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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: Fifty brown bears (Ursus arctos) were captured between 23 June and 3 July 1982 and an additional 30 bears were captured between 28 May and 16 June 1983 in the coastal plain and adjacent foothills and mountains of the northeastern portion of the Arctic National Wildlife Refuge (ANWR). Radio-transmitters were attached to total of 60 different bears during this time period and these bears were monitored through denning (October-November) in both years. 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. The sex ratio for captured bears was equal. No natural mortalities occurred in 1982 among sample bears, however in 1983, 10 apparent mortalities occurred among 17 young bears (cubs and yearlings). Reasons for this high mortality rate (58.9%) among young bears is undetermined. Brown bears were observed feeding on muskox (Ovibos moschatus) carcasses on 2 occasions, and were observed stalking or chasing muskox on 2 other occasions in 1983. No muskox/brown bear interaction was recorded in 1982. Brown bears were observed feeding on caribou (Rangifer tarandus) carcasses on 6 occasions in 1982 and 15 occasions in 1983. Bears were observed chasing caribou once in 1982, and 15 times in 1983, with 3 of the 1983 chases being successful (calf kills). Preliminary analysis of radio-relocation data indicate that brown bears appear to shift habitat use patterns to coastal areas in June to coincide with occupancy of these habitats by calving and post-calving caribou. Emergence from winter dens occurred from mid-April throughout May, with early emergence by males and non-paturient females and later emergence of females with cubs and females with young. Twenty-nine den sites were inspected in the spring and summer of 1983. Elevation of den sites averaged 816.2 $\pm$ 61.4 m (SE), and slope at den sites averaged 53.6 $\pm$ 3.8% (SE). Den sites were predominantly located on southeast facing slopes (mean aspect 145° $\pm$ 20° SE). In late September, October, and early November 1983, 58 den sites of radio-collared and unmarked bears were located. Bears again moved south into the foothills and mountainous habitats to den. Three bears denned during the first half of October, 52 bears denned during the last half of October, and 3 bears denned in early November 1983. One radio-collared bear and 1 unmarked bear denned in coastal plain habitats within the 1002c study area. Preliminary estimates of population size and productivity of brown bears in and adjacent to the 1002c study area were developed from capture and movement data. A minimum of 87 brown bears occurred in the area in 1983, with a total population estimate of 108 bears (density of 1 bear/80 km^2 for the 8300 km^2 study area). Estimated average age at first reproduction was 7.4 years, with a potential reproductive life of at least 16 years. Mean litter size was 1.9 young and minimum reproductive interval was estimated at 3.6 years. Theoretically, females could produce a total of 8.4 young during their lifespan. This relatively high reproductive rate, if accurate, may be related to the seasonal accessibility by bears on ANWR to the Porcupine caribou herd as a food source.

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

Brown bear (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 (USFWS 1982). Impending petroleum exploration on 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 dennning, 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 USFWS and the Alaska Department of Fish and Game (ADF&G), with FWS having primary responsibility for the first 3 objectives and ADF&G being primarily responsible for objective 4.

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 (USFWS 1982).

Field work was based at Barter Island and extended from 24 April through 5 November 1983. Bears were captured between 28 May and 11 July using a Hughes 500D helicopter. Fixed-wing aircraft were used to locate bears and direct the helicopter with the 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, 1 mg/ml, D-M Pharmaceuticals) was injected into the rump using Cap-Chur equipment (Palmer Chemical and Equipment Co., Douglasville, GA). All animals recovered after the antidote (M50-50, Dipremorphine, 0.2 mg/ml, D-M Pharmaceuticals, Rockville, MD) was administered intramuscularly in the rump, at 1.5 the dosage of M-99. 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 (Telenics, Inc., Mesa AZ). Young age animals were fitted with expandable breakaway collars. These animals will be recaptured in 1984 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 unitduring the breeding season..

The 2 vesitgial 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 seriological study by ADF&G 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 1:630,360 scale topographic maps and other relevant information was recorded on form sheets.

Range sizes will be calculated using Curatolo and Moore's (1975) modification of the exclusive boundary strip method (Stickel 1954). This method uses the approximate size of daily movements to define the range area. Grid size will be a 4.83 km square (Reynolds 1980). These determinations will be used for comparing this study's results with results of other studies of brown bear in northern Alaska. Additionally, range sizes will be calculated using the minimum area method described by Mohr (1947). 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 on 1:630,360 scale topographic maps. 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 1:630,360 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, USF&WS 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 later progress reports.

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 densite 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, Johnson and Pelton 1981).

At each densite, 2 30.5-m (100 feet) 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 densite will be 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 (1 foot) 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 densite). 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 later progress reports.

Snow depth in spring and depth of permafrost in the summer at each densite and at non-densite locations adjacent to the densites were recorded. Soil samples were taken at all sample locations to determine soil texture (Brady 1974). Non-densite locations will include 3 sites adjacent to each densite at a similar elevation, but with aspects at 90°, 180°, and 270° angle deviations from the densite aspect. 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 bear were captured and marked between 23 June and 3 July 1982 (Table 1). An additional 30 bear were captured and marked between 28 May and 16 June 1983 (Table 1). In addition, 11 bears captured in 1982 were recaptured in 1983 and refitted with new radio-collars. A total of 60 different bear were outfitted with radio-collars during 1982-1983. Distribution of 41 bears captured in 1983 included 27 (9 males, 18 females) in coastal plain habitats, 9 (7 males, 2 females) in foothills habitats, 3 (1 male, 2 females) in mountainous habitats, and 2 females in river valley habitats in mountainous terrain (Fig. 1).

Average weights of captured adult bears in 1982 and 1983 were comparable to weights of adult bears in the interior of the southern Yukon Territory, but were less than average weights recorded for adult brown bears in other localities of northern Alaska and the 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).

Productivity

Age structure of 78 captured bears and 13 associated unmarked young (Fig. 2) that were theoretically alive in late winter 1983 indicated a preponderance of males in age classes 5.5 years or less (19 males versus 11 females, plus 13 unidentified bears), while females predominated in age classes 6.5 years

Table 1. Physical characteristics of brown bears captured on the Arctic National Wildlife Refuge, Alaska, May June and July 1982 and 1983 (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 Ck.	26 June 1982
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
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
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
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
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
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
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
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
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
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
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
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
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

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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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

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
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
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
1233	M[a]	12.5	375e/170	186	104	32	63	110	22.4	33.4	109	3.8	3.2	Saddlerochit 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
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
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
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
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
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
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
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
1248	F[a]	10.5	180/82	158	88	25	55	93	19.1	30.7	92	-	-	Kongakut R.	12 June 1983
1249	F	3.5	110/50	122	74	22	53	86	15.2	28.1	83	-	-	Kongakut R.	12 June 1983
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
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
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
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
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
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
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

