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BLACK BEAR PREDATION ON MOOSE

By

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VOLUME III

Project Progress Report
Federal Aid in Wildlife Restoration
Project W-21-2, Job No. 17.3R

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JOB PROGRESS REPORT (Research)

State: Alaska

Cooperators: Charles C.Schwartz and Albert W. Franzmann

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

Job No.: 17.3R Job Title: Black Bear Predation on Moose

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

SUMMARY

Movements of 20 radio-collared black bears from 1981 are presented and discussed. The average home range of female bears was 15 ± 6 km^2. Home ranges for adult males (59 ± 41 km^2) were much larger than those of females. Preliminary estimates indicate a black bear density of 1 bear per (11 ± 7 km^2). This represents a 57% decline in bear density from 1980 and reflects a lack of cub production in 1980, a high yearling mortality, and a high hunter harvest of adults. Morphometric, blood physiology, and drugging information is listed but no assessment was available for this report.

CONTENTS

BACKGROUND

Black bear (Ursus americanus) studies were initiated on the Kenai Peninsula in 1977 (Franzmann and Schwartz 1979) as part of an intensive predator-prey study (Franzmann and Bailey 1977). Background and discussion were presented by Schwartz and Franzmann (1980, 1981).

OBJECTIVES

To determine the population density, age structure, and productivity of the black bear population within the study area at the Moose Research Center (MRC).

To determine seasonal movements and habitat usage by resident bears within the study area.

To evaluate seasonal, temporal, and spatial aspects of bear movements as they relate to moose calving areas at the Moose River Flats and Willow Lake areas.

To evaluate seasonal usage and avoidance of 2 moose browse rehabilitation areas (Willow Lake and MRC 1947) by black bears.

STUDY AREA

The Moose Research Center (MRC) study area is located within the Kenai National Wildlife Refuge (KNWR), formerly the Kenai National Moose Range, on the northwestern Kenai Peninsula lowlands (Fig. 1). Detailed descriptions of the study area appear in LeResche and Davis (1973), Oldemeyer et al. (1977), and Schwartz and Franzmann (1980).

PROCEDURES

Procedures used in 1981 were similar to those used in 1978-1980

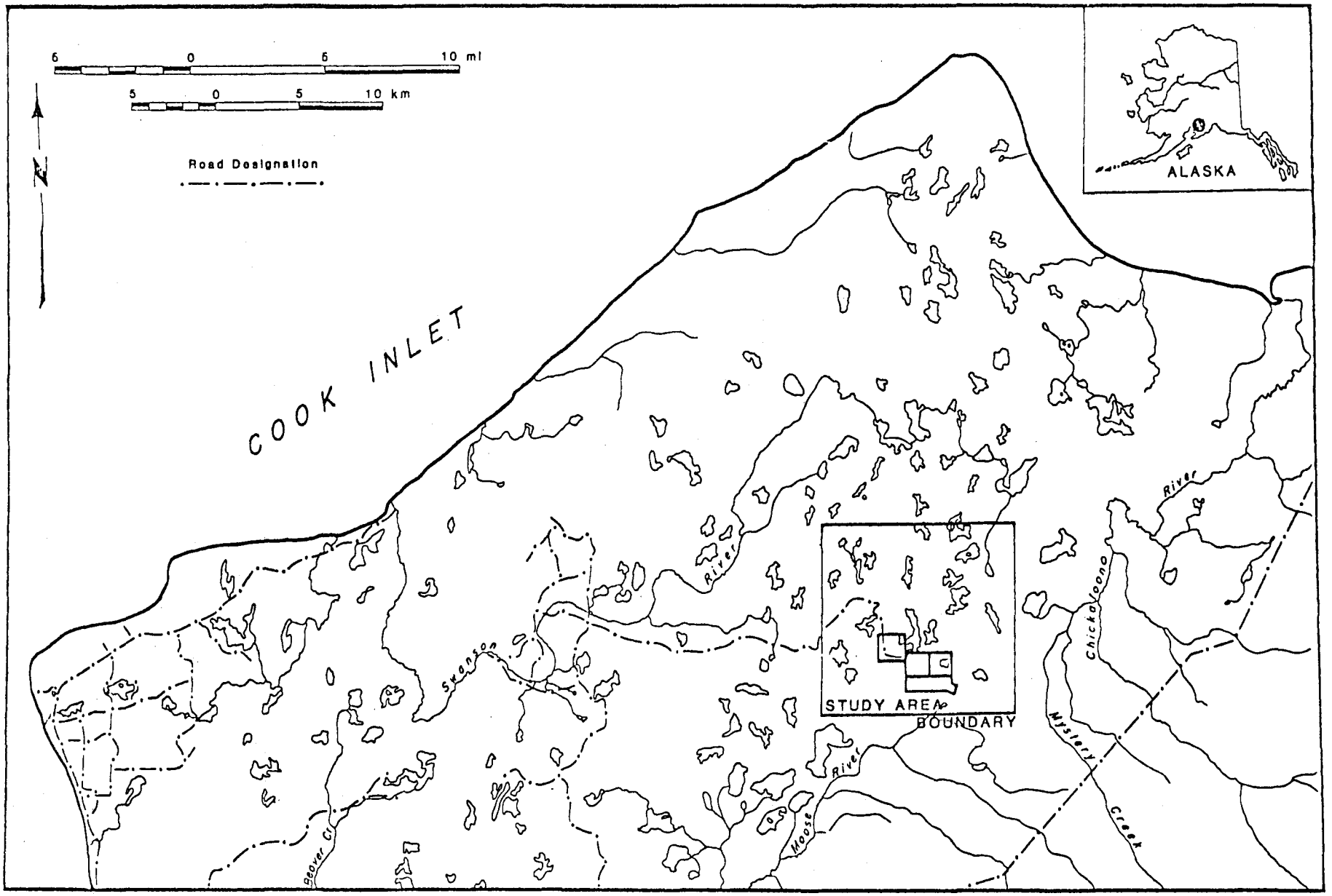

Fig. 1. Moose Research Center Study Area, Kenai Peninsula, Alaska.

(Schwartz and Franzmann 1980). Barrel traps (Fig. 2) were used to capture most bears in 1981.

Home range areas and density estimates were calculated using a graphics tablet and a computer program available through the U. S. Fish and Wildlife Service, Anchorage.

RESULTS

Capture and Handling

Trapping operations were initiated on 1 June 1981 and continued through 1 July 1981. During this period, we captured 25 bears during 723 trap-days (29 days per bear caught). The trapping success was down in 1981 compared to success rates in 1979 and 1980 which were 18 and 14 trap-days per bear caught, respectively. Of the 25 bears captured, 11 were different individuals and 14 were recaptures. Ten of the 11 different individuals had been previously handled and radio-collared in 1978-1980. The new capture, B35, was an adult female who was a resident in the north-central part of the study area. (Table 1).

We also trapped the study area during late fall (9-28 September) and captured 17 bears in 280 trap-days (16 trap-days per bear). Of the 17 bears handled, 8 were different individuals, and 1 (B47) was a new capture (Table 1). B47 was a 2-year-old male.

Results of immobilization attempts (Table 2) on 27 black bears indicated spurious results with several animals. All bears were successfully immobilized. Two mortalities were attributed to drugging. Both bears were yearlings (B43, B45) and in extremely poor physical condition. Both bears were darted from a helicopter; B43 was killed because the dart penetrated the base of the skull while B45 probably died from drug-related causes. His death, and several unsuccessful attempts at immobilizing bears captured in barrel traps, led us to conclude that the Sernylan we were using was no longer effective. The drug appeared to induce immobilization when used before 3-4 days after opening a vial; after that time we encountered difficulty in immobilization with dosages that were adequate in the past. Because of the restrictions imposed on the purchase and use of Sernylan and its unavailability, the drug we were using was out-dated.

Morphometric, Blood, and Hair Data

No attempt was made to assess the morphometric data collected during this report period (Table 3); data were recorded on a computer file for future analyses. Blood chemistry, protein electrophoresis and hematological data (Tables 4 and 5) analyses are complete on all samples collected in winter 1980-81 and summer 1981. These data have been entered on the computer file and will be analyzed in the final report. Hair sample analyses are not complete.

