182	111	29	77	114	23.9	35.9	113	2.9	3.2	Turner R.	12 June 1983
1251	M[a]	21.5	305/138	181	-	-	64	109	23.9	35.7	-	-	-	Okerokovik R.	19 June 1985

Table 1 (Continued.)

Bear number	Sex	Cementum age	Weight (lbs./kg)	Total length	Body length	Hind foot	Neck	Girth	Head width	Head length	Shoulder height	Upper left canine	Lower left canine	General capture location	Date
1252	F[a]	7.5	195/88	160	98	28	61	99	18.9	31.5	97	2.8	2.7	Kongakut R.	13 June 1983
1252	F[a]	8.5	205/93	-	-	-	57	93	19.2	30.7	-	-	-	Kongakut R.	15 June 1984
1253	M	1.5e	62/28	109	58	-	42	61	12.7	23.1	67	-	-	Kongakut R.	13 June 1983
1254	M	12.5	255e/116	174	104	27	66	93	21.8	34.0	111	3.4	2.8	Old Man Cr.	14 June 1983
1254	M[a]	14.5	275/125	172	-	-	61	115	22.3	33.2	-	-	-	Akootoaktuk R.	21 June 1985
1255	M[a]	1.5	48/22	107	62	19	32	52	12.2	21.2	68	0.9	0.5	Old Man Cr.	14 June 1983
1256	M[a]	4.5	220/100	172	98	30	56	94	18.1	32.8	111	3.7	3.3	Jago R.	15 June 1983
1257	F[a]	8.5	160/73	163	101	27	54	86	18.5	31.3	98	3.0	2.8	Okpilak R.	15 June 1983
1257	F[a]	9.5	190/86	-	-	-	53	89	18.8	31.8	-	-	-	Okpilak R.	13 June 1984
1258	F[a]	9.5	195/88	195	163	26	57	98	17.6	30.8	93	3.1	2.9	Akootoaktuk R.	15 June 1983
1258	F[a]	11.5	215/98	178	-	-	59	103	18.9	30.5	-	-	-	Okpilak R.	21 June 1985
1259	F[a]	23.5	215/98	153	103	25	58	102	19.3	31.4	106	3.4	3.1	Hulahula R.	15 June 1983
1259	F[a]	24.5	195/88	-	-	-	60	94	19.6	32.1	-	-	-	Itkilyariak R.	13 June 1984
1260	F[a]	10.5	220/100	166	107	28	59	108	19.8	32.1	107	3.2	2.9	Egaksrak R.	16 June 1983
1260	F[a]	11.5	255/16	-	-	-	58	110	19.5	32.4	-	-	-	Egaksrak R.	10 June 1984
1261	F[a]	7.5	190e/86	-	-	-	52	89	18.0	31.2	-	-	-	Aichilik R.	21 May 1984
1262	M[a]	10.5	395/179	-	-	-	82	-	24.0	35.9	-	-	-	Okerokovik R.	6 June 1984
1263	M[a]	11.5	300/136	-	-	-	71	108	21.5	36.6	-	-	-	Katakturuk R.	7 June 1984
1263	M[a]	12.5	400e/182	-	-	-	-	-	-	-	-	-	-	Canning R.	16 June 1985
1264	M[a]	11.5	445/202	-	-	-	79	129	24.1	38.2	-	-	-	Aichilik R.	8 June 1984
1265	M	0.5	22/10	-	-	-	26	43	10.7	16.5	-	-	-	Aichilik R.	9 June 1984
1266	M	0.5	17/8	-	-	-	25	40	10.1	15.0	-	-	-	Aichilik R.	9 June 1984
1267	F[a]	10.5	220e/100	-	-	-	63	103	19.3	30.4	-	-	-	Jago R.	9 June 1984
1268	M[a]	3.5	145/66	-	-	-	51	80	15.4	28.1	-	-	-	Egaksrak R.	10 June 1984
1269	F[a]	10.5	175/79	-	-	-	49	79	17.9	31.1	-	-	-	Itkilyariak R.	11 June 1984
1270	M	0.5	14/6	-	-	-	21	39	9.7	15.1	-	-	-	Clarence R.	11 June 1984
1271	M	0.5	15/7	-	-	-	23	37	9.7	15.6	-	-	-	Kongakut R.	11 June 1984
1272	F	0.5	17/8	-	-	-	25	41	9.9	15.0	-	-	-	Kongakut R.	11 June 1984
1273	M[a]	7.5	205/93	-	-	-	56	93	17.9	32.6	-	-	-	Jago R.	13 June 1984
1274	M[a]	4.5	165/75	-	-	-	51	93	15.9	27.3	-	-	-	Niguanak R.	13 June 1984
1275	M[a]	12.5	385/175	-	-	-	63	113	20.7	33.6	-	-	-	Aichilik R.	14 June 1984
1276	F	0.5	15/7	-	-	-	21	36	9.1	15.2	-	-	-	Kongakut R.	14 June 1984
1277	M	0.5	16/7	-	-	-	21	35	10.1	15.8	-	-	-	Kongakut R.	14 June 1984
1278	F[a]	8.5	185/84	-	-	-	50	99	18.5	31.0	-	-	-	Paulaluk R.	15 June 1984
1279	M	0.5	10/5	-	-	-	19	32	9.0	14.3	-	-	-	Paulaluk R.	15 June 1984
1280	M	0.5	14/6	-	-	-	22	37	10.3	15.0	-	-	-	Paulaluk R.	15 June 1984
1281	M[a]	6.5	260/118	-	-	-	61	106	19.9	33.9	-	-	-	Aichilik R.	15 June 1984
1281	M[a]	7.5	280/127	185	-	-	65	102	20.0	36.4	-	-	-	Okerokovik R.	15 June 1985
1282	F[a]	6.5	205/93	-	-	-	53	90	18.2	31.4	-	-	-	Niguanak R.	15 June 1984
1283	M[a]	4.5	195/88	-	-	-	56	90	14.0	30.0	-	-	-	Niguanak R.	15 June 1984
1283	M[a]	5.5	-	-	-	-	59	104	22.0e	35.0e	-	-	-	Niguanak R.	13 June 1985
1284	M[a]	7.5	255/116	176	-	-	60	96	20.2	34.0	-	-	-	Ekaluakat R.	15 June 1985
1285	M	0.5	19/9	78	-	-	24	37	9.9	16.7	-	-	-	Tamayariak R.	16 June 1985
1286	F	0.5	19/9	78	-	-	23	37	9.7	16.1	-	-	-	Tamayariak R.	16 June 1985
1287	F[a]	8.5	215/98	84	-	-	54	92	17.6	34.3	-	-	-	Tamayariak R.	17 June 1985

Table 1 (Continued.)