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

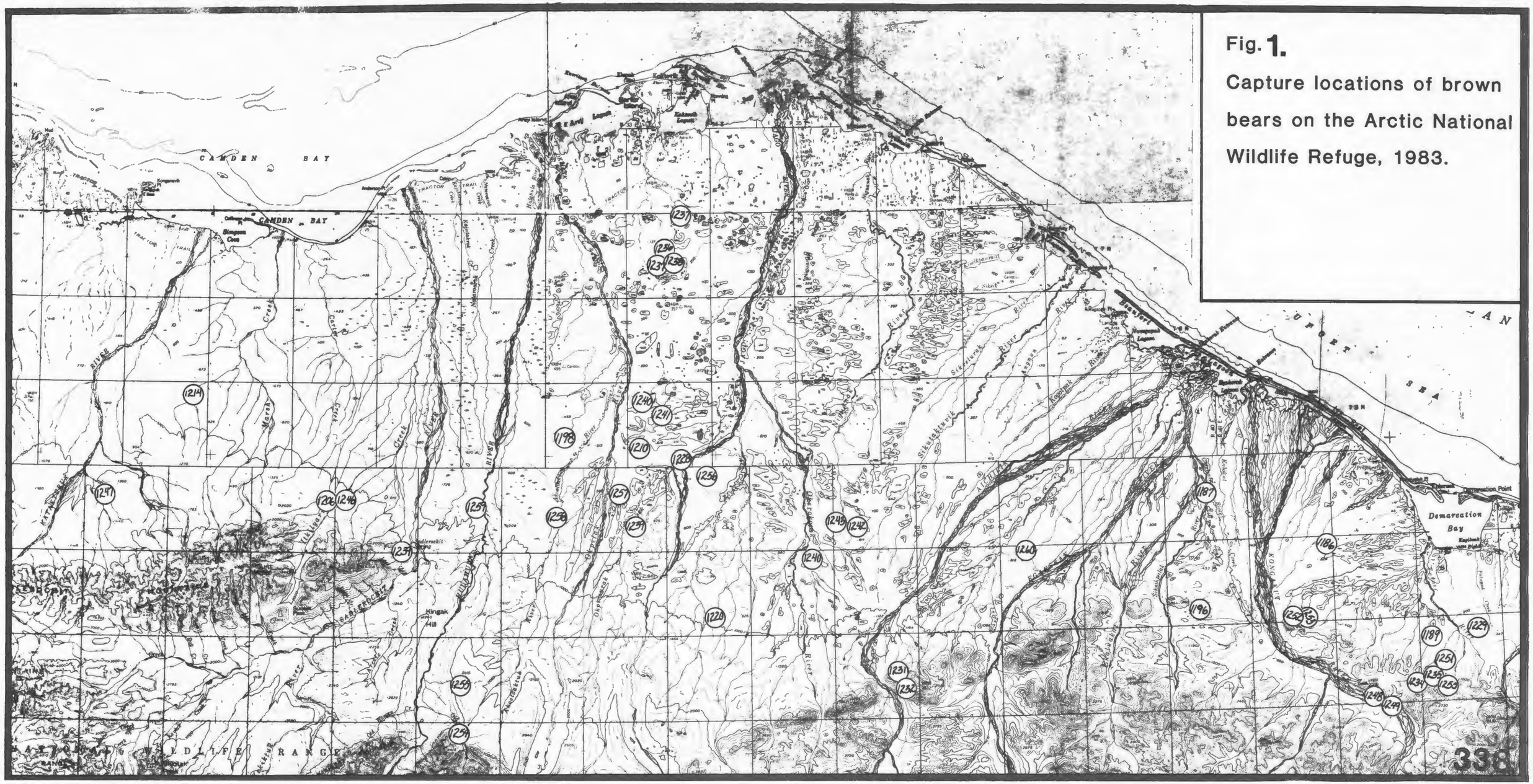

Fig. **1.**

Capture locations of brown bears on the Arctic National Wildlife Refuge, 1983.

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	74-124	interior-southern Yukon Territory	Pearson 1975
Male	25	169	-	northern 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	22	135	86-184	north slope, ANWR	This study 1982-1983
Female	32	93	73-116	north slope, ANWR	This study 1982-1983