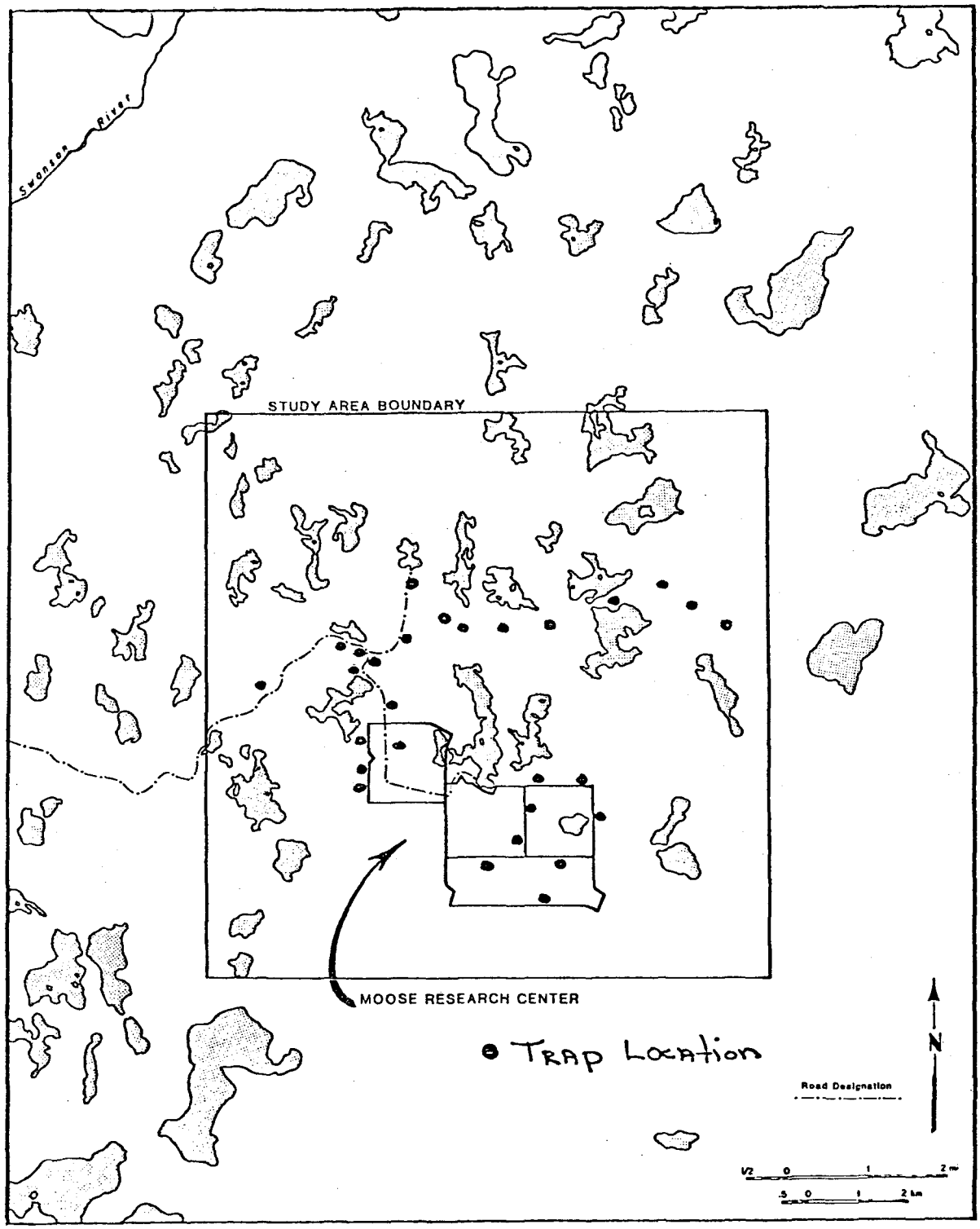

Fig. 2. Location of barrel traps used to capture black bears in the Moose Research Center Study Area, 1980.

Table 1. Capture and marking information for 2 newly captured black bears within the Moose Research Center Study Area, Kenai Peninsula, Alaska 1981.

Bear and Tattoo No.	Sex	Capture Date	Capture Location	Transmitter Frequency	Ear Tag No. Right	Ear Tag No. Left
B35	F	9 June 81	Barrel trap #14	164.350	273	272
B47	M	14 Sept. 81	Barrel trap #5	164.441	436	427

Table 2. Immobilization results for 27 black bear captures in the Moose Research Center Study Area, Kenai Peninsula, Alaska during 1981. The drug used was phencyclidine hydrochloride (Sernylan) alone or in combination with promazine hydrochloride (Sparine) as indicated.

Bear No.	Wt. (kg)	Date	Immobilization Time (min.)	Drug and Dosage (mg/kg) Sernylan	Sparine	Method of Capture	Comments
B1	61.7	21 June	13	1.3	0.3	Barrel trap	11:26-down, good dosage 12:11 responding, able to lift head
B2	62.1	8 June	14 9 -	1.3 0.3 0.6	0.3	Barrel trap	First 2 shots of Sernylan from opened vial of drug 1/ Last shot from new vial down time was not recorded
B2A	90.7	17 Sept.	17 19	0.7 0.7	0.2	Barrel trap	Down time not recorded First 2 shots from old vial
					0.2		Final drug level good-new vial used
B10		13 May	10 8			Helicopter	New bottle of drug
B11	125.6	8 June	8 9	0.7 0.3	0.3	Barrel trap	Good immobilization
B12	86.2	18 Sept.	12 4	1.2 0.5	0.2	Barrel trap	
B14	54.4	27 June	7	1.5	0.4	Barrel trap	Sneezing and yawning old drug - stiff effective bear very thin
B15	55.8	11 June	10 7 8	1.4 0.7 1.1 0.7	0.4	Barrel trap	Sernylan bottle had been open 4 days
B15A	---	18 June	14 6			Barrel trap	New bottle of drug Good level
B24	60.3	13 June	7	1.3	0.3	Barrel trap	Good dosage
B27	70.3	5 June	15 8	1.1 0.6	0.3	Barrel trap	Good immobilization

Table 2 (cont.).

Bear No.	Wt. (kg)	Date	Immobilization Time (min.)	Drug and Dosage (mg/kg) Sernylan	Sparine	Method of Capture	Comments
B27A	---	9 June	11			Barrel trap	Down time questionable because he wasn't completely out
B34	99.8	16 Sept.	12	0.8	0.4	Barrel trap	Good dose
B35	65.8	9 June	6	1.2	0.3	Barrel trap	
B38	31.8	12 June	9	0.9	0.3	Barrel trap	Good dose
B38A	49.9	18 Sept.	8 13	0.8 0.8 0.4	0.2	Barrel trap	Final down time not recorded drug bottle already open
B39	45.4	21 Sept.	11 10	0.9 0.9	0.2	Barrel trap	
B41	20.4	5 June	5	1.5	0.5	Barrel trap	Well immobilized: thin bear
B41A	40.8	22 Sept.	9 13	0.7 0.7 0.2	0.2	Barrel trap	Bear lively when pulled out of trap, last 0.2 to make him handable
B42	19.5	9 June	5	1.5	0.5	Barrel trap	Good immobilization
B42A	36.3	24 Sept.	15 17	1.1 0.6	0.6	Barrel trap	May not have received full dose, first injection
B43	19.5	13 May	3	0.6		Helicopter	M99 drug, down time not recorded 0.4 mg
B44	20.0	13 May	26 44			Helicopter	M99 drug & M5050 0.7 mg M99 0.8 mg M5050
B45	14	13 May	9			Helicopter	M99 drug 0.3 mg
B46	22	13 May	37 27 19			Helicopter	No apparent effect, M99 drug 0.5 mg 0.6 M99, Mixed w/1cc pencillin No final down time
B47	59.0	14 Sept.	8	0.6	0.2	Barrel trap	
B47A	---	27 Sept.	7				Final down time not recorded

1/ The Sernylan used was outdated by . The drug appeared to be effective from vials opened for less than 3-4 days, after this period it has almost no visual affect on injected bears.

Table 3. Age and morphometric data for 15 black bears captured 19 times at the Moose Research Center Study Area, Kenai Peninsula, Alaska, 1981. Measurements are in centimeters.

Bear No.	Wt. (kg)	Age (years)	Total Length	Circumference		Hind Foot		Skull		Left Canine						Right Canine					
										Upper			Lower			Upper			Lower		
				Chest	Neck	Length	Width	Length	Width	L	A-P	L-L	L	A-P	L-L	L	A-P	L-L	L	A-P	L-L
B1	136		156	90	47	16.8	8.8	27.2	10.1							2.6	1.6	1.1	2.4	1.5	1.1
B2	137	6	158	85	48	17.3	9.2	26.5	16.0	2.9	.7	1.0	2.3	1.5	1.4	R or L want't circled - unknown side					
B2A	200	6	155	102	56	17	8.5	26.9	16.2	2.7	1.8	1	2.5	1.8	1						
B10	---	12	194	109	65	22.0	13.0	29.6	20	2.9	1.8	1.3	2.5	1.7	1.2	R or L wasn't circled - unknown side					
B11	227	11	179	104	65	19.8	11.5	26.4	18.2	3.1	2.1	1.3	2.5	2.1	1.2						
B12	190	6	166	98	43	17.7	8.2	25.4	15.7							2.7	1.4	1.2	2.2	1.3	.9
B14	120	5	162	84	46	16.8	8.0	25.6	16.0	2.5	1.6	1.1	2.2	1.5	1.0						
B15	123	5	155	74	42	16.5	9.2	25.3	15.0							2.5	1.5	1.2	2.2	1.5	1.0
B24	133	12	151	84	52	16.8	9.2	25.4	15.4							2.7	1.5	1.0	2.3	1.5	1.0
B27	155	4	129	83	55	19.5	10.3	26.1	16.2	2.7	1.6	1.2	2.6	1.6	1.1	R or L wasn't circled - unknown side					
B34	220	4	154	99	57	20.0	10.0	28.5	16.8	2.9	1.8	1.2	2.6	1.8	1.1						
B35	145	7	164	98	53	17.5	10.0	23.6	15.0							2.4	1.5	1.2	2.1	1.3	1.0
B38	70	2	123	63	37	10.2	7.8	22.2	13.2							2.4	1.3	1.0	2.0	1.2	.9
B38A	110	2	135	94	43	14.0	11.5	22.3	14.1	2.5	1.5	1.1	2.2	1.2	.8						
B39	100	2	138	74	39	15.7	8.5	23.3	13.5							2.7	1.8	1.0	2.6	1.4	1.1
B41	45	1	111	54	33	13.0	7.5	17.6	11.2							1.6	1.0	.8	1.5	.8	.8
B41A	90	1	123	73	36	15.2	8.2	22.1	12.4							2.6	1.4	1.4	2.4	1.1	1.0
B42	43	1	113	61	31	13.5	7.0	18.6	10.8							1.4	.9	.7	1.2	.6	.6
B42A	80	1	124	68	40	15.0	7.0	22.0	12.0	2.2	1.4	.9	2.4	1.3	.9						
B43	19.5	1	94	--	27	7.7	5.7	16.5	9.8	1.3			1.3								
B44	20	1	81	44	25	11.5	6	17	9.9												
B45	14	1																			
B46	22	1																			
B47	130	2	145.0	84	44.0	18.1	9.2	22.4	14.4	2.8	1.5	1.1	2.1	1.5	1.0						

Table 4. Black bear blood chemical data collected from September 1980 to June 1981 on the Kenai Peninsula, Alaska.