Bear number	Sex	Cementum age	Weight (lbs./kg)	Total length	Body length	Hind foot	Neck	Girth	Head width	Head length	Shoulder height	Upper left canine	Lower left canine	General capture location	Date
1288	F	2.5	106/48	143	-	-	46	80	14.8	25.8	-	-	-	Jago R.	18 June 1985
1289	F	2.5	105/48	147	-	-	45	87	15.1	25.8	-	-	-	Jago R.	18 June 1985
1290	M[a]	5.5	205/93	177	-	-	54	102	17.5	33.3	-	-	-	Sadlerochit R.	18 June 1985
1291	M[a]	19.5	305/138	200	-	-	63	105	20.6	34.6	-	-	-	Okerokovik R.	20 June 1985
1292	F[a]	6.5	230/104	165	-	-	67	103	26.9	32.6	-	-	-	Aichilik R.	20 June 1985
1293	M	3.5	175/79	151	-	-	51	102	16.5	30.0	-	-	-	Jago R.	21 June 1985
1294	F[a]	14.5	210/95	172	-	-	55	104	19.4	32.6	-	-	-	Jago R.	21 June 1985
1295	M	0.5	29/13	82	-	-	27	48	10.5	17.2	-	-	-	Jago R.	21 June 1985
1296	M	0.5	27/12	85	-	-	29	46	10.2	17.4	-	-	-	Jago R.	21 June 1985
1297	F[a]	7.5	185/84	162	-	-	54	99	18.7	30.6	-	-	-	Okerokovik R.	23 June 1985
1298	F[a]	10.5	200/91	170	-	-	60	107	20.8	31.6	-	-	-	Aichilik R.	23 June 1985
1299	M	0.5	20/9	73	-	-	27	47	9.5	16.3	-	-	-	Aichilik R.	23 June 1985
1300	F	0.5	23/10	83	-	-	27	51	9.9	16.6	-	-	-	Aichilik R.	23 June 1985
1301	F	19.5	205/93	141	-	-	60	113	18.7	29.7	-	-	-	Tamayariak R.	24 June 1985
1302	M[a]	5.5	255/166	177	-	-	62	104	20.0	34.9	-	-	-	Marsh Cr.	24 June 1985
1303	M	4.5	145/66	149	-	-	48	84	15.4	28.0	-	-	-	Aichilik R.	24 June 1985
1304	M[a]	7.5	265/120	175	-	-	62	109	20.1	35.6	-	-	-	Egaksrak R.	25 June 1985
1305	M[a]	12.5	320/145	165	-	-	72	113	21.7	32.6	-	-	-	Egaksrak R.	25 June 1985
1306	M[a]	5.5	195/89	164	-	-	61	97	19.9	34.4	-	-	-	Ekaluakat R.	26 June 1985
1307	F[a]	10.5	190e/86	162	-	-	60	113	20.5	32.6	-	-	-	Egaksrak R.	26 June 1985
1308	M	2.5	85/39	109	-	-	47	81	14.8	25.5	-	-	-	Egaksrak R.	26 June 1985
1309	F	2.5	62/28	99	-	-	38	68	13.6	23.3	-	-	-	Egaksrak R.	26 June 1985
1310	F[a]	8.5	215/98	140	-	-	62	105	20.7	32.1	-	-	-	Aichilik R.	26 June 1985
1311	M	2.5	74/34	119	-	-	41	66	14.6	24.3	-	-	-	Aichilik R.	26 June 1985
1312	F	2.5	97/44	121	-	-	47	67	15.3	26.8	-	-	-	Ekaluakat R.	27 June 1985
1313B	M[a]	14.5	305/138	200	-	-	65	124	23.4	38.0	-	-	-	Turner R.	27 June 1985
1313A	M[a]	4.5	210/95	160	-	-	59	95	19.3	32.7	-	-	-	Turner R.	27 June 1985
1314	M	3.5	110/50	145	-	-	51	75	15.2	28.1	-	-	-	Kongakut R.	27 June 1985
1315	M[a]	7.5	255/116	180	-	-	60	108	20.8	33.9	-	-	-	Ekaluakat R.	27 June 1985
1316	M	0.5	24/11	80	-	-	26	44	9.8	17.0	-	-	-	Jago R.	4 July 1985
1317	M	0.5	21/10	80	-	-	26	47	10.1	16.6	-	-	-	Jago R.	4 July 1985
1318	F	0.5	22/10	73	-	-	27	46	10.3	16.4	-	-	-	Jago R.	4 July 1985
1319	F[a]	6.5	235/107	171	-	-	59	103	19.0	31.7	-	-	-	Tamayariak R.	10 July 1985
1320	F[a]	20.5	280/127	186	-	-	60	114	19.0	32.6	-	-	-	Sikutaktuvik R.	10 July 1985
1321	M	0.5	33/15	86	-	-	29	48	11.3	18.7	-	-	-	Sikutaktuvik R.	10 July 1985
1322	M	0.5	32/15	85	-	-	27	51	12.2	17.6	-	-	-	Sikutaktuvik R.	10 July 1985
1323	F[a]	4.5	175/79	163	-	-	53	87	17.3	30.2	-	-	-	Sikutaktuvik R.	10 July 1985
1324	M[a]	8.5	300/136	177	-	-	63	114	20.0	34.4	-	-	-	Angun R.	10 July 1985

[a] Radio-collared
[b] e=estimated

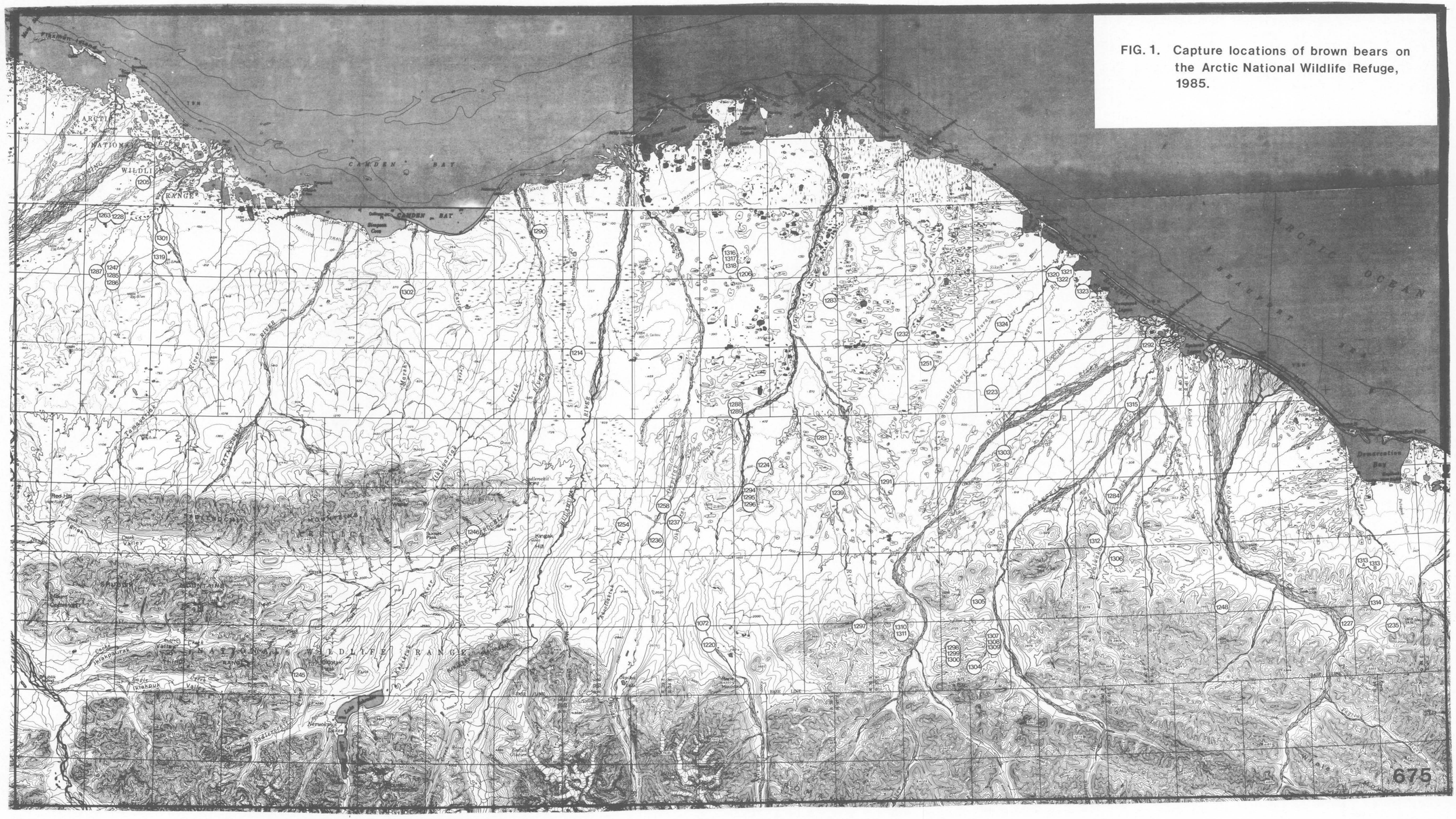

FIG. 1. Capture locations of brown bears on the Arctic National Wildlife Refuge, 1985.