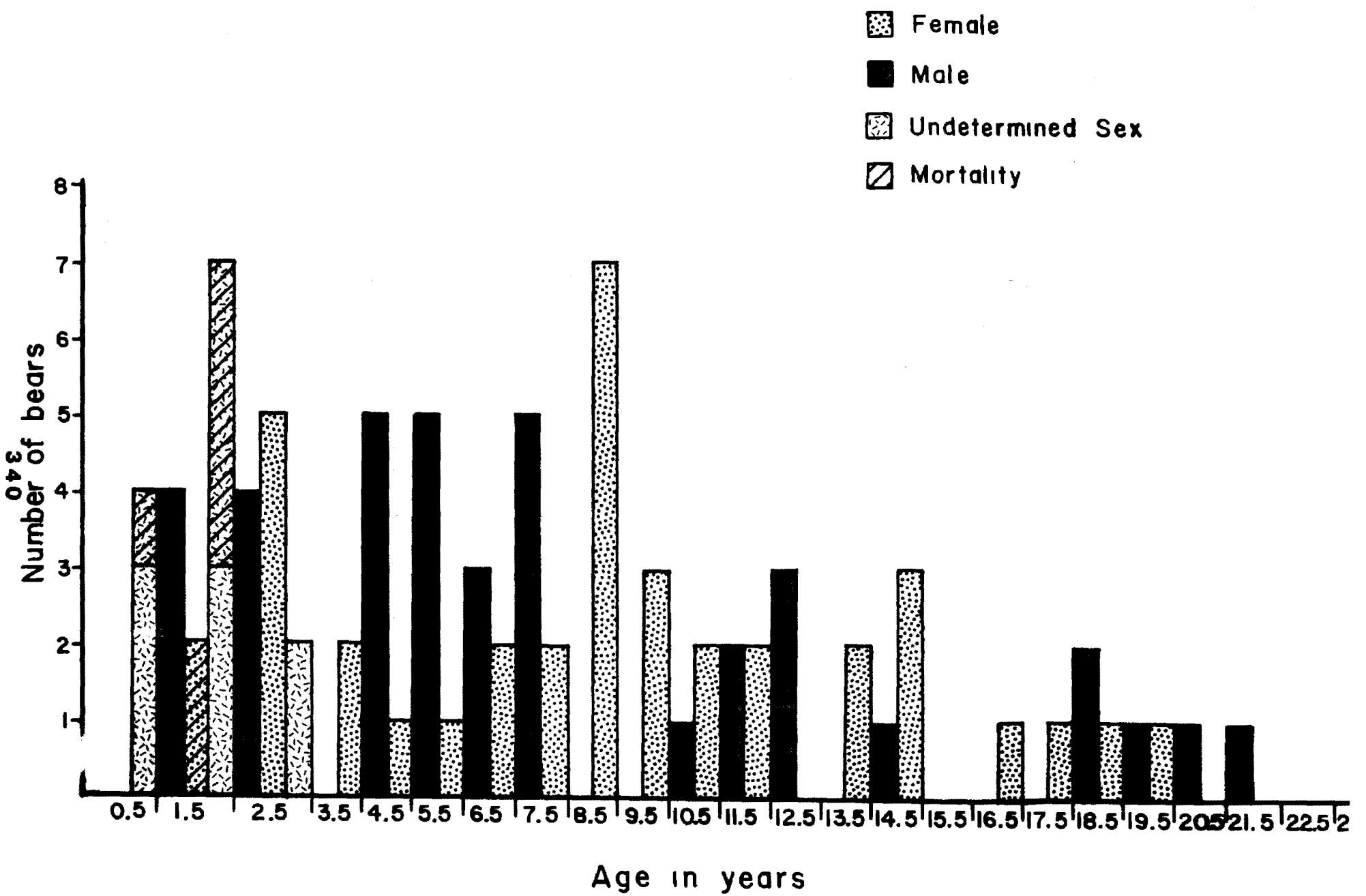

Fig. 2. Age structure of 78 brown bears based upon known denning in fall 1982 and subsequent capture of new bears in May and June 1983 on the Arctic National Wildlife Refuge.

and older (28 females versus 20 males). Immature bears (4.5 years old or less) comprised 40.7% of the theoritical population in late winter 1983, with cubs, yearlings, 2.5 year olds, 3.5 year olds, and 4.5 year old comprising 4.4%, 14.3%, 12.1%, 3.3%, and 6.6% respectively. Adults comprised 59.3% of captured bears and associated young. The sex ratio for the 78 captured bears was equal (39 males, 39 females). This age structure differs from that presented for bears in northeast Alaska along the Canning River (Reynolds 1976), however the Canning River data were more complete than the current study. On the coastal plain and adjacent foothills and mountains of ANWR, 44 bears were captured that were aged 3.5-11.5 years old in contrast, only 19 bears were aged 12.5 years and older. Reynolds (1976) indicated that more older age class bears (12.5+years, n=43) were captured than younger age classes (3.5-11.5 years old, n=29). If the age structure of captured bears is representative of the population, these data indicate a shift from a declining population identified by Reynolds (1980) to a poplation status of uncertain 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 there was relatively good survival of young bears through the first 4 years of life. During 1982, 9 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). The age structure presented in Fig. 2 is based upon known denning in the fall of 1982 (Garner et al. 1983) and subsequent capture of new bears in May and June 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 sow and are assumed dead. One radio-collared yearling (#1225) was killed by another bear in late June (Table 3, Fig. 2). This apparent mortality represents a 58.9% mortality rate among the cubs and yearling cohorts. Reasons for this high mortality among young bears is undetermined at this time.

Breeding season normally extends from May through approximately 10 July, with peak of breeding occurring between 10 and 20 June (Reynolds pers. comm.). Observations of pairs was common during this period in 1983 (Fig. 3). Pairs observed after mid-July were probably short term reassociations of siblings and/or family groups. Sexual maturity in females evidently occurs at 6 years of age, with 7 of the 18 females with young apparently breeding when 6.5 years old (Table 4). Two females (#1236 and 1252) apparently bred when 5.5 years of age (Table 4).

Interactions Between Brown Bears and Other Species

Brown bears were observed in the vicinity of dall sheep (Ovis dalli) on 2 occasions, moose (Alces alces) on 5 occasions, and wolf (Canis lupus) on 1 occasion. No interaction between bears and these species were observed, except bear (#1196) was following a lone moose on 14 October in a mountainous region along the Egaksrak River. In contrast to 1982, bear (#1250) was observed feeding on a muskox carcass (adult bulls) on 2

Table 3. Maternal females captured on the ANWR study area in 1982 and 1983 and their associated offspring.

Bear #	1983 Offspring Numbers/age/sex	Time period with female	Offspring marked/bear#
1182	2/yearlings/FF	both disappeared-9 June 83	Yes/1182,1183
1185	2/2.5-year olds/FM	all season	Yes/1231,1232
1190	2/yearlings/MM	1 yearling-did not emerge from den, 1 yearling disappeared-9 June 83	Yes/1191,1192
1193	2/cubs	at least through 7 Aug 83	No
1197	2/2.5-year-olds	2 disappeared 27 June 83	No
1202	3/2.5-year-olds/MMM	all season	Yes/1203,1204, 1205
1208	2/yearlings	1 disappeared-9 June 83 1 disappeared-15 June 83	No
1212	1/cub	all season	No
1213	1/3.5-year old/F	all season	Yes/1214
1217	1/cub	disappeared-8 May 83	No
unknown	1/3.5-year old/M	last seen-26 June 83	Yes/1218
1227	2/2.5-year olds/FF	1 separated from sow-9 June 83 1 separated from sow-30 May 83	Yes/1234,1235
1236	2/2.5-year olds/FF	2 disappeared-9 June 83	Yes/1237,1238
1239	2/yearlings	all season	No
1245	2/yearlings	1 disappeared-5 Sept 83 1 all season	No
1248	1/3.5-year old/F	disappeared-17 June 83	Yes/1249
1252	1/yearling/M	1 all season	Yes/1253
unknown	1/yearling/M	killed-26 June 83	Yes/1255
1257	1/yearling	disappeared-date undetermined	No