Bear Number	Date	Age (mo.)	Sex	Glu-cose mg/dl	Trigly-ceride mg/dl	LDH U/L	SGOT U/L	SGPT U/L	Alkaline Phos-phatase mg/dl	P mg/dl	Ca mg/dl	Ca/P ratio	Na mE8/L	K mE8/L	Cl mE8/L	CO_2 mE8/L	BUN mg/dl	Creat. mg/dl	Bili-rubin mg/dl	Uric Acid mg/dl
B1	6/21/81	88	F	93	396	989	465	144	60	4.8	9.1	1.90	137	04	100	21	34	1.0	.1	1.8
B2	6/8/81	76	F	101	634	581	93	118	91	4.8	9.2	1.92	139	05	102	22	12	.9	.1	1.4
B2	9/12/81	79	F	96	226	996	-	-	17	4.3	8.2	0.08	147	05	98	20	15	1.2	0.0	1.8
B10	5/13/81	148	M	85	383	897	151	36	45	7.5	10.4	1.39	142	04	102	05	9	1.4	.1	3.0
B11	6/8/81	136	M	120	181	706	118	53	115	3.9	8.9	2.28	141	05	106	20	11	1.0	.1	1.5
B12	9/18/81	79	F	131	296	406	45	67	24	5.3	8.5	1.60	150	04	105	22	33	1.1	0.1	1.3
B15	6/11/81	64	F	98	226	589	77	36	80	4.6	8.7	1.89	143	05	109	16	22	.9	.1	1.4
B24	6/13/81	148	F	77	249	812	108	51	79	4.3	7.8	1.81	144	05	110	16	21	1.0	.1	1.4
B27	6/5/81	52	M	53	412	989	163	108	55	6.2	9.5	1.53	146	05	105	19	24	1.2	0.0	1.7
B34	9/16/81	57	M	105	342	417	55	29	61	4.2	9.1	2.17	143	04	103	15	22	1.6	0.0	1.3
B35	6/9/81	90	F	90	456	989	260	109	76	5.9	10.0	1.69	145	04	107	16	31	0.9	0.1	1.5
B38	6/12/81	28	F	96	239	593	48	29	69	5.7	9.5	1.67	137	05	105	17	07	.8	.1	1.8
B38	9/18/81	33	F	100	154	553	81	62	48	4.8	8.4	1.75	147	05	106	18	06	1.1	0.1	1.1
B39	9/21/81	33	M	166	211	553	90	59	61	3.9	7.7	1.97	146	04	107	19	36	1.9	0.1	0.9
B41	9/30/80	7	M	71	286	508	68	38	80	5.4	7.9	1.96	146	04	104	12	33	.9	0.0	1.2
B41	6/5/81	15	M	32	379	890	110	141	126	8.3	10.1	1.22	146	05	106	15	09	.6	.2	2.2
B41	9/22/81	18	M	106	213	601	51	32	34	4.7	9.3	1.98	144	05	104	16	21	1.1	0.1	1.4
B42	10/1/80	8	F	79	285	440	52	621	84	6.4	9.5	1.48	141	04	102	12	30	.7	.1	1.4
B42	6/9/81	15	F	81	268	853	111	52	138	7.5	9.8	1.31	143	04	107	16	21	.7	0.0	1.7
B42	9/24/81	18	F	005	247	695	104	82	72	5.5	6.5	1.18	151	05	101	18	46	1.5	0.1	6.6
B44	5/13/81	15	F	143	117	940	194	100	58	6.9	9.2	1.33	140	06	103	15	12	1.2	.1	2.5
B45	5/13/81	15	M	126	92	963	191	27	30	4.4	9.0	2.05	137	05	104	11	16	1.0	.1	1.7
B46	5/13/81	15	F	88	113	926	152	19	42	4.7	9.1	1.94	136	05	105	10	14	1.2	.1	1.4
B47	9/14/81	33	M	120	290	643	76	97	69	5.6	9.2	1.64	147	04	105	22	22	1.1	0.1	1.5

Table 5. Black bear blood protein, electrophoresis and hematologic data collected from September 1980 to September 1981.

Bear Number	Date	Age (mo.)	Sex	Total Protein g/dl	Albumin g/dl	Globulin g/dl	Alpha 1 g/dl	Alpha 2 g/dl	Beta g/dl	Gamma g/dl	A/G ratio	Hb g/dl	PCV %
B1	6/21/81	88	F	7.6	4.6	3.0	0.2	0.6	0.8	1.4	1.53	15	39
B2	6/8/81	76	F	6.5	3.7	2.8	0.5	0.6	0.7	1.1	1.30	18	43
B2	9/17/81	79	F	9.2	4.2	5.0	0.7	1.0	2.5	0.8	0.84	28	52
B10	5/13/81	148	M	7.3	3.3	4.0	0.7	0.6	0.8	1.8	0.83	18	44
B11	6/8/81	136	M	7.8	4.3	3.5	0.4	0.6	0.8	1.7	1.21	16	40
B12	9/18/81	79	F									2.8	53
B15	6/11/81	64	F	6.7	4.1	2.6	0.5	0.8	0.7	0.6	1.60	18.2	43
B24	6/13/81	148	F	6.7	3.7	3.0	0.4	1.0	0.8	0.8	1.25	15.0	36
B27	6/5/81	52	M	6.6	4.3	2.3	0.4	0.7	0.7	0.7	1.85	16.5	34
B34	9/16/82	57	M	6.6	3.6	3.0	0.6	0.8	0.9	0.7	1.22	19.5	48
B35	6/9/81	90	F	7.2	4.2	3.0	0.5	0.7	0.8	0.9	1.40	16.8	42
B38	6/12/81	28	F	5.7	4.1	1.6	0.5	0.3	0.6	0.2	2.58	17.0	41
B38	9/18/81	33	F	6.0	3.7	2.3	0.7	0.5	0.6	0.6	1.55	22	47
B39	9/21/81	33	F	5.9	3.5	2.4	0.6	0.2	0.7	0.9	1.50	18	45
B41	9/30/80	7	M	6.1	4.2	1.9	0.1	0.6	0.7	0.6	2.16	--	--
B41	6/5/81	15	M	5.8	4.0	1.8	0.4	0.5	0.6	0.2	2.23	17.0	37
B41	9/22/81	18	M	6.1	4.0	2.1	0.5	0.5	0.7	0.4	1.97	19.8	47
B42	10/1/80	8	F	6.3	3.9	2.4	0.6	0.8	0.8	0.3	1.60	16.0	39
B42	9/24/81	18	F	6.6	4.3	2.3	0.5	0.7	0.7	0.4	1.81	22.0	46
B44	5/13/81	15	F	5.3	3.2	2.1	0.6	0.3	0.7	0.5	1.54	16.8	33
B45	5/13/81	15	M	5.2	3.3	1.9	0.6	0.0	0.7	0.6	1.78	10.5	27
B46	5/13/81	15	F	5.8	3.8	2.0	0.6	0.0	0.7	0.7	1.83	12.2	28
B47	9/14/81	33	M	5.8	3.6	2.2	0.7	0.3	0.7	0.6	1.62	20	48

Current Status, Movements, and Home Range

We are currently monitoring 20 black bears (Table 6). We recaptured B1 during routine trapping operations in June 1981. She was sighted in early May in Pen 1 with 2 yearlings. Although her radio was dead at this time, all other radio-collared female bears had been observed during that tracking flight and she was the only possible collared bear who could have been in the area. We, therefore, know she produced 2 cubs in 1980 and successfully kept them until spring 1981. We searched for her from a helicopter at that time, but were unable to locate her. We did locate her winter den.

We lost contact with adult male B9 in May 1981; premature radio failure was suspected. Bears B17, B19, B31, and B40 were all taken by hunters during 1981. Yearlings B43 and B45 were both killed during routine darting in spring 1981. Both bears were in very poor condition (wt. 8.9 and 6.1 kg for B43 and B45, respectively) indicating poor weight gains the previous fall and/or excessive weight loss through the 1980-1981 winter. Their poor condition coupled with poor quality drugs (see drugging section) probably caused the mortalities. The twin of B43, B44 and the twin of B45, B46 both died (Table 6) within 1-2 months of being radio-collared on May 13, 1981. The carcasses of both bears were intact when located eliminating the possibility of predation by another black bear. The humerus of B44 was fractured, with no indication of healing. This bear was darted in the rump when immobilized in May, and showed no indications of a broken leg during routine processing. She stayed with her mother (B14) for 2 weeks following immobilization and then remained alone until found dead on 14 July 1981. Although we could not determine cause of death, we suspect that B44 died of natural causes, probably starvation associated with a fractured leg. Normal weights during this season for yearlings should range between 13 and 16 kg; B44 weighed 8.9 kg and was quite thin. The cause of death of B46 was probably a delayed reaction due to the immobilization, or natural mortality caused by starvation. B46 was also in extremely poor physical condition when immobilized (wt. 6.1 kg.). Our suspicions about starvation in B44 and B46 were developed because: (1) winter 1980-81 was probably energetically expensive to denning bears. That winter was marked by little snowfall, heavy rainfall and little snow accumulation. Lack of snow coupled with moist conditions results in bear dens being exposed to ambient temperatures as opposed to being protected by the usual 0.5-1 m of snow. This exposure would result in colder temperatures in the den chamber. Another factor contributing to the potential starvation of these bears was the lack of early spring food, namely lowbush cranberry (Vaccinium vitis-idaea). During a "normal winter," the berries of lowbush cranberry remain on the plants, protected by a blanket of snow. Because of the lack of snow cover, these berries did not remain on the plant and were subsequently unavailable. The lack of snow during the winter has an obvious adverse effect on the bears and was reflected in their weights.

During the 1981 field season, 25 radio-collared black bears were

Table 6. Aerial tracking data for 1981 and current status of all black bears captured at the Moose Research Center study area, 1977-1981.