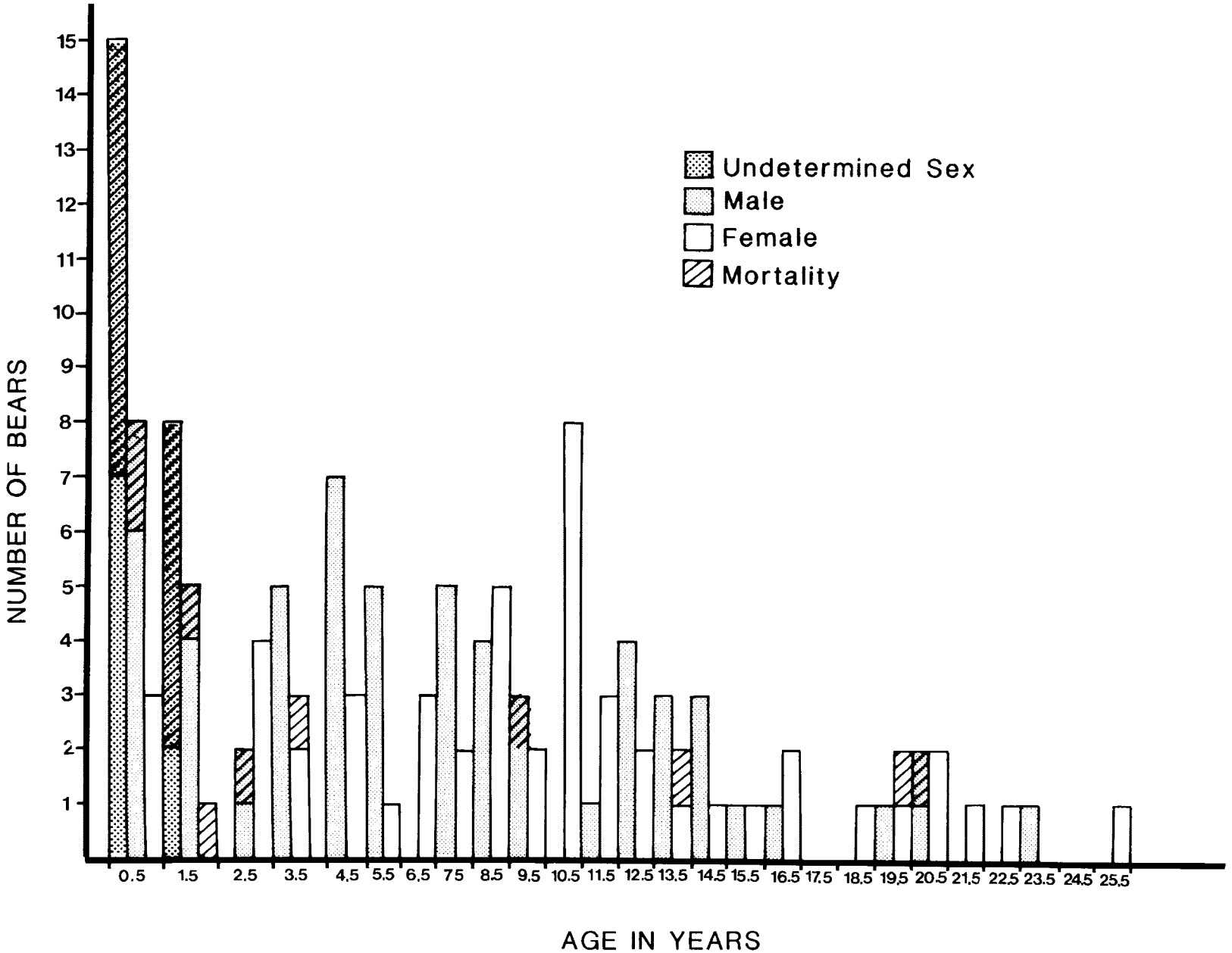

Fig. 2. Age structure of 114 captured bears and 23 associated unmarked young based upon known denning in fall 1984 and subsequent capture of ne individuals in June and July 1985 in the northeastern portion of the Arctic National Wildlife Refuge, Alaska.

theoretical population, while the sex ratio for the 115 captured bears was 61 males and 54 females.

Table 2. Average weights (kg) of adult brown bears in northern Alaska and Yukon Territory.

Sex	Sample Size	Weight		Location	Reference
		Average	Range		
Male	40	139	106-240	interior-southern Yukon Territory	Pearson 1975
Female	21	95	74-12	interior-southern Yukon Territory	Pearson 1975
Male	25	169	-	norther Yukon Territory	Pearson 1976
Female	31	111	-	northern Yukon Territory	Pearson 1976
Male	-	180	136-268	Canning R. drainage, northeast Alaska	Reynolds 1976
Female	18	109	88-41	Canning R. drainage, northeast Alaska	Reynolds 1976
Male	19	167	107-218	northwestern Alaska, NPR-A	Reynolds 1980
Female	24	111	84-177	northwestern Alaska, NPR-A	Reynolds 1980
Male	53	139	93-202	north slope, ANWR	This study 1982-1985
Female	65	94	68-127	north slope, ANWR	This study 1982-1985

This age structure differs from that presented for bears in northeast Alaska along the Canning River (Reynolds 1976). On the coastal plain and adjacent foothills and mountains of ANWR, 60 (65.2%) bears were captured that aged 3.5-11.5 years old, while 32 (34.8%) bears captured aged 12.5 years and older. In contrast to the ANWR data, Reynolds (1976) captured a larger proportion of older age class bears (12.5+ years, n=43, 59.7%) than younger age classes 3.5-11.5 years old, n=29, 40.3%) in the Canning River drainage. Assuming the age structure of captured bears is representative of the population, these data indicate that the declining population status identified by Reynolds (1976) for the Canning River area does not apply to the coastal plain of ANWR. The ANWR populations would have a status of stable or increasing. It should be noted that search and capture efforts during the current study were focused on the coastal plain and adjacent foothills, and intensive search efforts were not conducted in mountainous terrain. Therefore, these data are biased towards bears using the coastal plain and foothill habitats.

Age structure for immature bears in 1982 indicated relatively good survival of young bears through the first 4 years of life (Table 3). During 1982, nine females were captured that had young. All young survived throughout the 1982 monitoring period and all young apparently denned with the maternal female, except bear 1221 (Garner et al. 1983). In 1982, mortalities were recorded for only 2 study related deaths and those data indicated a high survival rate for young bears from 1 year to the next (Garner et al. 1983). The 1983 survival data were not consistent with the 1982 data (Table 3). During 1983, 9 of 17 young brown bears (cubs and yearlings), either died or disappeared from the maternal

Table 3. Maternal female brown bears captured on the Arctic National Wildlife Refuge, their associated offspring, and the fate of those offspring, 1982-1985.