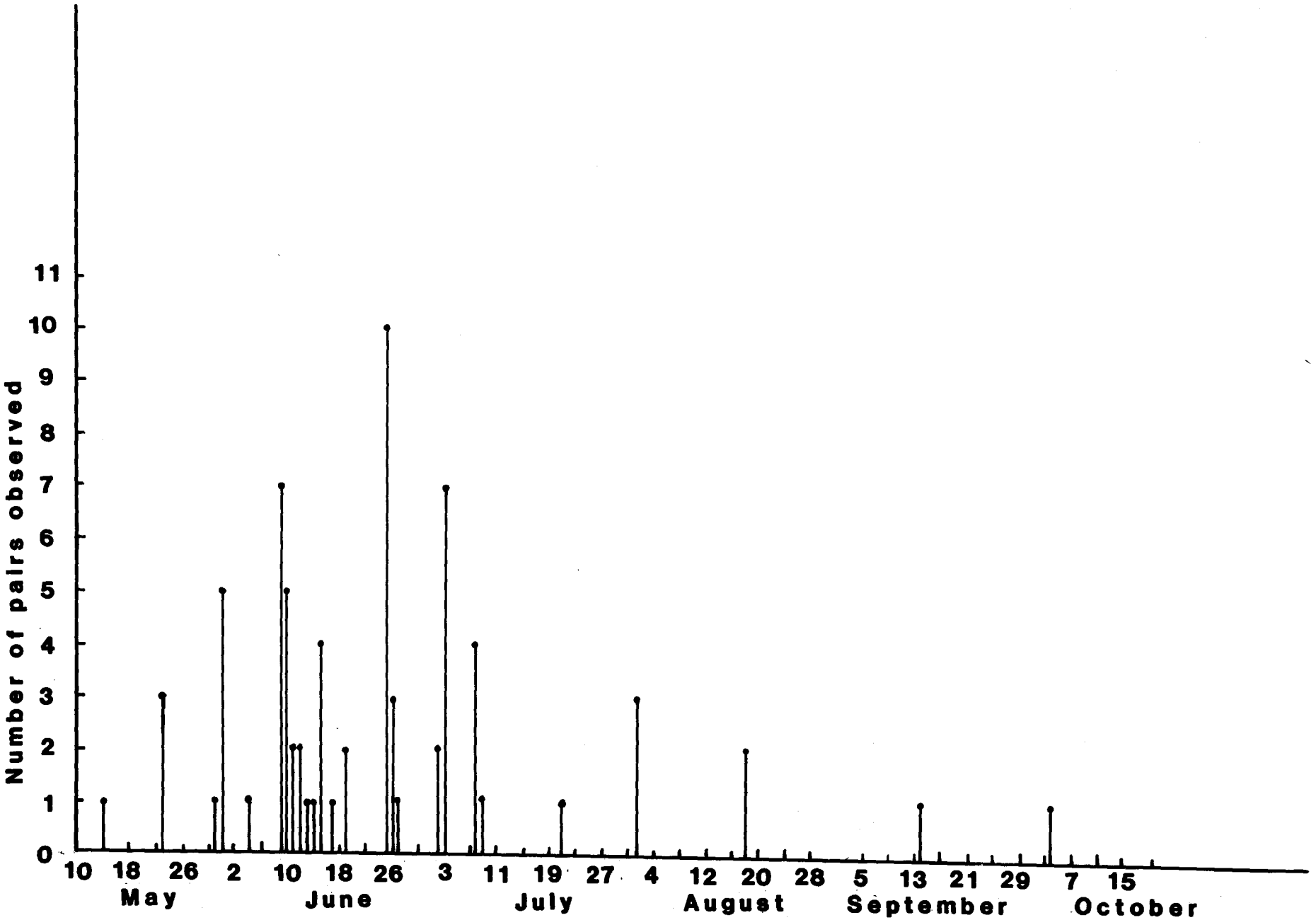

Fig. 3. Chronology for observations of brown bear pairs on the Arctic National Wildlife Refuge, 1983.

Table 4. Age at breeding for 9 radio-collared female brown bears on the ANWR study area, 1982-1983.

Bear #	Cementum age	Reproductive status - winter 1982-1983	Age at breeding
1182	16.5	2 yearlings	14.5
1185	19.5	2 3.5 year olds	15.5
1190	8.5	2 yearlings	
1193	9.5	2 cubs	8.5
1197	9.5	2 2.5-year olds	6.5
1202	17.5	3 2.5-year olds	14.5
1208	8.5	2 yearlings	6.5
1212	14.5	1 cub	13.5
1213	13.5	1-3.5-year old	9.5
1217	13.5	1 cub	12.5
1220	11.5	1-4.5-year old	6.5
1227	14.5	2-3.5-year olds	10.5
1236	8.5	2-2.5-year olds	5.5
1239	8.5	2 yearlings	6.5
1245	14.5	2 yearlings	12.5
1248	10.5	1-3.5-year old	6.5
1252	7.5	1 yearling	5.5
1257	8.5	1 yearling	6.5

occasions and other bears were observed either stalking or chasing muskox on 2 other occasions in 1983. On 5 occasions bears were observed in close proximity to muskoxen herds, but no reaction was evident. In both cases of a bear feeding on a muskox carcass, other muskox were not known to occur in the area, and the muskox were apparently lone bulls.

Caribou were in the vicintiy of bears on 98 occasions and interactions were recorded on 32 of these observations. Caribou did not react to nearby brown bear on 66 sightings of the 2 species in close proximity. Bears were observed on 11 caribou carcasses during May, June, and July and were seen on 4 carcasses in August, September and October 1983. The majority of bear sightings at caribou carcasses (10) occurred in late May and June when the Porcupine caribou herd was calving on the coastal plain of ANWR (Whitten et al. 1984). Bears were observed chasing caribou on 15 separate occasions, and 3 of these chases were successful, with 3 caribou calves being killed by bears. During capture operations between 4-16 June, 7 of 25 bears captured in the foothills and coastal plain had either dried blood or fresh blood on their muzzle. Eight field observations of brown bears either killing or feeding upon caribou calves were made between 4-16 June (P. miller pers. comm., Phillips 1984). Preliminary inspection of radio-relocations of bears in the Caribou Pass area of the Kongakut River, indicate that most radio-collared bears shifted their areas of use in June 1983 to the coastal plain between the Kongakut and the Clarence Rivers. Radio-collared bear locations were abundant in the VARM Bitty area of the Jago River during June. This area was considered a high density calving area in 1983 (Whitten et al. 1984).

Observations of brown bear feeding on caribou carcasses and killing calves during June 1983 indicate that caribou are probably an important food source during this time period for certain bears. However, this use appears to be limited to the time period caribou occupy the coastal plain and adjacent foothills of ANWR. Detailed analyses of bear movement patterns and home range use may clarify this temporal relationship.

Denning

During the fall of 1982 dens were located for 28 radio-collared bears and 10 dens of unmarked bears (Garner et al. 1983). Beginning on 24 April 1983, den sites of radio-collared bears were monitored regularly to determine approximate dates of emergence (Table 5). Ten bears were out of the den on 24 April (5 males, 5 females) when these surveys were initiated. An additional 8 bears were out of the den on 1 May (3 males, 5 females). The remaining 10 bear emerged from their dens throughout May and these bears were predominantly females with young (Table 5). Of the 18 bears emerging from dens by 1 May, 13 were single males or non-parturient females. Four females with yearlings or older also were in this early emergence group. One female (#1217) was at the den mouth on 24 April. She remained at the den site until 1 May when she was accompanied by 1 cub. On 8 May she was 2 km from the den site without the cub. Two weeks later (23 May), she was accompanied by male #1056. This female evidently emerged from the den with 1 cub, lost it in early May, and then initiated breeding activity in late May. Den emergence among radio-collared bears followed the general patterns of early emergence by males and non-parturinet females and later emergence of females with new cubs and females with young (Quimby 1974, Ruttan 1974, Harding 1976).

Table 5. Approximate dates of emergence from winter dens for 28 radio-collared brown bears in the Arctic National Wildlife Refuge, 1983.