Bear Number	Sex	Times Located 1981	Last Observed	Current Status
B1	F	10	27 Oct. 81	Active
B2	F	19	27 Oct. 81	Active
B3	M	--	22 Aug. 78	Status unknown
B4	M	--	2 May 78	Dead, drug overdose, 78
B5	M	--	3 Oct. 78	Status unknown
B6	M	--	23 June 78	Dead, hunter kill, 1 Sept. 78
B7	F	--	9 May 78	Dead, drug overdose, 78
B8	M	--	1 May 79	Dead, natural causes 79
B9	M	6	7 May 81	Status unknown radio malfunction, May 81
B10	M	16	27 Oct. 81	Active
B11	M	17	27 Oct. 81	Active
B12	F	21	27 Oct. 81	Active
B13	F	--	26 Aug. 80	Dead, hunter kill, 4 Sept. 80
B14	F	21	27 Oct. 81	Active
B15	F	20	27 Oct. 81	Active
B16	M	20	27 Oct. 81	Active
B17	M	--	8 Nov. 78	Dead, hunter kill, 6 Sept. 81
B18	F	--	15 May 80	Status unknown
B19	M	--	21 Aug. 79	Dead, hunter kill, 16 Sept. 81
B20	F	18	27 Oct. 81	Active
B21	F	--	26 Aug. 80	Status unknown
B22	M	--	20 June 80	Status unk., assumed alive, ear tagged only
B23	F	--	14 Mar. 80	Status unknown, shed radio collar
B24	F	20	27 Oct. 81	Active
B25	M	15	22 Sept. 81	Assumed alive - radio frequency overlap w/B1
B26	M	--	26 June 79	Dead, hunter kill, 24 May 80
B27	M	8	27 Oct. 81	Active
B28	M	--	20 June 79	Dead, hunter kill, 18 May 80
B29	M	--	26 Aug. 80	Dead, hunter crippling loss
B30	F	--	26 Aug. 80	Dead, hunter kill, 3 Sept. 80
B31	F	--	7 Nov. 80	Dead, hunter kill, 20 May 81
B32	M	--	18 June 80	Dead, black bear predation
B33	M	1	15 Oct. 81	Active-not in study area-not radio-tracked
B34	M	4	27 Oct. 81	Active
B35	F	11	27 Oct. 81	Active
B36	F	--	28 May 80	Status unknown, radio collar
B37	M	--	17 Sept. 80	Status unknown, transmitter failed
B38	F	18	27 Oct. 81	Active
B39	M	9	27 Oct. 81	Active
B40	M	--	12 June 80	Dead, hunter kill, 20 May 81
B41	M	11	27 Oct. 81	Active
B42	F	11	27 Oct. 81	Active
B43	M	1	13 May 81	Dead, darting mortality 81
B44	F	1	14 July 81	Dead, unk. causes; may be natural mortality
B45	M	1	13 May 81	Dead, darting mortality 81
B46	F	1	11 June 81	Dead, unk. causes natural mortality
B47	M	2	27 Oct. 81	Active

relocated 282 times (Table 6). An additional 9 uncollared black bears were sighted in 1981, 6 were inside the study area. Two of these 6 bears were the yearlings of B1 discussed earlier. A 3rd bear was a juvenile male marked with pink ear tags in 1980 and was probably B22. A large bear with yellow ear tags and a nonfunctioning radio was sighted in the study area by Muskrat Lake. It was included in the unmarked category of bears but was probably B5 an adult male tagged in this area in 1978. There were no marks on the remaining 4 bears.

Analysis of home range data for female bears (age $\geq$1 yr) (Figs. 3-12) indicates that average home range was 15 $\pm$ 6 km^2 (Table 7). Average home range size (Table 8) for 5 adult male black bears was (59 $\pm$ 41 km^2) (Figs. 13-18) was much larger than for females. We also radio-tracked one yearling male (B41) before and after he separated from his mother (B15) in 1981. His home range was quite small (15 km^2) and was within the home range of his mother.

As in years past, all resident bears that were radio-collared, left the MRC study area in late July and early August and traveled to their "summer feeding areas" (Figs. 19 and 20). Most bears returned to the MRC area in late August. Lowbush cranberry was not abundant throughout the study area in 1981, but several local areas produced good berry crops. The lack of snow cover in 1980-81 caused severe winter-kill of most cranberry plants on exposed sites, particularly north slopes. This winter-kill resulted in almost no berry production in affected areas. The few places that did produce berries had an adequate crop and bears fed in these areas as evidenced from scat collections.

Population Density, Age Structure, and Reproductive Success

Our estimate of the 1981 population of black bears in the MRC study area was 0.3 $\pm$ 0.2 bears/mi^2 (0.8 $\pm$ 0.5 bears/ km^2) or 1 bear per 4 $\pm$ 2.6 mi^2 (11.5 $\pm$ 6.8 km^2). These estimates were obtained by calculating bear density in 6 1 mi^2 areas as described by Schwartz and Franzmann (1981) (Fig. 21; Table 9). These estimates probably underrepresent the real bear density because: (1) juvenile males within the study area were not included (B22, B27, B34, B40, B47); (2) we did not have radio contact with several resident adults all year (B9, B39, B1), thus precluding delineation of their home ranges; and (3) not all adult males using the MRC study area were radio-collared.

Age and sex data for radio-collared bears in the MRC study area (Table 10) are presented for years 1978-81. These data indicate no cubs born to females in the study area in 1981. Females B2, B12, B31 (all adults) should have had cubs in 1981 if an alternate year breeding cycle exists. The lack of cub production in 1981 was probably a result of poor fall food (Rogers 1977) and/or poor winter denning conditions previously discussed. All dens of the above-mentioned females were visited in spring 1981, and no dead cubs were found. If cubs were produced, they were either eaten by the females, or resorbed prior to parturition.

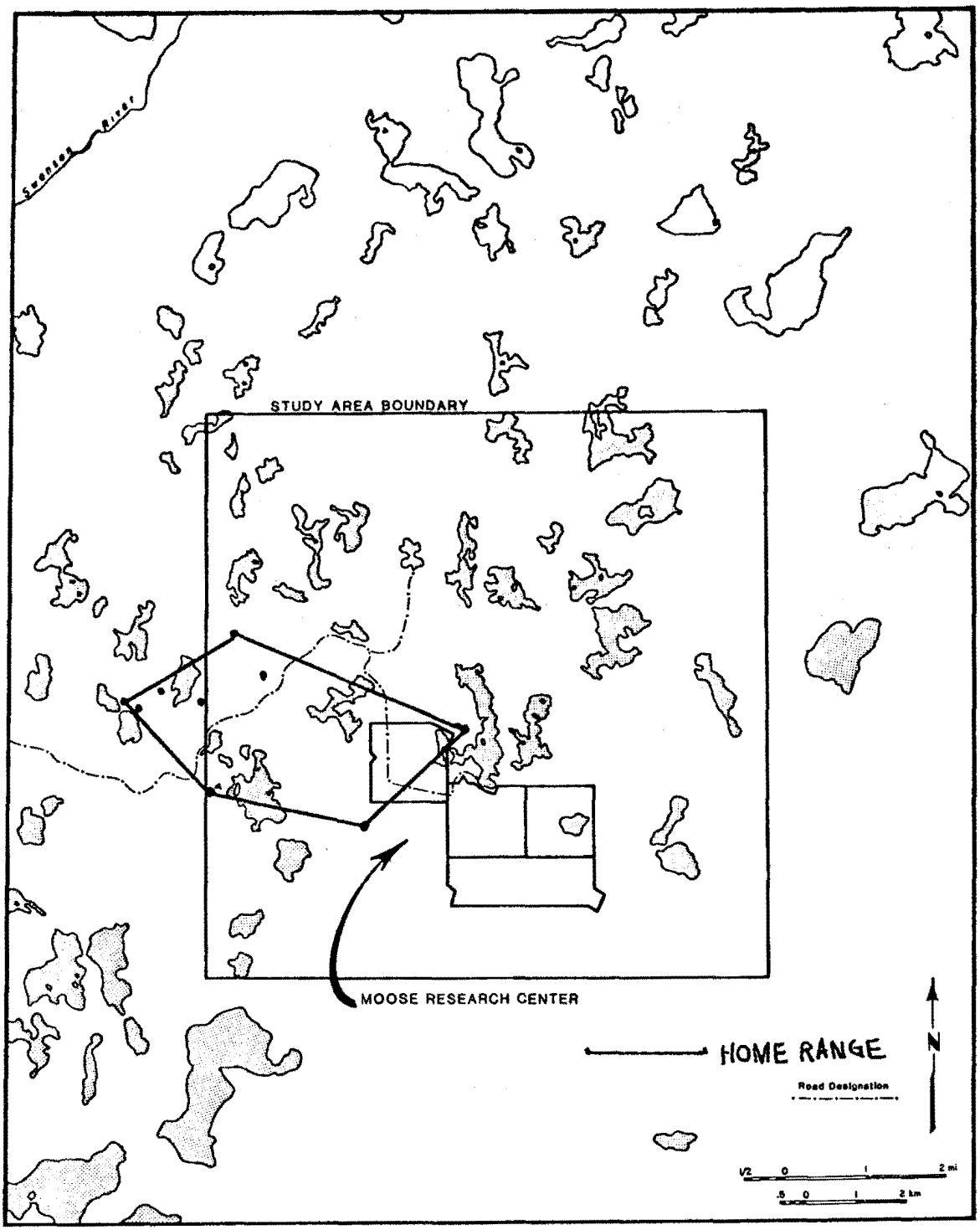

Fig. 3. Home range and movements of adult female B1 in 1981.