	Offspring				Time period with female			
	1982	1983	1984	1985				
Bear#	No./Age/Sex	No./Age/Sex	No./Age/Sex	No./Age/Sex	1982	1983	1984	1985
1182	2/cubs/FF	2/yrlg/FF	no young	no young	all season	2 disappear 9 June	--	--
1185	2/yrlg	2/2.5yr/FM	2/3.5yr/FM	sow dead 15 Oct 1984	all season	all season	2 separated 5 June	sow dead 15 Oct.1984
1189	--	--	--	1/cub	--	--	--	1 dissapear 19 June
1190	2/cubs/MM	2/yrlg/MM	3/cubs	--	all season	1 emerge den 1 disappear 9 June	sow died at capture	--
1193	--	2/cubs	radio failed 1983	--	--	through 7 Aug (radio failed)	--	--
1197	2/yrlg	2/2.5yr	2/cubs	2/cubs	all season	2 disappear 27 June	2 disappear 23 June	all season
1202	3/yrlg/MMM	3/2.5yr/MMM	3/3.5yr/MMM	sow dead 4 June 1985	all season	all season	1 separated 8 June 2 separated 13 June	sow dead 4 June 1985
1206	--	--	1/cub	3/cubs/MMF	--	--	1 disappear 1 June	all season
1208	2/cubs	2/yrlg	no young	no young	all season	1 disappear 9 June 1 disappear 15 June	--	--
1212	--	1/cub	no young emerge den	3/cubs	--	all season	--	3 disappear 19 June 1985
1213	1/2.5yr/F	1/3.5/F	1/4.5/F	sow dead 18 Sept 1984	all season	all season	1 separated 27 May	sow dead 18 Sept 1984
1217	--	1/cub	2/cubs	2/cubs	--	1 disappear 8 May	2 disappear 16 May	all season
1220	1/3.5yr/M	no data	2/cubs	1/yrlg	until 23 Aug	no data	1 disappear 19 July 1 all season	1 disappear 1 June
1227	2/yrlg	2/2.5yr/FF	collar failed 1983	3/yrlg	all season	1 separated 30 May 1 separated 9 June	collar failed 1983	all season
1230	--	--	2/cubs/FM	1/yrlg	--	--	all season	1 disappear 18 June
1236	--	2/2.5yr/FF	no young	no young	--	2 separated 9 June	--	--
1239	--	2/yrlg	2/2.5yr	2/3.5yr	--	all season	all season	2 separated 28 May
1245	--	2/yrlg	1/2.5yr	3/cubs	--	1 disappear 5 Sept 1 all season	1 disappear 15 May	all season
1247	--	--	2/cubs	2/cubs/MF	--	--	2 disappear 1 June	all season
1248	--	1/3.5yr/F	2/cubs+1 cub	2/yrlg	--	1 separated 17 June	1 disappear 25 June 2 with sow 28 July; collar failed	all season
1252	--	1/yrlg/M	1/2.5yr/M	1/cub	--	all season	1 disappear 5 June	1 disappear 9 June
1257	--	1/yrlg	no young	no young	--	1 disappear - date?	--	--
1260	--	--	1/cub	3/cubs	--	--	1 disappear 8 June	3 disappear 9 June
1261	--	--	2/cubs	no young	--	--	2 disappear 13 June	--
1267	--	--	2/2.5yr	2/3.5yr	--	--	all season	2 separated 19 May
1269	--	--	3/cubs	2/yrlg	--	--	all season	2 disappear 17 May
1278	--	--	2/cubs	no young emerge den	--	--	--	all season --
1287	--	--	--	2/yrlg	--	--	--	all season
1294	--	--	--	2/cubs/MM	--	--	--	2 disappear 15 July
1298	--	--	--	2/cubs/MF	--	--	--	all season
1307	--	--	--	2/2.5yr/MF	--	--	--	all season
1310	--	--	--	1/2.5yr/M	--	--	--	1 disappear 31 July
1320	--	--	--	2/cubs/MM	--	--	--	all season

sow and were assumed dead. One radio-collared yearling (#1225) was killed by another bear in late June 1983. This apparent mortality represents a 58.9% mortality rate among the cubs and yearling cohorts in 1983. The 1984 survival data for young bears were similar to 1983, with 13 of 24 young bears (cubs and yearlings) wither died or disappeared from the maternal sow and were assumed dead (54.2%) mortality rate). The 1985 mortality rate for cubs and yearlings was 45.0% with 18 of 40 young bears either dying or disappearing from the maternal sow (Fig. 2). Causes for the high mortality rate among cubs and yearlings during 1983-1985 are undetermined. Other adult bears are suspected in this mortality, however no direct evidence exists to support this hypothesis.

One capture-related mortality occurred during 1985 when bear 1228 died on 16 June during the immobilization procedure. This bear apparently died as a result of a reaction to the immobilizing drug M99. Five other mortalities occurred during 1985 (Fig. 2). Bears 1202 (a 19.5-year old female) and 1225 (a 10.5-year old male) died during the late fall or early winter of 1984-1985. Sow 1202 was discovered dead on 25 April. An autopsy revealed 2 near term fetuses. This sow had apparently fallen into a steep canyon and had succumbed to cold temperatures. Bear 1225 was found frozen in the lagoon ice in Camden Bay in April. This bear had apparently walked onto the newly frozen lagoon during early fall, broken through the ice, and drowned. Bear 1311 (a 2.5-year old male) disappeared from the maternal sow on 31 July and was presumed dead, although the 2 year old cub might have been able to survive. Bears 1220 (a 13.5-year old female) and 1293 (a 3.5-year old male) were killed by hunters.

Breeding season normally extends from May through approximately 10 July, with peak of breeding occurring during June. Observations of pairs in 1985 were common during this period (Fig. 3), and pairs observed after late July were probably short-term reassociation of siblings and/or family groups. Sexual maturity in females evidently occurs at 6.5 years of age, with 9 of 33 females with young producing cubs at 7.5 years of age (Table 4). Three females produced cubs when 6.5 years of age. The loss of young bears (cubs and yearlings) noted previously that occurs early in the summer often results in rapid recycling of the maternal females into the breeding cycle. Eight different females lost cubs or yearlings in one year and produced another litter of cubs the following year (Table 4).

Population Characteristics

Conclusions based on data presented here are preliminary and contingent upon further analyses. Because arctic brown bears are generally solitary, wide-ranging, and have low population densities, accurate population estimates and density calculations require intensive capture programs coupled with detailed movements and home range use data collected over a 4 or 5 year period. Similarly, parameters describing population dynamics and productivity, especially litter size, reproductive interval, and survival of young must be recorded for more than 3 years in order to be accurate (Reynolds 1980, Reynolds and Hechtel 1983).

Age and Sex Structure. The age and sex of 172 captured and 66 associated unmarked bears (Table 5) indicates a relatively young age structure. In the 3.5 to 11.5-year old age classes, 95 bears are represented by 49 males and 46