Bear #	Age/Sex	Date 1st observed out of den	Den type	Associated bears number/age/sex/bear#
1056	21/M	24 April	Dug	None
1185	19/F	24 April	Dug	2/3.5-year olds/FM/ 1231,1232
1188	5/M	24 April	Dug	None
1195	5/M	24 April	Dug	None
1198	6/M	24 April	Dug	None
1210	4/F	24 April	Dug	None
1217	13/F	24 April	Dug	1/cub
1227	14/F	24 April	Dug	2/2.5-year olds/FF/ 1234,1235
1229	5/M	24 April	Dug	None
1230	8/F	24 April	Dug	None
1186	7/M	1 May	Dug	None
1189	6/F	1 May	Dug	None
1196	7/M	1 May	Dug	None
1206	8/F	1 May	Dug	None
1208	8/F	1 May	Dug	2/yearlings
1213	13/F	1 May	Dug	1/3.5-year old/F/1214
1216	6/F	1 May	Dug	None
1226	11/M	1 May	Dug	None
1200	14/M	7 May	Dug	None
1194	12/M	8 May	Dug	None
1190	8/F	14 May	Dug	1/yearling/M/1191 or 1192
1193	9/F	14 May	Dug	2/cubs
1202	17/F	15 May	Cave	3/2.5-year olds/MMM/ 1203, 1204, 1205
1212	14/F	15 May	Dug	1/cub
1197	9/F	22 May	Dug	2/2.5-year olds
1187	7/F	23 May	Dug	None
1182	16/F	30 May	Cave	2/yearlings/FF/1183, 1184
1225	18/M	30 May	Dug	None

Den sites of 18 radio-collared bears and 11 unmarked bears were inspected in late May and early June 1983 and physical characteristics of each den were measured. Each den site was revisited in late July 1983 and the vegetational and soil characteristics of the densite were sampled. In addition, 6 densites used during the winter of 1982-1983 were visited in late July and August and their physical characteristics were measured (Table 6). All dens were located in mountainous terrain, except 3 dens which were located in coastal plain tundra habitats (#83-11, #83-15, and #83-22). Elevation of all densites averaged 816.2 ± 61.4m (SE) with a range of 48.8 - 1341.1 m. Average den elevation is similar to that found along the Canning River (975m) by Reynolds et al. (1976). The 3 coastal plain dens had an average elevation of 139.3 m in elevation, whereas the 26 mountain dens have an average elevations of 894.3 m. Densites were equally divided between slope positions of lower 1/3 (14) and middle 1/3 (15), with no densites occurring in the upper 1/3 slope position. Of the 23 dens inspected in late May and early June, 18 were either intact or partially collapsed. Two of these dens were rock caves. In contrast, 1 dug den was intact in late July, with the remaining 25 dug dens being collapsed (Table 6). These data are similar to results reported by Reynolds et al. (1976) and Reynolds (1980).

Soil textures at densites in northern Alaska have been described generally as coarse (Reynolds et al. 1976, Reynolds 1980). Texture of soils at 29 densites (Table 6) were in the lower portions of the soil texture triangle (Brady 1974) and were predominantly silt loams (12) and sandy loams (9). Also, all densites, except the coastal plain sites (#83-11, #83-15, #83-22) had numerous rock fragments and small boulders in the tailings pile below the den opening. All densites, except #83-11, were located on well drained soils with average slopes at densites being 53.6 ± 3.8% (S.E.), range 2% to 103% (Table 6). The incidence of collapsed dens in July agrees with Pearson's (1978) and Reynolds (1980) conclusions that soil texture and moisture content are important factors in densite selection by northern brown bears.

Aspects of den sites (Table 6) were examined using circular statistics (Batshelet 1981, Zar 1984). Aspects of densites were concentrated in a southeast direction (Fig. 4). Mean aspect of 29 densites was 145° (95% C.I, 125°-165°) with an angular dispersion of 46°. Bear den aspects were not uniformly distributed in all directions (Raleigh's test, $P << 0.001$) and were strongly oriented in a southeast direction (mean aspect 145°; V-test, $P < 0.0005$). Reynolds et al. (1976) reported that 47 of 52 dens (90%) were located on southerly slopes along the Canning River. These data indicate that aspect of brown bear densites in the northeastern Brooks Range are strongly oriented in a southeasterly direction. Continued documentation of densites in future years should provide data to more clearly define this relationship.

During late September, October, and early November 1983, densites of 46 radio-collared brown bears and 12 unmarked brown bears were recorded during den surveys. Distribution of located dens was 1 on the coastal plain, 13 in foothills, and 44 in mountainous 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). Twenty seven bears were captured in coastal plain habitats, but only 1 radio-collared bear denned in this habitat type. Chronology of denning indicated that 3 bears denned

Table 6. Physical Characteristics of 29 densites used by brown bears during the winter of 1982-1983 in the northeast portions of the Arctic National Wildlife Refuge, Alaska.

Den#	Bear #	Date-1983	Slope (%)	Aspect(°)	Elevation(m) Den	Valley floor	Crest	Slope position (1/3)	Topography	Den status May	Den status July	Soil texture
83-1	1217	25 May	60	164	1069.9	871.7	1176.5	mid	mountains	partially collapsed	partially collapsed	silt loam
83-2	unmarked	25 May	41	125	1100.3	810.8	1277.1	mid	mountains	intact	collapsed	sandy loam
83-3	unmarked	25 May	49	170	984.5	905.3	1709.9	low	mountains	intact	intact	loamy sand
83-4	1185	25 May	62	118	682.8	502.9	972.3	mid	mountains	partially collapsed	collapsed	sandy loam
83-5	unmarked	26 May	43	112	1018.0	743.7	1414.3	mid	mountains	intact	collapsed	silt loam
83-6	1208	30 May	45	117	920.5	786.4	1371.6	low	mountains	intact	collapsed	loamy sand
83-7	unmarked	30 May	45	117	920.5	786.4	1371.6	low	mountains	partially collapsed	collapsed	sandy loam
83-8	unmarked	30 May	58	280	981.5	853.4	1133.9	mid	mountains	partially collapsed	collapsed	sandy loam
83-9	1210	30 May	71	158	1225.3	1079.0	2304.3	low	mountains	intact	partially collapsed	silt
83-10	1202	31 May	99	86	746.8	634.0	1158.2	low	mountains	cave	cave	silt loam
83-11	1213	31 May	2	153	189.0	140.2	265.2	mid	tundra	collapsed	collapsed	silt loam
83-12	1056	31 May	59	120	1054.6	944.9	1426.5	low	mountains	collapsed	collapsed	sandy loam
83-13	1212	31 May	73	121	1307.6	1237.5	1475.2	low	mountains	intact	collapsed	silt loam
83-14	1182	31 May	103	171	1341.1	1194.8	1426.5	mid	mountains	cave	cave	loamy sand
83-15	1225	1 June	40	220	180.0	137.2	516.3	low	tundra hills	intact	collapsed	silt loam
83-16	1230	1 June	56	279	661.4	378.0	914.4	mid	mountains	collapsed	collapsed	silt loam
83-17	1226	1 June	54	116	420.6	396.2	944.9	low	mountains	collapsed	collapsed	sand
83-18	1188	1 June	50	152	570.0	310.9	798.6	mid	mountains	intact	collapsed	silt loam
83-19	1194	1 June	31	41	365.8	189.0	664.5	mid	mountains	intact	collapsed	silt loam
83-20	1189	1 June	49	88	640.1	512.1	1005.8	low	mountains	intact	collapsed	silt loam
83-21	1227	1 June	59	222	798.6	682.8	1066.8	low	mountains	partially collapsed	collapsed	loamy sand
83-22	1197	2 June	23	165	48.8	42.7	64.0	low	tundra hills	intact	collapsed	sandy loam
83-23	1229	2 June	72	182	658.4	469.4	1423.4	low	mountains	collapsed	collapsed	silt loam
83-24	unmarked	21 July	55	188	926.6	871.7	1176.5	low	mountains	collapsed	collapsed	silt loam
83-25	unmarked	21 August	78	72	902.2	795.5	1002.8	mid	mountains	-	cave	sandy loam
83-26	unmarked	21 August	40	160	960.1	393.2	1376.2	mid	mountains	-	collapsed	loamy sand
83-27	unmarked	21 August	44	138	955.5	393.2	1376.2	mid	mountains	-	collapsed	loam
83-28	unmarked	23 August	39	151	1080.5	995.2	1222.2	mid	mountains	-	collapsed	sandy loam
83-29	unmarked	23 August	56	176	958.6	795.5	1100.3	mid	mountains	-	collapsed	silt loam