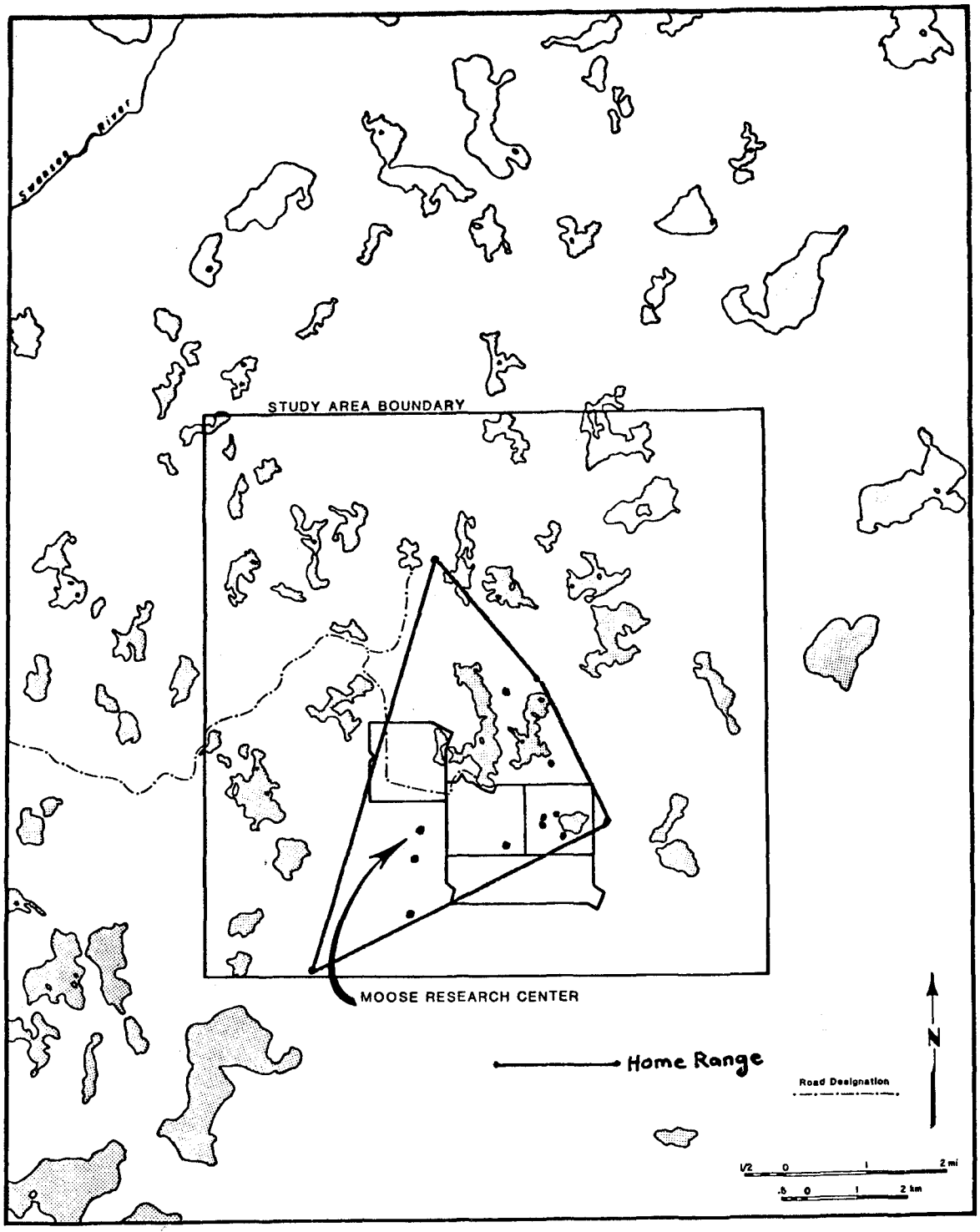

Fig. 4 Home range and movement of adult female B2 in 1981.

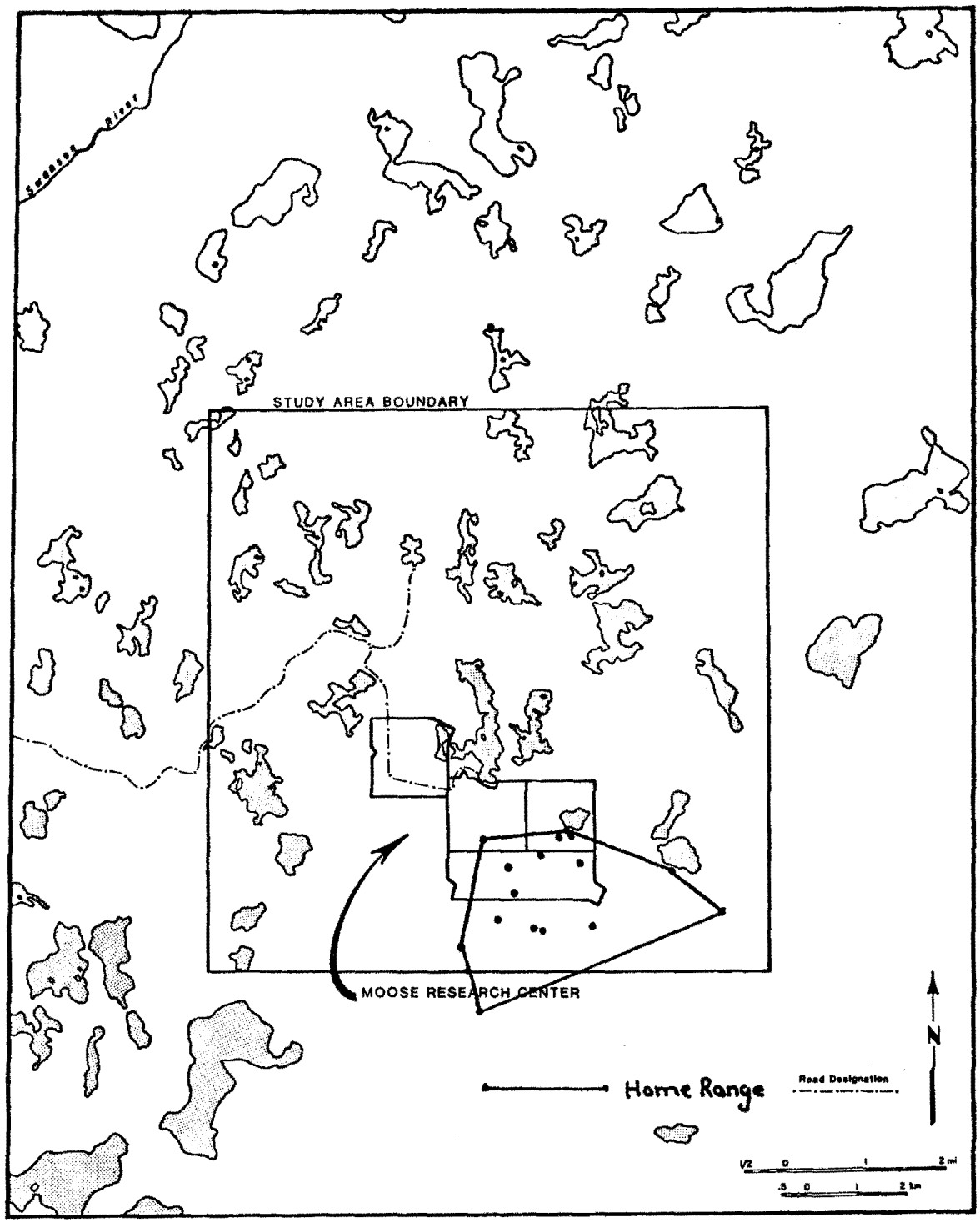

Fig. 5. Home range and movements of adult female B12 in 1981.