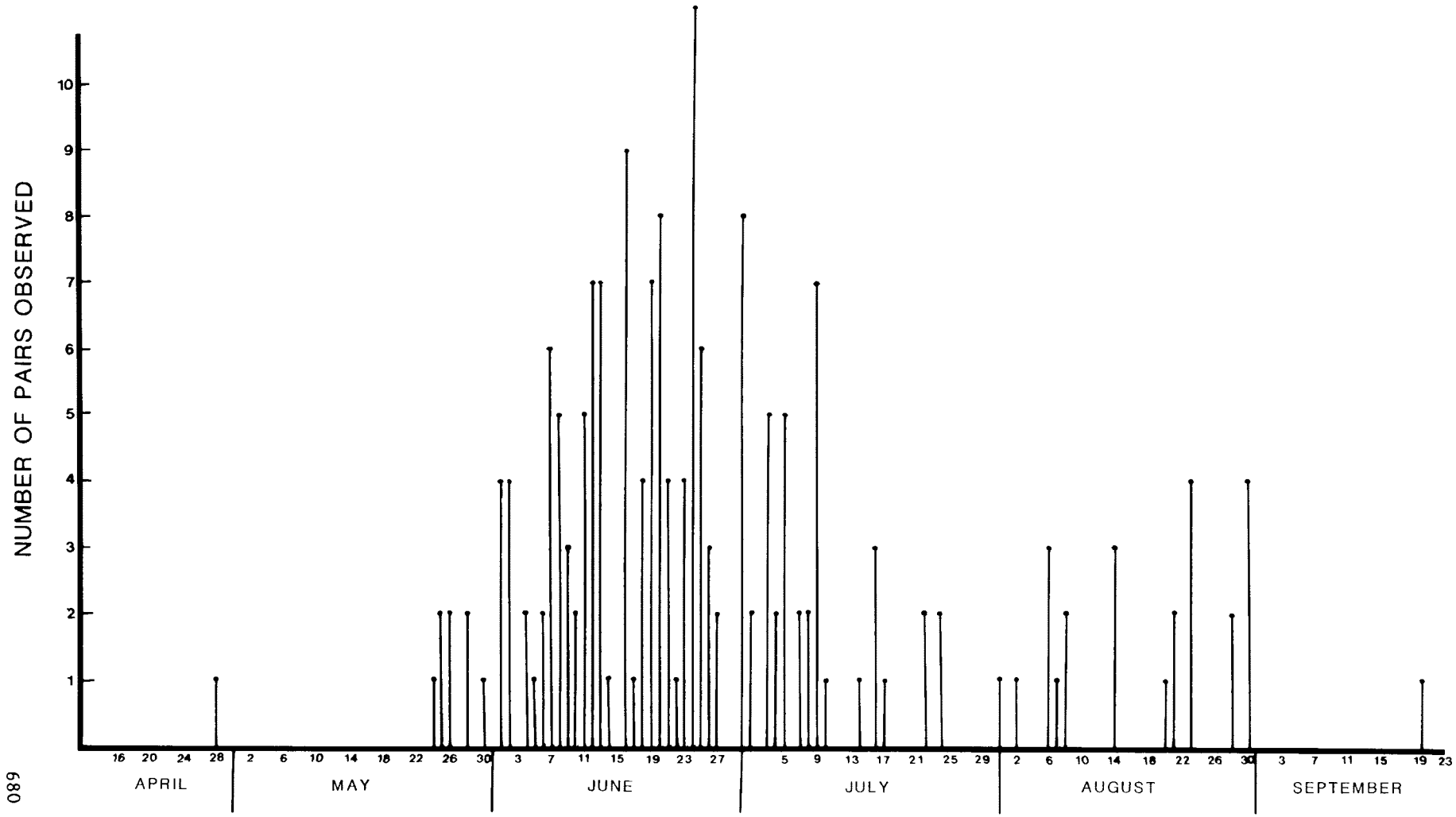

Fig. 3. Chronology of observations of brown bear pairs in the northeast portion of the Arctic National Wildlife Refuge, Alaska, 1985.

Table 4. Age of earlies observed reproduction and known reproductive history for 33 female brown bears in the northeastern portion of the Arctic National Wildlife Refuge, 1982-1985.

Bear #	Cementum age-1985	Reproductive Status 1982	1983	1984	1985	Age at earliest reproduction
1182	18.5	2 cubs	2 yrlgs	none	- -	15.5
1185	21.5	2 yrlgs	2-2 yr	2-3 yr	Dead	17.5
1189	8.5	none	none	none	1 cub	8.5
1190	10.5	2 cubs	2 yrlgs	3 cubs	Dead	7.5
1193	11.5	none	2 cubs	2 yrlgs	- -	9.5
1197	11.5	2 yrlgs	2 yrlgs	2-2 yr	2 cubs	7.5
1202	19.5	3 yrlgs	3-2 yr	3-3 yr	Dead	15.5
1206	10.5	none	none	1 cub	3 cubs	9.5
1208	10.5	2 cubs	2 yrlgs	none	none	7.5
1212	16.5	none	1 cub	2 cubs	3 cubs	14.5
1213	15.5	1-2 yr	1-3 yr	1-4 yr	Dead	10.5
1217	15.5	milk, no cubs	1 cub	2 cubs	2 cubs	13.5
1220	13.5	1-3 yr	1-4 yr	2 cubs	1 yrlg	7.5
1227	16.5	2-2 yr	2-3 yr	unknown	3 yrlgs	11.5
1230	10.5	none, no milk	none	2 cubs	1 yrlg	9.5
1236	10.5	- -	2 yr	none	none	6.5
1239	10.5	- -	2 yrlgs	2-2 yr	3-3 yr	7.5
1245	16.5	- -	2 yrlgs	1-2 yr	3 cubs	13.5
1247	20.5	- -	milk, no cubs	2 cubs	2 cubs	19.5
1248	12.5	- -	1-3 yr	2 cubs	2 yrlgs	7.5
1252	9.5	- -	1 yrlg	1-2 yr	1 cub	6.5
1257	10.5	- -	1 yrlg	none	none	7.5
1260	12.5	- -	none, no milk	1 cub	3 cubs	11.5
1261	8.5	- -	- -	2 cubs	none	7.5
1267	11.5	- -	- -	2-2 yr	2-3 yr	8.5
1269	11.5	- -	- -	3 cubs	2 yrlgs	10.5
1278	9.5	- -	- -	2 cubs	none	8.5
1287	8.5	- -	- -	- -	2 yrlgs	7.5
1294	14.5	- -	- -	- -	2 cubs	14.5
1298	10.5	- -	- -	- -	2 cubs	10.5
1307	10.5	- -	- -	- -	2-2 yr	9.5
1310	8.5	- -	- -	- -	1-2 yr	6.5
1320	20.5	- -	- -	- -	2 cubs	20.5

females. However, the 12.5 and older age classes contained only 41 bears (20 males and 21 females). This age structure would indicate an apparently stable or increasing population. These data are biased towards those bears that frequent the coastal plain and adjacent foothills of ANWR. Bears were only captured along the edges of more mountainous terrain and the central mountains were no searched to capture bears for this study.

Reproductive Biology. Reproductive rates for brown bears are dependent upon the following measures of reproductive biology: age at first production of young, length of the productive life for females, average litter size, and length of the reproductive cycle or reproductive interval, (Craighead et al. 1974, Bunnell and Tait 1980, 1981). Arctic brown bears have low reproductive rates (Reynolds, 1980). Because the proportion of females with offspring in arctic populations is low and reproductive cycles may be 6 years or longer (Reynolds and Hechtel 1983), accurate measures of reproductive rates require long-term observations. As mentioned earlier, the reproductive history of female brown bears in ANWR (Table 3 and 4) indicates a rapid recycling of females into the breeding cycle, when young cubs are lost early in the breeding season.

Interaction Between Brown Bears and Prey Species

Brown bears were observed in the vicinity of caribou (Rangifer tarandus) on 340 different occasions during June-August 1982-1985. In a majority of these instances, caribou did not react to bears nor did bears react to caribou. Bears

Table 5. Age and sex structure of brown bears and associated young captured in the Arctic National Wildlife Refuge, 1982-1985.

Age by cementum (yr)	Number of bears: Age at capture 1982 M	F	Unk	Age at capture 1983 M	F	Unk	Age at capture 1984 M	F	Unk	Age at capture 1985 M	F	Unk
0.5	2	2	12	0	0	4	7	2	17	8	3	3
1.5	3	0	4	2	0	12	0	0	2	2	0	2
2.5	1	1	-	1	5	2	0	0	5	2	4	3
3.5	4	1	-	0	1	-	1	0	-	2	0	-
4.5	5	0	-	1	0	-	2	0	-	4	3	-
5.5	2	3	-	0	1	-	0	0	-	4	1	-
6.5	5	1	-	1	0	-	1	1	-	1	3	-
7.5	0	4	-	0	1	-	1	1	-	4	1	-
8.5	0	2	-	0	3	-	0	1	-	1	2	-
9.5	0	0	-	0	1	-	0	0	-	1	1	-
10.5	1	1	-	1	2	-	1	2	-	0	5	-
11.5	1	0	-	1	1	-	2	0	-	0	1	-
12.5	0	2	-	2	0	-	1	0	-	4	1	-
13.5	1	2	-	0	0	-	0	0	-	0	1	-
14.5	0	0	-	0	1	-	0	0	-	2	1	-
15.5	0	1	-	0	0	-	0	0	-	0	0	-
16.5	0	1	-	0	0	-	0	0	-	0	2	-
17.5	1	0	-	0	0	-	0	0	-	0	0	-
18.5	1	1	-	1	1	-	0	0	-	0	0	-
19.5	0	0	-	1	0	-	0	0	-	1	1	-
20.5	1	0	-	1	0	-	0	0	-	0	2	-
21.5	0	0	-	0	0	-	0	0	-	1	0	-
22.5	0	0	-	0	0	-	0	0	-	0	0	-
23.5	0	0	-	0	1	-	0	0	-	0	0	-
24.5	0	0	-	0	0	-	0	0	-	0	0	-
Totals	28	22	16	12	18	18	16	7	24	37	32	8
		66			48			47			77	

were observed chasing caribou on 28 occasion during June 1982-1985. The of these chases resulted in a successful kill in 1985. Bears were observed feeding on caribou carcasses on 72 occasions during 1982-1985. For those instances when the age of the carcass was discernable, 31 were adults and 22 were calves. Caribou did not react to nearby bears unless the bear attempted a chase. These observations indicate the bears utilize caribou as a seasonal food source during June and early July. This use appears to be limited to the time when caribou are present on the coastal plain and adjacent foothills. Preliminary analysis of bear movement data indicate that bears shift their activity areas to the coastal plain when caribou are present. Detailed analysis of concurrent bear and caribou movement patterns in the study area will clarify this temporal and spatial relationships between the two species.