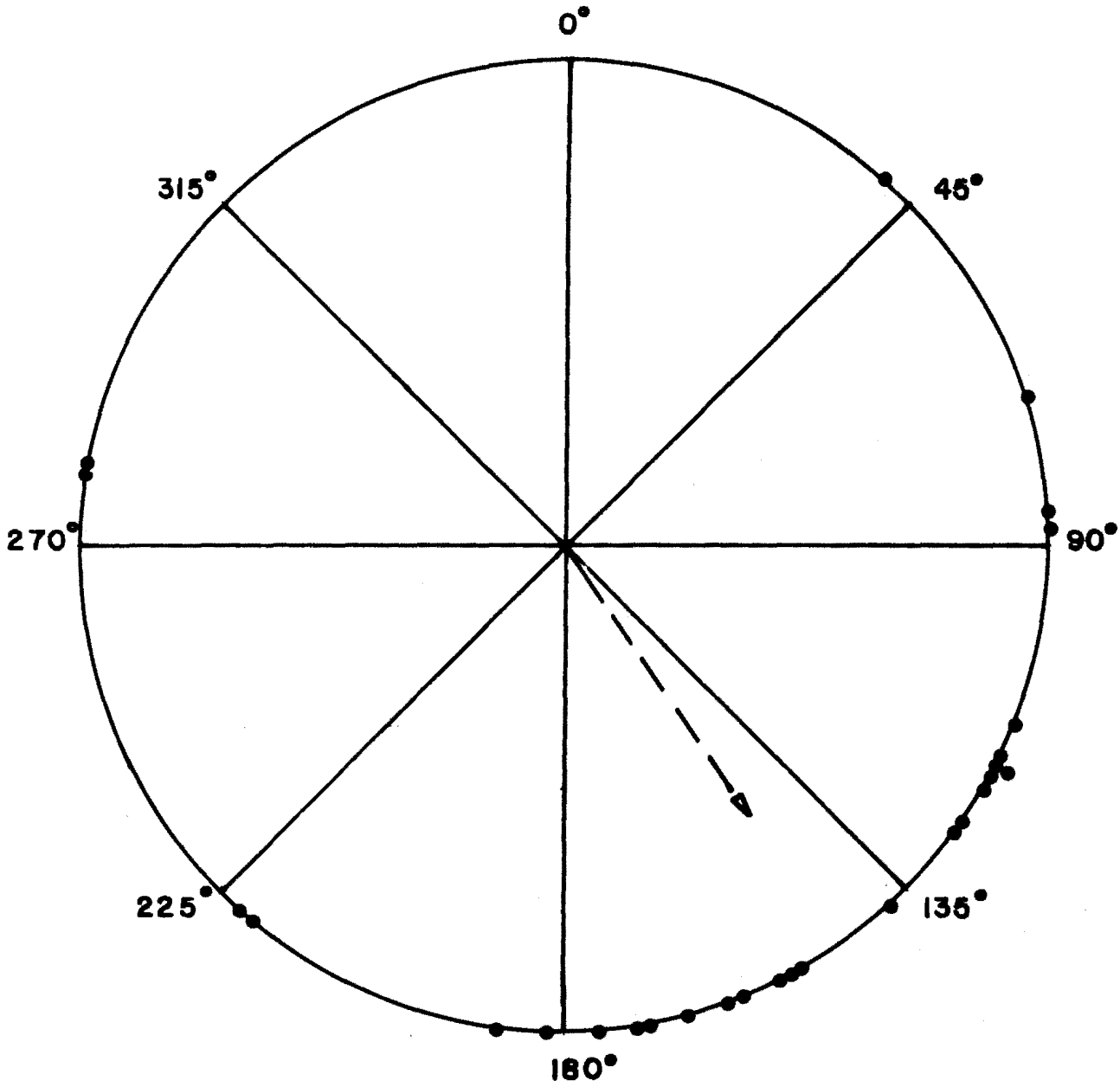

Fig. 4. Aspects and mean aspect (dotted arrow) of 29 bear dens used during winter 1982-1983 on the Arctic National Wildlife Refuge.

during the first half of October, while 52 bears denned during the last half of October and early November (Table 7). Three bears denned in early November. Elevations and aspects of the 58 fall densites were estimated from 1:633360 scale topographic maps (Table 7). Average estimated elevation was 894 $\pm$ 42 m (SE) and is comparable to average elevations of 28 densites in summer 1983. Estimated aspects for the 58 fall densites are depicted in Fig. 6. In general, estimated aspects of these 58 dens show a wider disperison than the 28 densites visited during summer 1983 (Fig. 4 and Fig. 6). However, the southeast and the southwest quandrats contained a majority of the estimated aspects of densites (25 southeast and 14 southwest, respectively). These densites will be inspected in early summer 1984 and actual aspects and elevations will be determined at that time.

Population Characteristics

Conclusions based on the data presented here should be viewed as preliminary and contingent upon further observations. 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 3 or 4 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).

Population Size. Eighty bears were captured in the area of intensive study; an additional 17 unmarked but identifiable bears were observed. These unmarked bears included 9 offspring of marked females, 1 adult male, 1 female with 3 yearlings, and 1 female with 2 2-year-olds. Since 10 mortalities were observed in 1982-83, the minimum number of bears in the study area in 1983 was 87 bears. If 80% is used as a reasonable approximation of the proportion of bears which were captured in the 8300 km^2 area, the calculated population would be 108 bears or a density of 1 bear/80 km^2. Again, this figure is preliminary and subject to the following biases: 1) the proportion of bears marked in the area may be inaccurate, 2) the proportion of bears which are resident in the area year-round has not been established; and 3) the degree to which population size is influenced by movement of bears from the south and east is not known. Additional research and data analysis from the 1984 field season, should help to reduce the effects of these biases and increase the accuracy of population estimates.