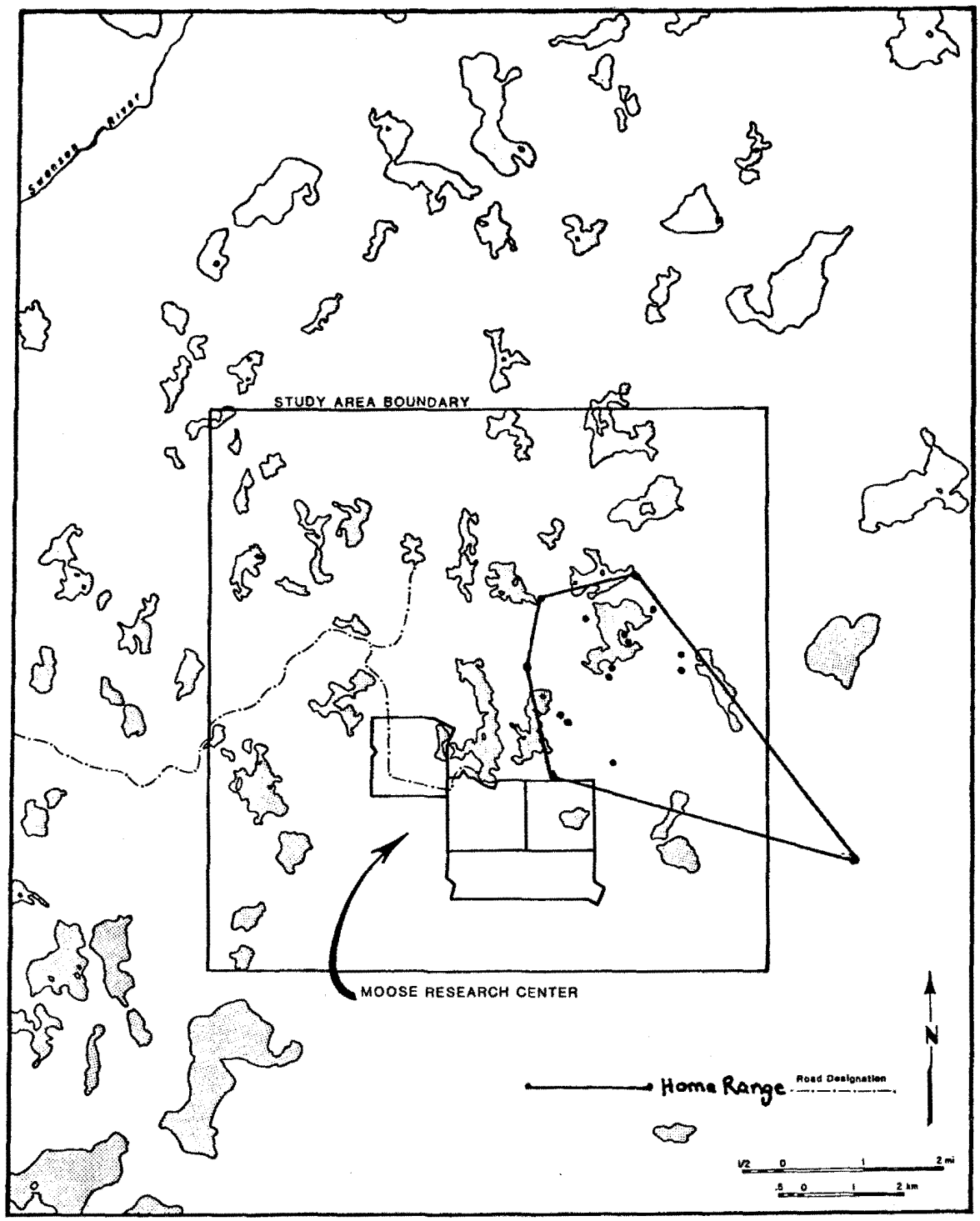

Fig. 6. Home range and movements of adult female B14 in 1981.

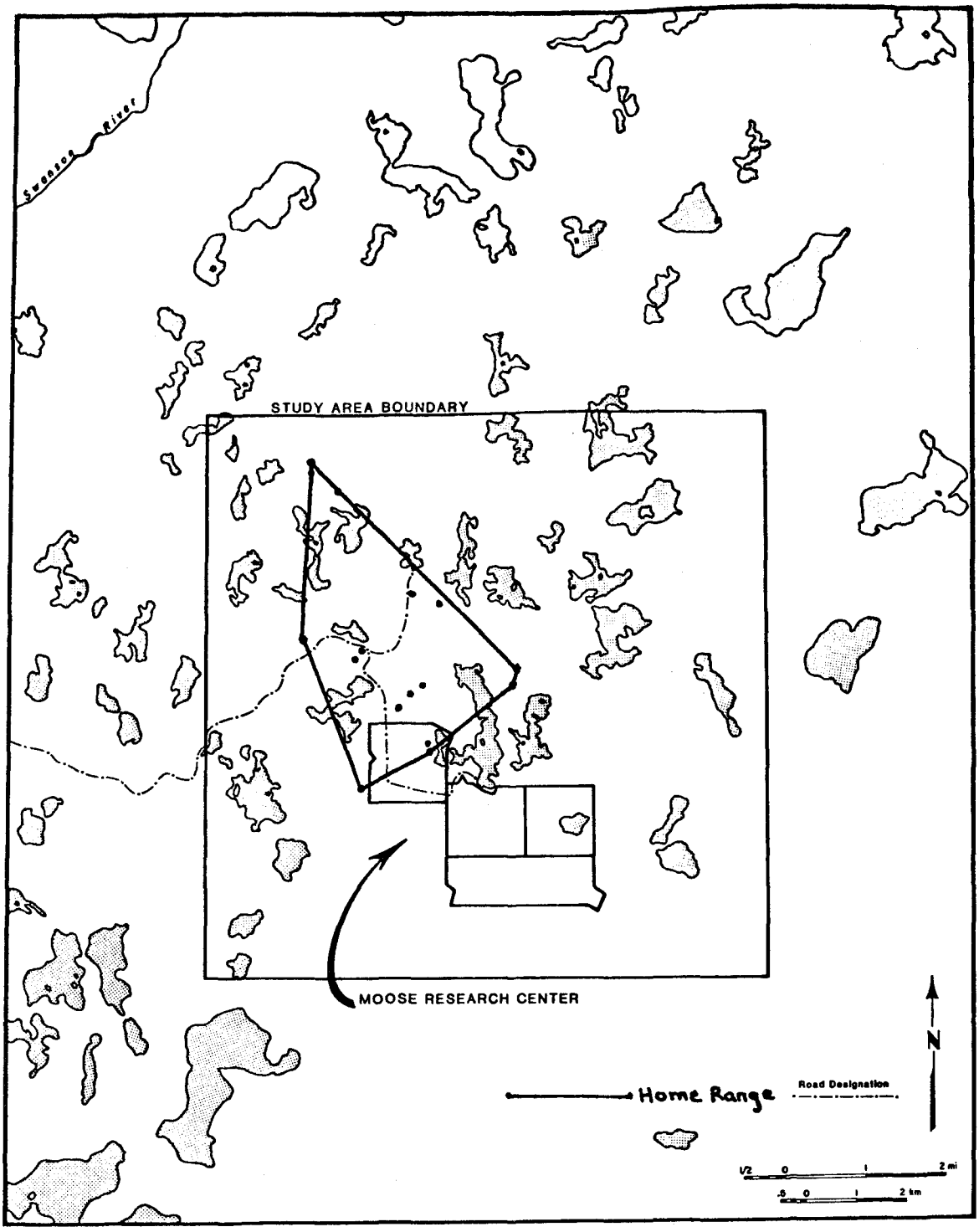

Fig. 7. Home range and movements of adult female B15 in 1981.

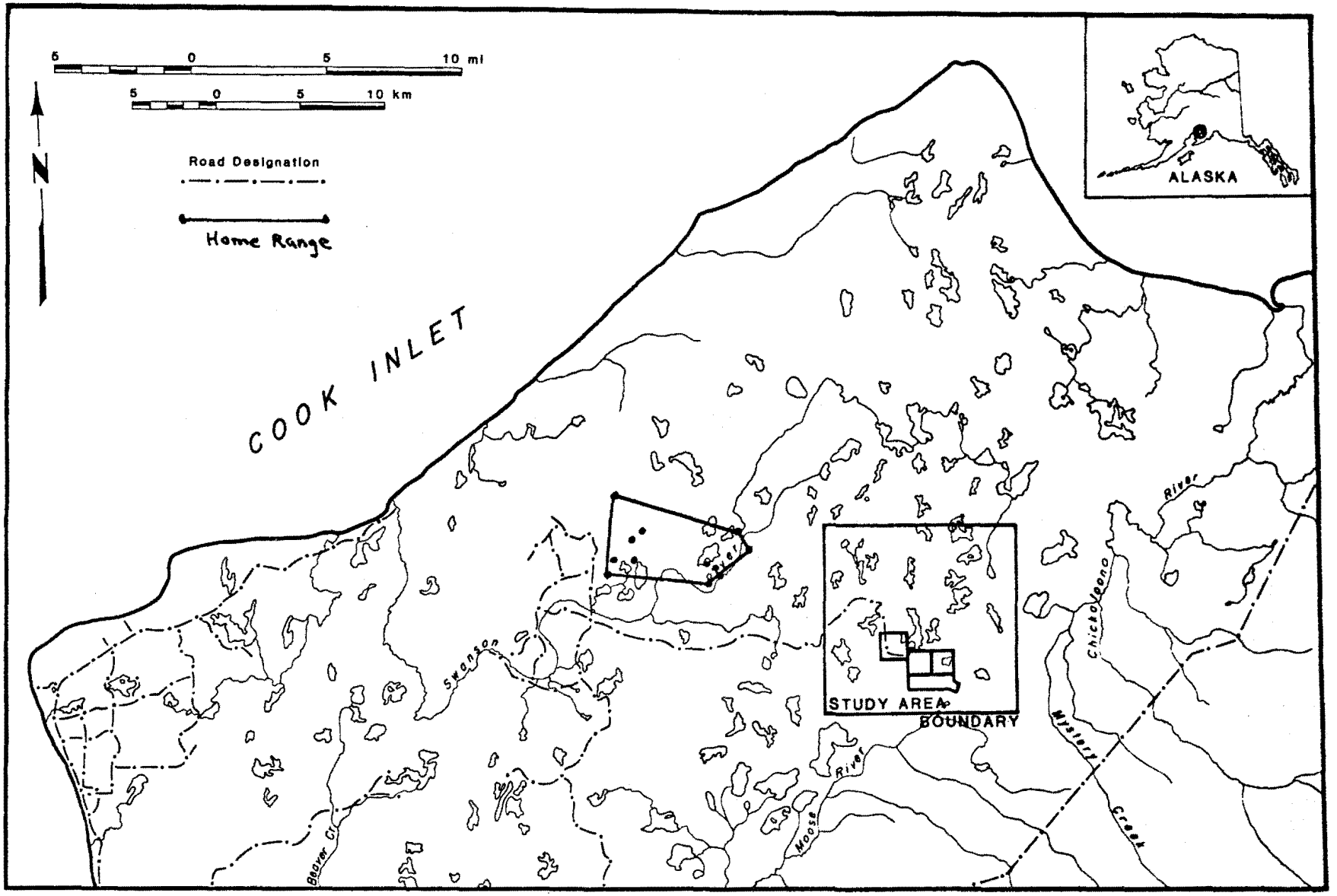

Fig. 8. Home range, movements and summer feeding area of adult female B20 in 1981.