Bears were observed in the vicinity of moose (Alces alces) in mountainous habitats on 28 occasions during 1982-1985. Three unsuccessful chases were observed and moose easily outdistanced the pursuing bear. An unmarked bear was observed feeding on a moose calf during June 1985. Moose were seldom observed on coastal plain habitats and represent an occasional food source in mountainous terrain.

Muskoxen (Ovibos moschatus)were observed in the vicinity of brown bears on 32 occasions during 1982-1985. One unsuccessful chase was observed and bears were observed feeding on a muskox carcass on 3 occasions. Muskoxen are widely distributed on the coastal plain of ANWR and are a potential food source for bears.

Denning

Radio-collared bears were monitored to determine approximate dates of emergence from winter dens (Table 6). Six bears were out of their dens by 29 April, an additional 5 bears by 19 May, and all bears were out of their dens by early June. Inclement weather curtailed aerial monitoring of radio-collared bears, however the general pattern of early emergence by males and non-parturient females and later emergence of females with new cubs (Quimby 1974, Ruttan 1974, Harding 1976) was apparent.

Table 6. Approximate dates of emergence from winter dens for 37 radio-collared brown bears in the Arctic National Wildlife Refuge, 1985.

Bear #	Date first observed out of den	Den type	Associated bears number/age/sex/bear #
1056	26 May	dug	none
1182	28 May	dug	none
1188	28 April	dug	none
1189	26 May	cave	1/cub
1197	25 May	cave	2/cubs
1204	25 May	dug	none
1205	25 May	dug	none
1208	25 May	dug	none
1210	25 May	dug	none
1212	26 May	dug	3/cubs
1214	25 May	dug	none
1217	25 May	dug	2/cubs
1220	26 May	dug	1/yrlg
1223	25 May	dug	none
1226	28 May	dug	none
1230	17 May	dug	1/yrlg
1232	26 May	dug	none
1235	28 May	dug	none
1236	29 April	dug	none
1239	28 April	dug	2/3 yr
1245	24 May	dug	3/cubs
1246	29 April	dug	none
1247	19 May	dug	2/cubs/MF/1285,1286
1251	28 May	dug	none
1252	2 June	dug	1/cub
1257	25 May	dug	none
1259	19 May	cave	none
1260	25 May	dug	3/cubs
1261	19 May	dug	none
1263	24 May	cave	none
1264	28 April	dug	none
1267	29 April	1/2 snow, 1/2 dug	2/3 yr
1269	17 May	cave	2/yrlg
1278	26 May	dug	none
1281	2 June	dug	none
1282	25 May	dug	none
1283	6 June	dug	none

Den sites of 32 radio-collared bears and 5 unmarked bears were inspected in late May 1985 and physical characteristics of each den were measured. Each den was revisited in July 1985 and the vegetational and soil characteristics of the den site were sampled. All dens were located in foothills and mountainous terrain except 3 dens which were located in coastal plain tundra habitats (Table 7). Elevations of all den sites averaged 963.7 $\pm$ 64.7 m (SE) with a range of 29-1954 m. Dens located in mountainous terrain (n = 31) averaged 1077.1 $\pm$ 53.9 m (SE), while dens located in foothills terrain (n = 3) averaged 580.0 $\pm$ 135.2 m (SE). Three dens located in tundra habitats averaged 175 $\pm$ 103.4 m (SE). Average elevation of den sites recorded during 1983 and 1984 in the same study area (Garner et al. 1983, 1984) and to den sites recorded by Reynolds et al. (1976) along the Canning River. Den sites were must common in the middle and upper slope positions (n = 16 and 13 respectively), while the lower 1/2 slope was less common with 7 dens. These results are in contrast to 1984 when dens were equally

Table 7. Physical characteristics of 37 den sites used by brown bears during the winter of 1984-1985 in the northeastern portion of the Arctic National Wildlife Refuge, Alaska.

Den #	Bear #	Date inspected 1985	(%) Slope	Aspect	Elevation (m) Den	Valley Floor	Crest	Slope position (1/3)	Topography	Den status May & June 1985	Den status July 1985
85-1	1261	10 June & 26 July	77	212	695	341	854	upper	mountains	intact	collapsed
85-3	1267	21 May & 29 July	44	118	1075	927	1226	mid	mountains	intact	collapsed
85-4	1205	21 May & 19 July	34	174	957	622	976	upper	mountains	intact	intact
85-5	1203	31 May & 27 July	76	142	750	625	926	mid	mountains	intact	intact
85-6	1202	31 May & 27 July	71	154	838	625	926	upper	mountains	intact	intact
85-6a	unmarked	31 May & 27 July	71	154	841	625	926	upper	mountains	intact	intact
85-7	1247	31 May & 21 July	66	120	787	567	835	upper	mountains	collapsed	collapsed
85-9	1259	21 May & 25 July	61	107	988	570	1082	upper	mountains	intact	collapsed
85-10	1269	05 June & 23 July	43	145	988	433	1268	mid	mountains	collapsed	collapsed
85-11	1264	17 May & 26 July	56	148	957	756	1021	upper	mountains	collapsed	collapsed
85-12	1208	-- 23 July	67	149	1516	1079	1793	mid	mountains	--	collapsed
85-13	1056	-- 23 July	64	117	1363	984	1834	mid	mountains	--	collapsed
85-14	1212	01 June & 22 July	72	127	1216	1165	1988	lower	mountains	partially collapsed	collapsed
85-15	1182	-- 20 July	47	98	1560	1465	1640	mid	mountains	--	collapsed
85-16	1220	04 June & 20 July	62	156	1651	1497	1744	mid	mountains	partially collapsed	partially collapsed
85-17	1283	29 May & 28 July	62	210	122	113	125	upper	tundra	collapsed	collapsed
85-19	1282	17 May & 23 July	56	140	918	720	1140	mid	mountains	intact	intact
85-20	1239	17 May & 25 July	56	179	1244	1110	1366	mid	mountains	partially collapsed	collapsed
85-22	unmarked	-- 25 July	61	175	1531	1123	1954	mid	mountains	--	partially collapsed
85-23	1233	10 June & 28 July	53	170	1012	939	1256	lower	mountains	partially collapsed	partially collapsed
85-25	1223	10 June & 26 July	44	346	360	311	616	lower	foothills	collapsed	collapsed
85-27	1252	-- 28 July	55	217	926	882	1290	lower	mountains	--	partially collapsed
85-28	1189	-- 24 July	60	199	853	678	1283	lower	mountains	--	partially collapsed
85-29	1235	-- 24 July	68	143	1207	868	1480	mid	mountains	--	collapsed
85-31	1260	10 June & 26 July	64	26	854	591	918	upper	mountains	collapsed	collapsed
85-32	1217	22 July	48	258	1086	992	1290	upper	mountains	--	partially collapsed
85-33	1246	31 May & 19 July	50	174	893	720	1220	mid	mountains	intact	intact
85-34	1245	30 May & 21 July	66	153	991	860	1622	lower	mountains	collapsed	collapsed
85-35	1210	-- 20 July	64	200	1954	1786	2256	mid	mountains	--	partially collapsed
85-36	1204	31 May & 27 July	71	93	872	625	926	upper	mountains	intact	intact
85-37	unmarked	-- 21 July	49	210	868	540	1305	mid	mountains	--	partially collapsed
85-38	1214	31 May & 27 July	15	159	375	375	378	lower	tundra	partially collapsed	collapsed
85-39	1263	01 June & 21 July	51	77	854	457	927	upper	mountains	intact	intact
85-40	1236	21 May & 23 July	66	97	826	579	863	upper	foothills	partially collapsed	collapsed
85-42	1188	-- 24 July	57	176	554	255	667	upper	foothills	--	partially collapsed
85-46	unmarked	-- 25 July	104	73	1145	729	1713	mid	mountains	--	collapsed
85-47	unmarked	-- 27 July	31	96	29	26	33	mid	tundra	--	collapsed

distributed among the 3 slope positions (Garner et al. 1985) and to 1983 when no den sites were recorded in the upper 1/3 slope position (Garner et al. 1984).