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, In press). Because the proportion of females with offspring in arctic populations is low and reproductive cycles may be 6 years or longer (Reynolds In press, Reynolds and Hechtel 1983), accurate measures of reproductive rates require long-term observations. Calculations presented here require extrapolation and should be viewed as preliminary.

Based on data from 11 females (Table 8), the average minimum age at which females are first observed with young is 7.4 years and range from 6.5 years

Fig. **5.**

Distribution of densites on the Arctic National Wildlife Refuge, fall 1983.

N

Table 7. Fall denning characteristics of 58 brown bears in the northeastern portion of the Arctic National Wildlife Refuge, 1983.

Bear #	Reproductive status	Terrain	Date observed denned	Estimated aspect(°)	Estimated elevation(m)
1056	male	mountainous	20 Oct	118	1250
1182	potential breeder	mountainous	21 Oct	152	1219
1185	2 2.5-year olds	foothills	14 Oct	114	762
1188	male	foothills	26 Oct	162	732
1189	potential breeder	mountainous	26 Oct	300	549
1190	potential breeder	mountainous	26 Oct	260	732
1194	male	mountainous	26 Oct	90	732
1196	male	mountainous	24 Oct	74	1067
1197	potential breeder	foothills	24 Oct	35	579
1198	male	mountainous	6 Nov	193	1311
1200	male	mountainous	undetermined	171	808
1202	3 2.5-year olds	mountainous	15 Oct	99	960
1206	potential breeder	mountainous	26 Sep	34	1356
1208	potential breeder	mountainous	6 Nov	119	945
1210	immature female	mountainous	24 Oct	192	1585
1212	1 cub	mountainous	13 Oct	166	1097
1213	1 2.5-year old	foothills	20 Oct	335	381
1216	young female	mountainous	6 Nov	240	1158
1217	potential breeder	foothills	14 Oct	274	610
1220	potential breeder	mountainous	13 Oct	238	1250
1223	male	foothills	24 Oct	89	488
1225	male	foothills	21 Oct	139	610
1226	male	foothills	25 Oct	118	427
1229	male	mountainous	24 Oct	289	1524
1230	potential breeder	foothills	15 Oct	148	762
1233	male	mountainous	14 Oct	169	853
1234	immature female	mountainous	24 Oct	144	792
1235	immature female	mountainous	15 Oct	230	732
1236	potential breeder	mountainous	15 Oct	53	1006
1239	2-yearlings	mountainous	14 Oct	57	1341
1240	male	mountainous	2 Oct	190	777
1241	male	mountainous	15 Oct	157	1356
1243	potential breeder	mountainous	14 Oct	106	914
1244	potential breeder	mountainous	20 Oct	77	1219
1245	1-yearling	mountainous	15 Oct	115	1280
1246	male	mountainous	15 Oct	191	945
1247	potential breeder	mountainous	15 Oct	51	762
1248	potential breeder	foothills	25 Oct	239	488
1250	male	foothills	26 Oct	70	610
1251	male	mountainous	26 Oct	236	762
1252	1-yearling	mountainous	15 Oct	172	884
1257	young female	mountainous	21 Oct	98	1585
1259	potential breeder	mountainous	15 Oct	92	792
1260	young female	foothills	14 Oct	148	442
unmarked	unknown	mountainous	14 Oct	95	823
unmarked	unknown	mountainous	14 Oct	237	853
unmarked	unknown	mountainous	14 Oct	85	1250
unmarked	unknown	mountainous	15 Oct	168	945
unmarked	unknown	mountainous	15 Oct	42	884
unmarked	unknown	mountainous	15 Oct	115	1097
unmarked	unknown	mountainous	21 Oct	326	1372
unmarked	unknown	mountainous	25 Oct	178	640
unmarked	unknown	coastal plain	25 Oct	301	98
unmarked	unknown	foothills	26 Oct	150	553
unmarked	unknown	mountainous	26 Oct	195	549
unmarked	unknown	mountainous	26 Oct	88	945
unmarked	unknown	mountainous	26 Oct	270	732
unmarked	unknown	mountainous	20 Oct	267	975