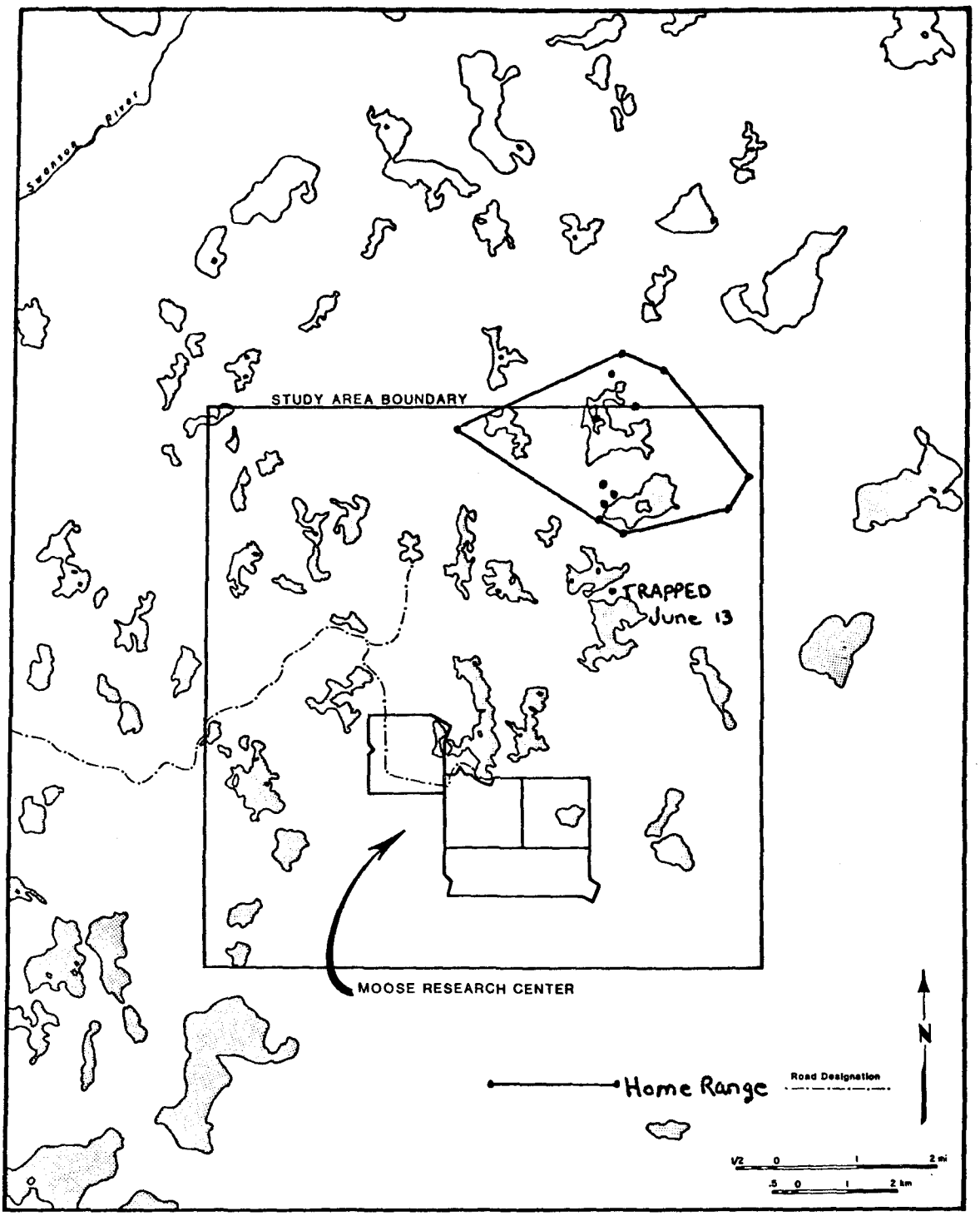

Fig. 9. Home range and movements of adult female B24 in 1981.

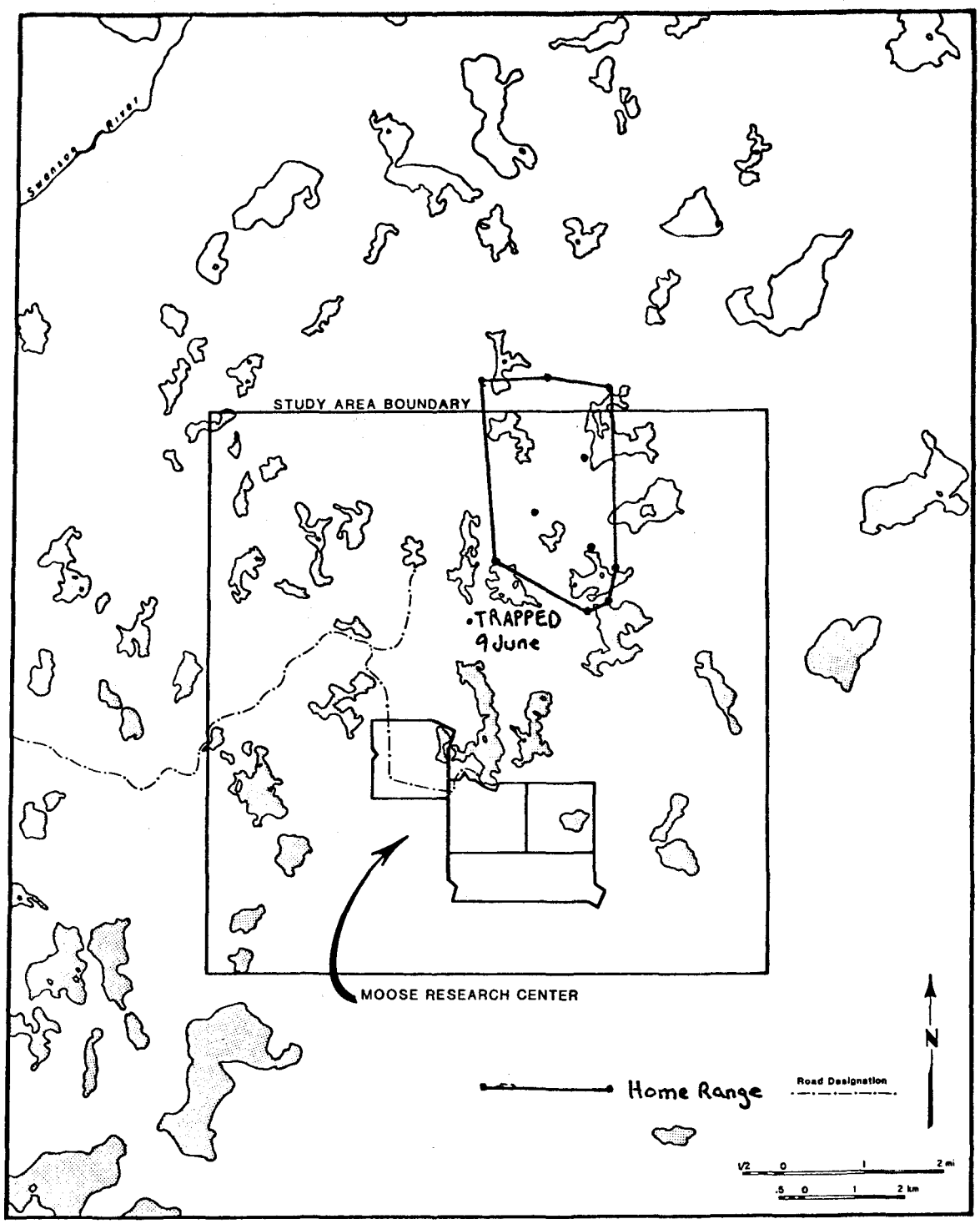

Fig. 10. Home range and movements of adult female B35 in 1981.

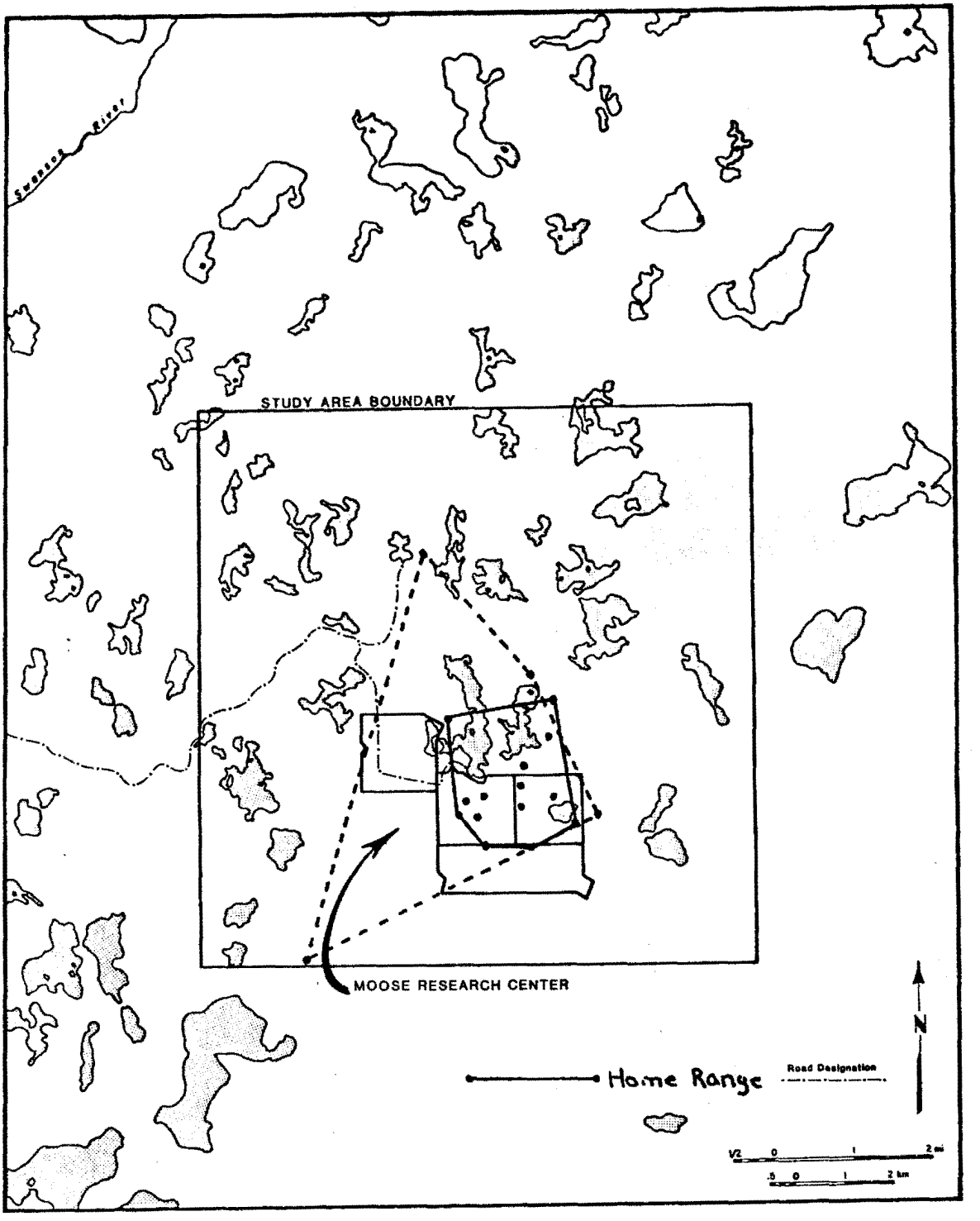

Fig. 11. Home range and movements of 2 year old female B38 in 1981. The dotted line represents her mother's (B2) home range in 1981.