Twenty-four dens were inspected in late May and early June 1985 and 11 dens were intact, including 7 rock caves, while 6 were partially collapsed and 7 were totally collapsed (Table 7). In July, all dug dens were partially collapsed or totally collapsed except 1 den. One den was a snow den with a bed of vegetation at ground level. This den was located in a small snow-filled creek in coastal plain habitats. No reuse of dug dens was documented during the study and the majority of dug dens were collapsed by late July. The incidence of collapsed dens in July supports Pearson's (1975) and Reynold's (et al. 1974) conclusions that soil depth and moisture content (re. frozen top soil) are important factors in den site selection by northern brown bears. All den sites were well drained and located on slopes ranging from 15-104% ($x = 58.4 \pm 2.5\%$ SE).

Aspects of den sites (Table 7) were examined using circular statistics (Batschelet 1981, Zar 1984). Aspects were concentrated in a southeast direction (Fig. 4), with a mean aspect of 146° (95% C.I., 128°-164°) with an angular dispersion of 48°. Aspects were not uniformly distributed in all directions (Raleigh's test; $Z=15.6$, $P<0.001$) and were strongly oriented in a southeast direction (mean aspect = 146°; V-test, $u=3.58$, $p<0.001$). Reynolds et al. (1976) reported that 47 of 52 dens (90%) were located on southerly slopes along the Canning River. These data are also in close agreement with aspects (mean aspect = 145°) of 29 dens examined in 1983 (Garner et al. 1984) and 46 dens examined in 1984 (Garner et al. 1985). These data indicate that bear dens in the northeastern Brooks Range are located on slopes with aspects strongly oriented in a southeasterly direction. These slopes are warmer and are normally free of snow earlier than northern facing slopes. Bears may be selecting southeastern facing slopes for the earlier warming trend; however, other edaphic factors may also be influencing this selection (i.e. permafrost depths, etc.)

During October and early November 1985, den sites of 66 radio-collared and 4 unmarked bears were recorded during den surveys. Distribution of these dens were 63 in mountainous terrain, 4 in foothills terrain, and 3 in coastal plain terrain (Fig. 5). In general, all radio-collared bears captured on coastal plain or foothills habitats denned south of their capture sites (Figs. 1 and 5). Chronology of denning indicated that 36 bears were denned by 16 October, while an additional 30 bears were denned by the end of October and 4 additional bears denned in early November (Table 8). Incidence of denning in early November in 1985 was similar to 1983 when 3 of 46 bears denned in early November (Garner et al. 1984). Snow cover was moderate and temperature was mild throughout October. In 1984, 21.9% of the radio-collared bears denned in early November (Garner et al. 1985).

Elevations and aspects of the 70 fall den sites were estimated from 1:63,360 scale topographic maps (Table 8). Average estimated elevation was 809 ± 38 m (SE) and is similar to the average elevations of the 37 measured den sites in summer 1985. Estimated aspects for these 70 fall dens are depicted in Fig. 6. In general, estimated aspects of the 70 dens show a wider dispersion than the 37 den sites visited during summer 1985 (Figs. 4 and 6). However, the southeast and southwest quadrants contained a majority of the estimated aspects of den sites (29 and 24 respectively).

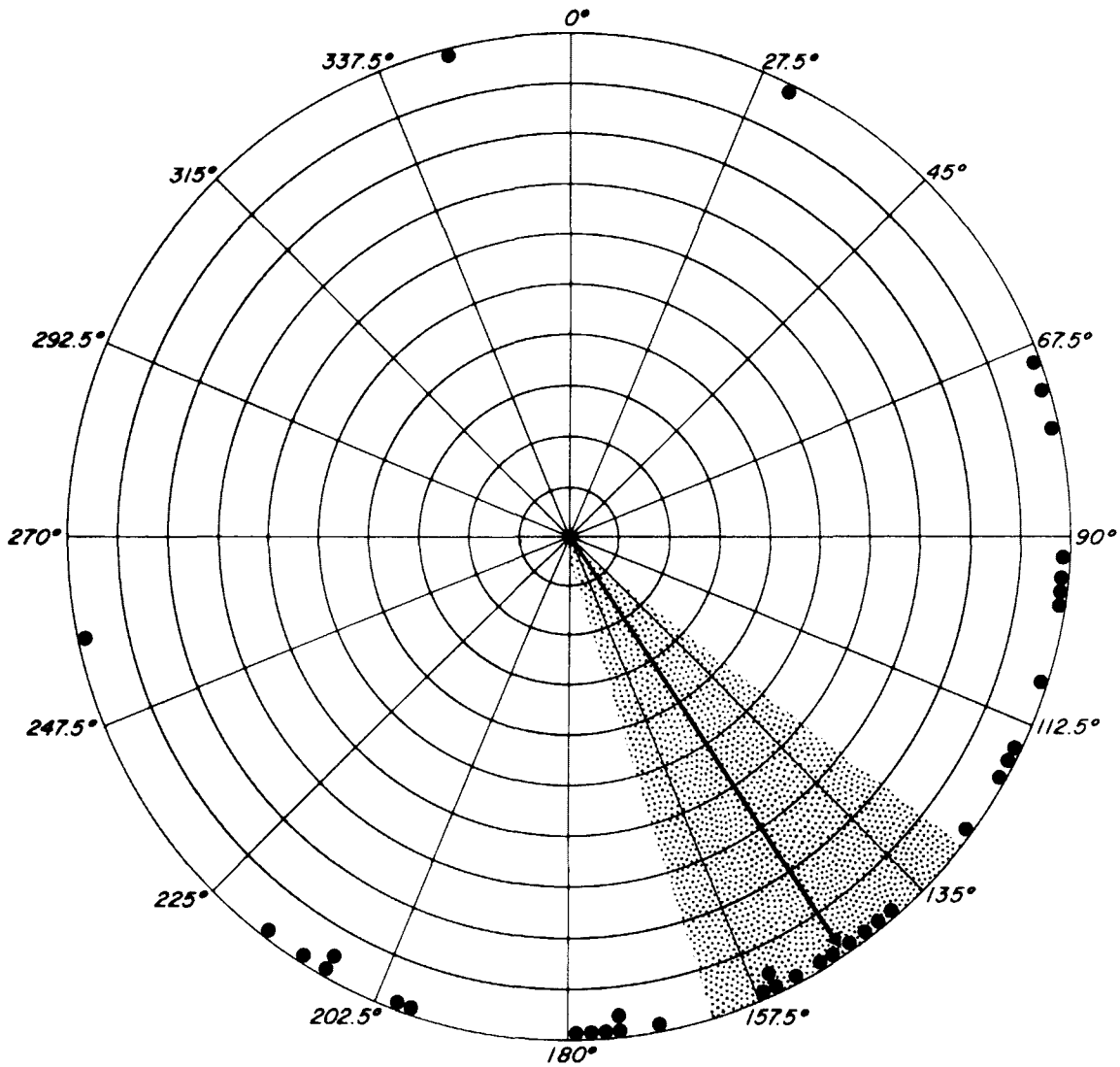

Fig. 4. Aspects, mean aspect (arrow), and 95% confidence interval (shaded area) of 46 bear dens used during winter 1983-1984 on the Arctic National Wildlife Refuge, Alaska.

Table 8. Fall denning characteristics of 70 brown bears in the northeastern portion of the Arctic National Wildlife Refuge, 1985.