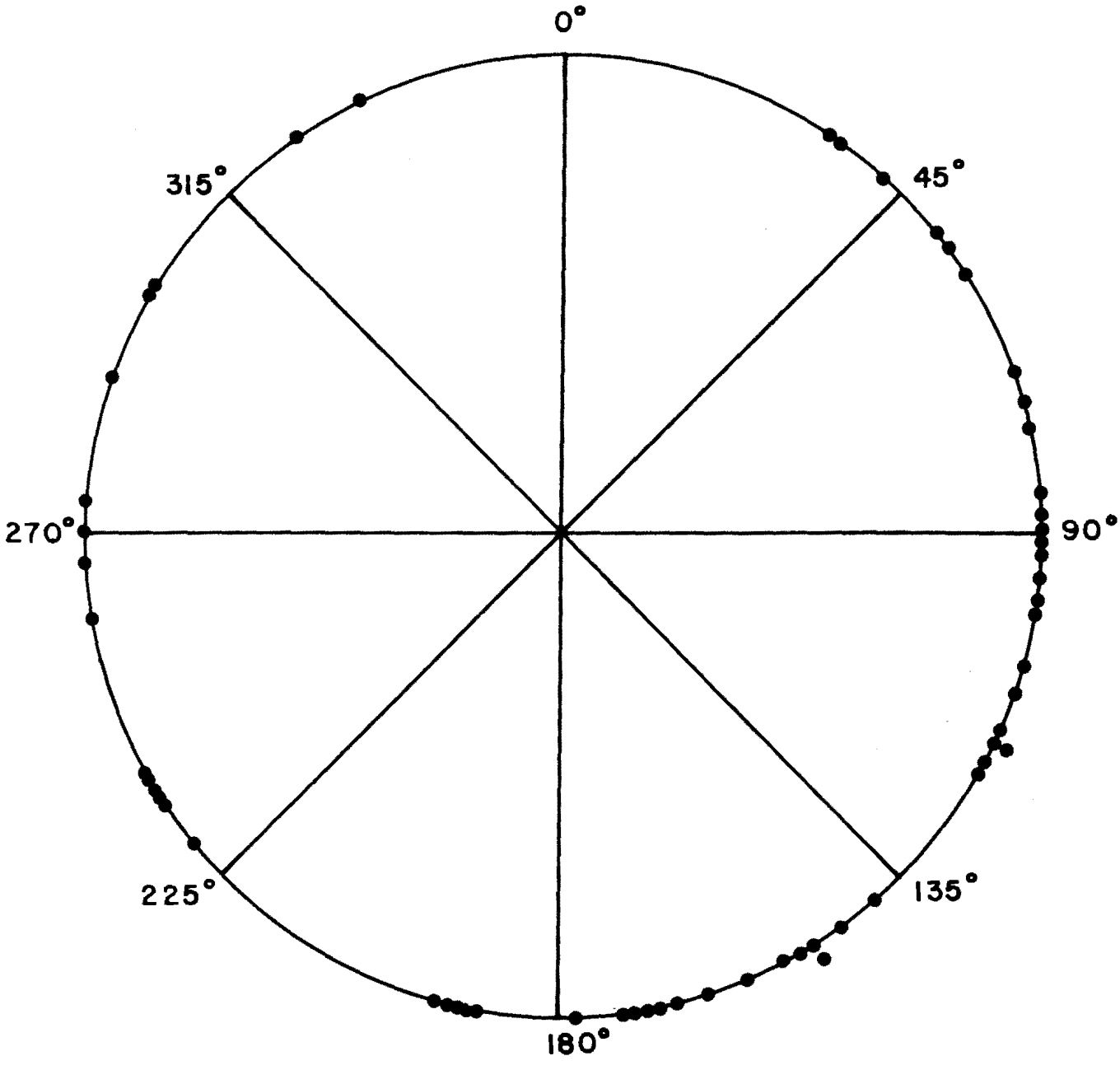

Fig. 6. Estimated aspects of 58 brown bear den sites located on the Arctic National Wildlife Refuge in October and November 1983.

Table 8. Reproductive history and litter size for female brown bears in the Arctic National Wildlife Range, 1982-83.

Bear #	Age[b] 1983	# offspring	Offspring prior to capture	Reproductive history/litter size 1981	1982	1983	Comments
1182	16.5	1283F,1284F	yes	B	2 cub	2 ylg/B	Mort 2ylg 83
1185	19.5	1231F,1232M	yes	2 cub	2 ylg	2 2yr/B	w/2 yr after B?
1187	7.5		no		B?	B	
1189	6.5				B?	B	
1190	8.5	1191M,1192M	yes	B	2 cub	1 ylg/B	Mort 1 ylg 83
1193	9.5		yes		B	2 cub	
1197	9.5	2 UM	yes	2 cub	2 ylg	2 2-yr/B	
1201	5.5e		no		B		Capture mortality
1202	17.5	1203M,1204M, 1205M	yes	3 cub	3 ylg	3 2-yr	
1206	8.5		yes		B	B	
1208	8.5		yes	B	2 cub	2 ylg/B	w/ylg after B 1 ylg mort
1210	4.5		no		NB	B	
1212	14.5		yes		B	1 cub	
1213	13.5	1214F	yes	1 ylg	1 2-yr	1 3y/B	w/3yr. after breed
1216	6.5		no		B?	B	
1217	12.5		yes		B	1 cub/B	
1220	11.5	1221M	yes	1 2 yr	1 3-yr	1 4 yr/B	
1227	14.5	1234F,1235F	yes	2 cub	2 ylg	2 2yr/B	
1230	8.5		yes		B	B	
1236	8.5	1237F,1238F	yes	2 cub	2 ylg	2 2yr/B	Capture-related weaning
1239	8.5	2UM ylg	yes	B	2 cub	2 ylg	
1242	5.5		no			B	
1243	11.5		yes			B	
1245	14.5	2 UM ylg	yes	B	2 cub	2 ylg	1 ylg mort 83
1247	18.5		yes			B	
1248	10.5	1249F	yes	1 cub	1 2 yr	1 3 yr/B	
1249	3.5		no				
1252	7.5	1253M	yes	B	1 cub	1 ylg	
1254	12.5						
1257	8.5	1 UM ylg	yes	B	1 cub	1 ylg	Capture, 1 ylg mort
1258	9.5		yes				
1259	23.5		yes			B	
1260	10.5					B	
UM Hulahula			yes		3 cub	3 ylg	
UM Kongakut			yes	2 cub	2 ylg	2 2-yr	

[a]Designations are as follows: UM-unmarked; UN=unobserved; B=bred during that season; NB-did not breed; cub, yrlg, 2 yr, 3 yr=female accompanied by cub, yearling, 2 year old, or 3 year old young; cut/B=cubs lost prior to breeding season, subsequent breeding by female; yrlg/B, 2 yr/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 occured prior to observation.

to 8.5 years. This calculation is based on 2 females which had their first litter of cubs at 6.5 years and 6 which had their first litter at 7.5 years; for 1 female the earliest age was 8.5 years. However, since this sample size is low and is a minimum figure, subsequent data may show a higher average age, probably between 7.5 and 8.0 years. In calculating these ages, it is assumed that bears did not have young before age 5.5 because no females were observed breeding: 2 of 6 were observed with males at age 4.5 years and at least 5 of 8 bred at age 5.5 years (Table 8).

The actual ages at which females had litters in many cases were extrapolated from observations of bears with older offspring. For example, bear #1236 was captured with 2-year-old young as an 8.5-year-old; therefore, she was 6.5 years old when her young were cubs of-the-year. This was presumed to have been her first litter, since no younger females were observed with cubs. Based on the observation of a 23.5 year old female breeding during 1983, the potential length of productive life for females in the ANWR is at least 16 years (23.5 years-age at first production or 7.4 years = 16.1 year). In the western Brooks Range, 7 old age females were observed with litters: 3 had offspring at age 18.5, 2 at age 19.5, and 1 at age 22.5 (Reynolds and Hechtel 1983). Litter sizes ranged from 1 to 3 cubs.

A mean litter size of 1.87 was calculated for the cubs and yearlings. These 2 age groups were combined to increase sample size and because the average litter size for cubs (10 wks/6 litters = 1.7) was smaller than the average for yearlings (18 yearlings/9 litters = 2.0). The reason for this discrepancy between the age classes in unclear, but is probably due to the small sample size in the cub age class. Only minimum values for the reproductive interval or the period between production of successive litters can be calculated at this time. Four of the females observed will have a minimum reproductive interval of 3 years, 2 bears will have a reproductive interval of 4 years and 1 bear will have a reproductive interval of 5 years for an average minimum reproductive interval of 3.6 years. This figure is very likely low since it is based on minimums and does not take into account the possibility of breeding which does not result in the production of young, a common occurrence for brown bears in the Brooks Range (Reynolds 1980, Reynolds and Hechtel 1983).

Because of the cummulative biases in reproductive parameters and the need for additional data, calculation of reproductive rate should be used only as a rough indicator of productivity on the coastal plain of the ANWR. Theoretically, the 16 year potential reproductive life of females on ANWR, females would produce an average of 1.9 offspring every 3.6 years for a total of 8.44 young during her life or an average of 0.5 young/year. This compares with 0.48 young/year for bears in the western Brooks Range during 1977-82 and 0.42 young/year for bears near the Canning River during 1973-75 (Reynolds In press). Like the western Brooks Range population, bears on the ANWR study area have access to caribou and like the western Brooks Range population, probably owe their relatively high productivity to the availability of caribou as a source of food.

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ARCTIC NATIONAL WILDLIFE REFUGE COASTAL PLAIN
RESOURCE ASSESSMENT

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Section 1002C
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U.S. Fish and Wildlife Service
Region 7
Anchorage, Alaska
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