Bear #	Reproductive Status	Terrain	Date observed denned	Estimated aspect	Estimated elevation(m)
1056	male	mountainous	13 Oct	82°	975
1072	male	mountainous	13 Oct	122°	1036
1182	probable breeder	mountainous	21 Oct	158°	1173
1189	probable breeder	mountainous	16 Oct	170°	655
1194	male	mountainous	22 Oct	256°	808
1206	3 cubs	mountainous	12 Oct	118°	692
1208	probable breeder	mountainous	13 Oct	8°	914
1210	probable breeder	mountainous	21 Oct	196°	1676
1212	probable breeder	mountainous	21 Oct	231°	1250
1214	immature female	coastal plain	21 Oct	140°	152
1216	probable breeder	mountainous	13 Oct	127°	1250
1217	2 cubs	mountainous	15 Oct	149°	792
1223	male	mountainous	22 Oct	216°	518
1226	male	mountainous	20 Oct	192°	320
1227	3 - 1.5 year old	mountainous	16 Oct	234°	381
1230	probable breeder	mountainous	16 Oct	268°	792
1232	male	mountainous	24 Oct	185°	1082
1233	male	mountainous	11 Oct	88°	899
1235	immature female	mountainous	20 Oct	110°	762
1236	probable breeder	foothills	20 Oct	230°	594
1237	immature female	mountainous	21 Oct	129°	1173
1239	probable breeder	mountainous	22 Oct	184°	930
1245	3 cubs	mountainous	12 Oct	116°	914
1246	male	mountainous	20 Oct	154°	686
1247	2 cubs	mountianous	20 Oct	94°	792
1248	2 - 1.5 year old	mountainous	22 Oct	177°	381
1251	male	mountainous	16 Oct	145°	808
1252	probable breeder	mountainous	22 Oct	118°	1113
1254	male	mountainous	21 Oct	270°	930
1257	probable breeder	mountainous	13 Oct	226°	1509
1258	probable breeder	mountainous	13 Oct	271°	975
1259	probable breeder	mountainous	20 Oct	156°	914
1260	probable breeder	mountainous	16 Oct	233°	472
1261	probable breeder	mountainous	11 Oct	136°	564
1263	male	mountainous	20 Oct	286°	732
1264	male	foothills	22 Oct	204°	472
1267	probable breeder	mountainous	4 Nov	63°	747
1269	probable breeder	mountainous	12 Oct	275°	853
1275	male	mountainous	16 Oct	205°	503
1278	probable breeder	mountainous	20 Oct	156°	518
1281	male	mountainous	5 Nov	163°	1311
1282	probable breeder	mountainous	13 Oct	133°	884
1283	male	coastal plain	2 Nov	256°	152
1284	male	mountainous	5 Nov	210°	716
1287	2 - 1.5 year old	mountainous	12 Oct	346°	884
1288	immature female	mountainous	12 Oct	289	1005
1289	immature female	mountainous	12 Oct	125°	1173
1290	male	mountainous	13 Oct	72°	1128
1291	male	mountainous	13 Oct	258°	1280
1292	probable breeder	mountainous	22 Oct	92°	701
1294	probable breeder	mountainous	12 Oct	270°	1082
1297	probable breeder	mountainous	13 Oct	143°	1280
1298	2 cubs	mountainous	22 Oct	146°	960
1301	probable breeder	mountainous	12 Oct	88°	808
1302	male	coastal plain	21 Oct	89°	91
1303	male	mountainous	15 Oct	140°	1036
1305	male	mountainous	22 Oct	186°	655
1307	2 - 2.5 year old	mountainous	15 Oct	257°	960
1310	probable breeder	foothills	22 Oct	148°	472
1312	immature female	mountainous	15 Oct	7°	442
1313B	male	mountainous	20 Oct	160°	853
1314	male	mountainous	6 Oct	286°	610
1315	male	mountainous	20 Oct	225°	930
1319	probable breeder	mountainous	7 Oct	241	716
1320	2 cubs	foothills	20 Oct	230°	366
1323	immature female	mountainous	10 Oct	134°	914
UM1	---	mountainous	12 Oct	67°	838
UM3	---	mountainous	16 Oct	281°	503
UM4	---	mountainous	16 Oct	122°	518
UM5	---	mountainous	20 Oct	220°	655

FIG. 5. Distribution of den sites of brown bears on the Arctic National Wildlife Refuge, fall 1985.

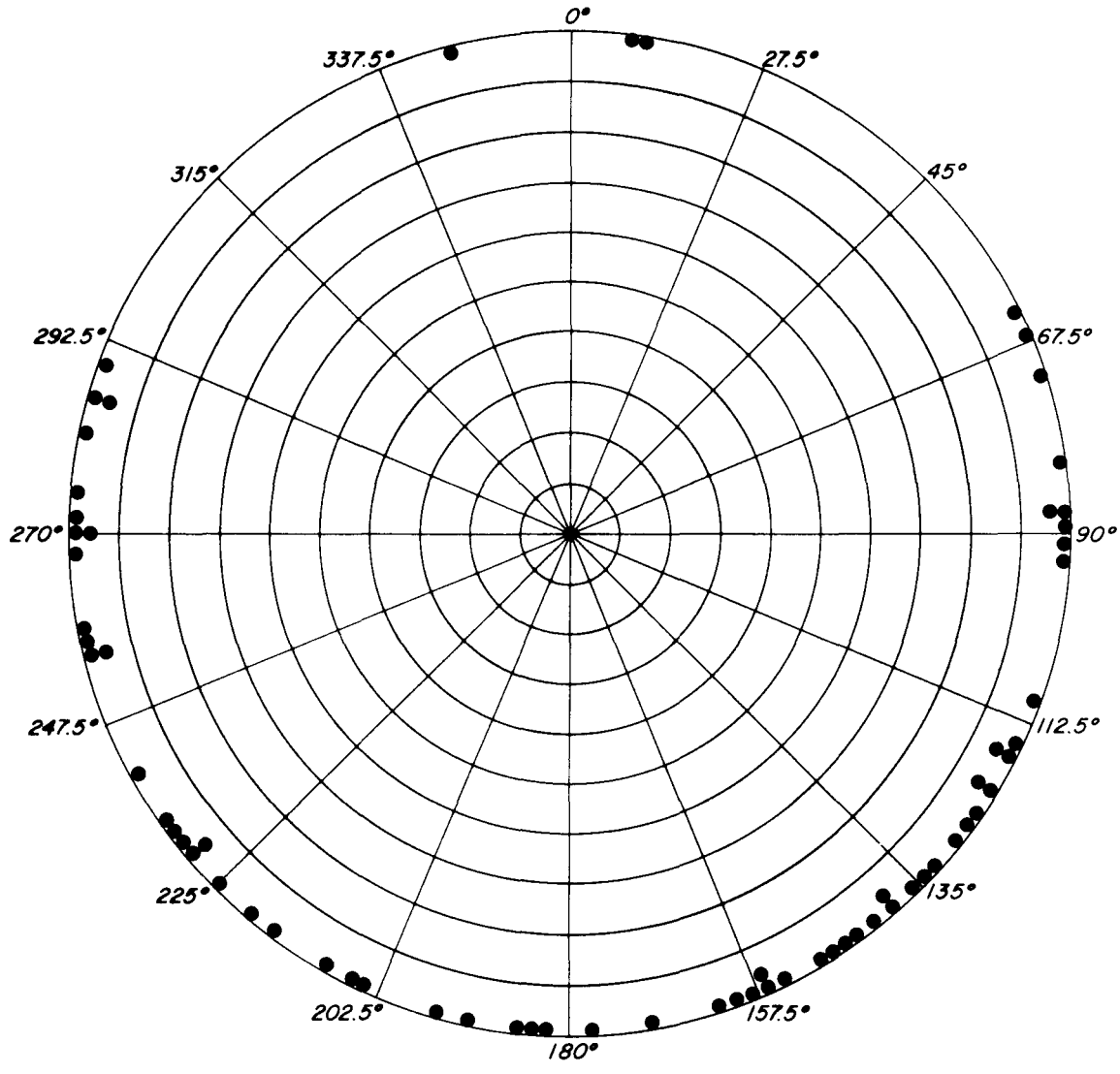

Fig. 6. Estimated aspects of 70 bear den sites located on the Arctic National Wildlife Refuge in October 1985.

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Volume II of III

Section 1002C
Alaska National Interest Lands Conservation Act

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