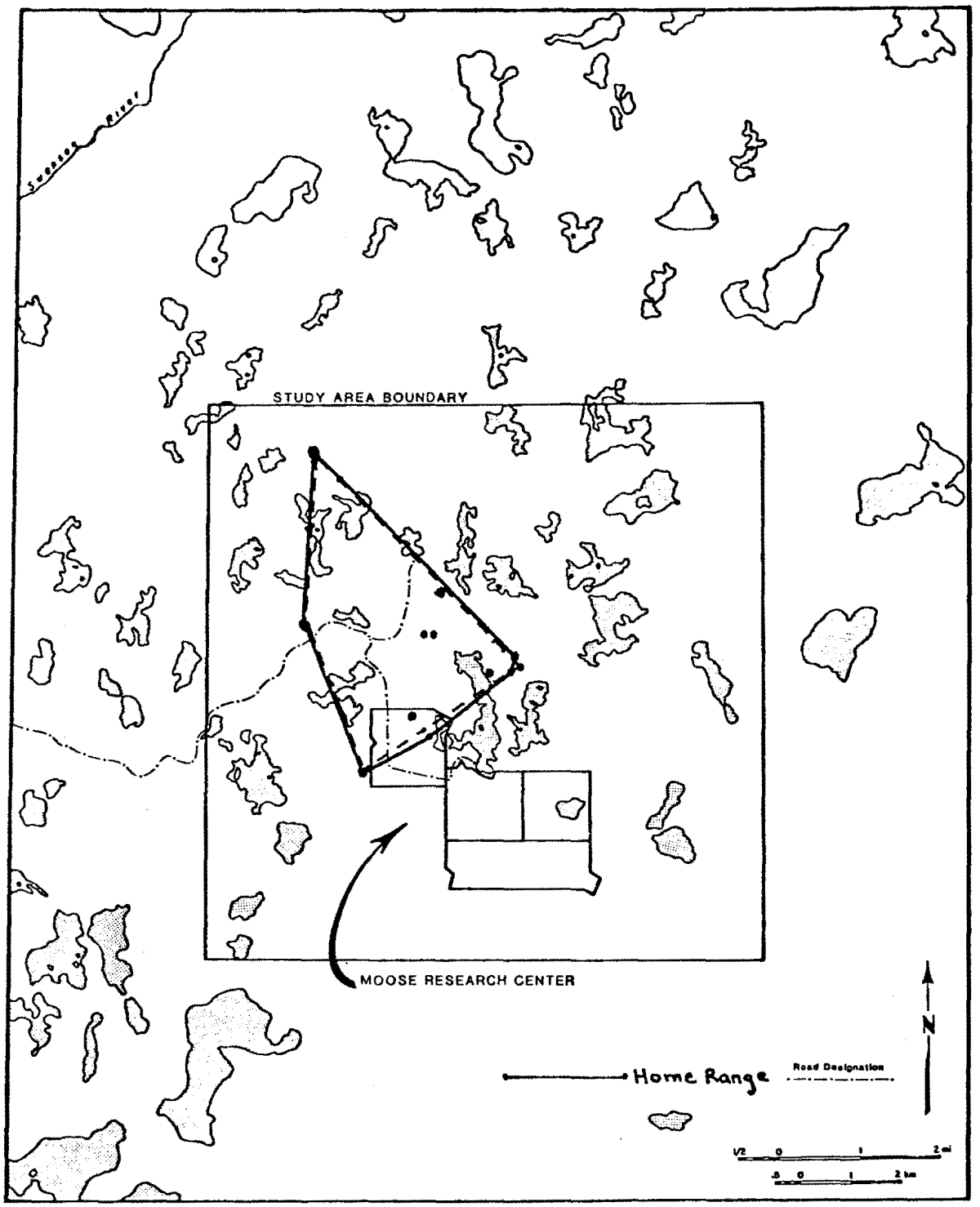

Fig. 12. Home range and movements of yearling female B42 in 1981. The solid line represents her mother's (B15) home range in 1981.

Table 7. Home range size and reproductive status for 10 female black bears in the Moose Research Center Study Area, 1981.

Bear No.	Age	Reproductive Status	Home Range Size (ha)
B1	7	2 yearlings	1453
B2	6	open	2123
B12	6	open	1133
B14	5	2 yearlings	1807
B15	5	2 yearlings	1647
B20	9 or 10	2 yearlings	2656
B24	12	2 yearlings	1197
B35	7 or 8	open	1019
B38	2	open	590
B42	1	open	1504

Table 8. Home range size and age of 6 male black bears in the Moose Research Center Study Area, 1980.

Bear No.	Age	Home Range Size mi 2/	km 2/
B10	12	44	114
B11	10 or 11	25	62
B16	10	21	55
B25	7	47	121
B27	4	21	55
B41	1	6	15

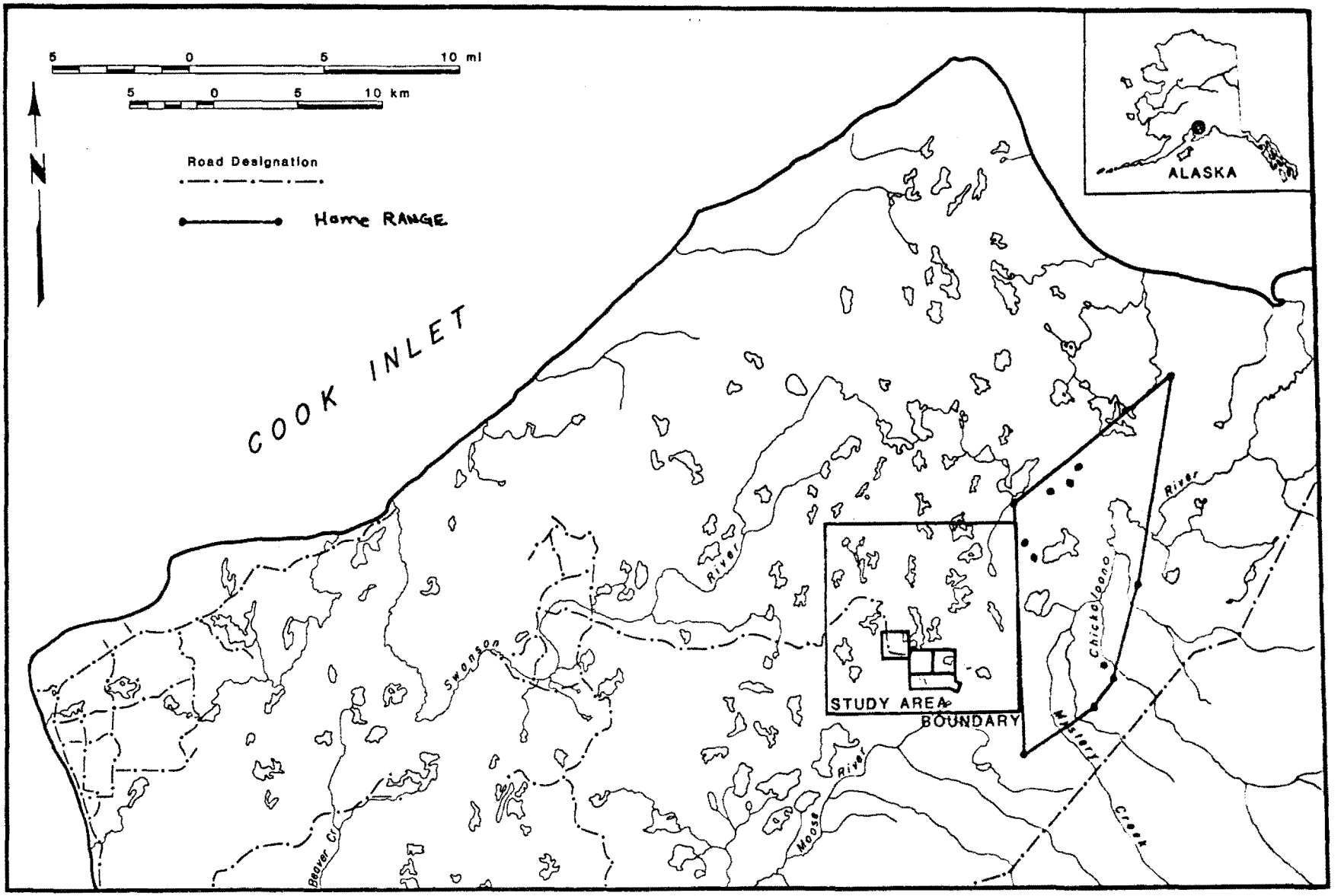

Fig. 13. Home range and movements of adult male B10 in 1981.

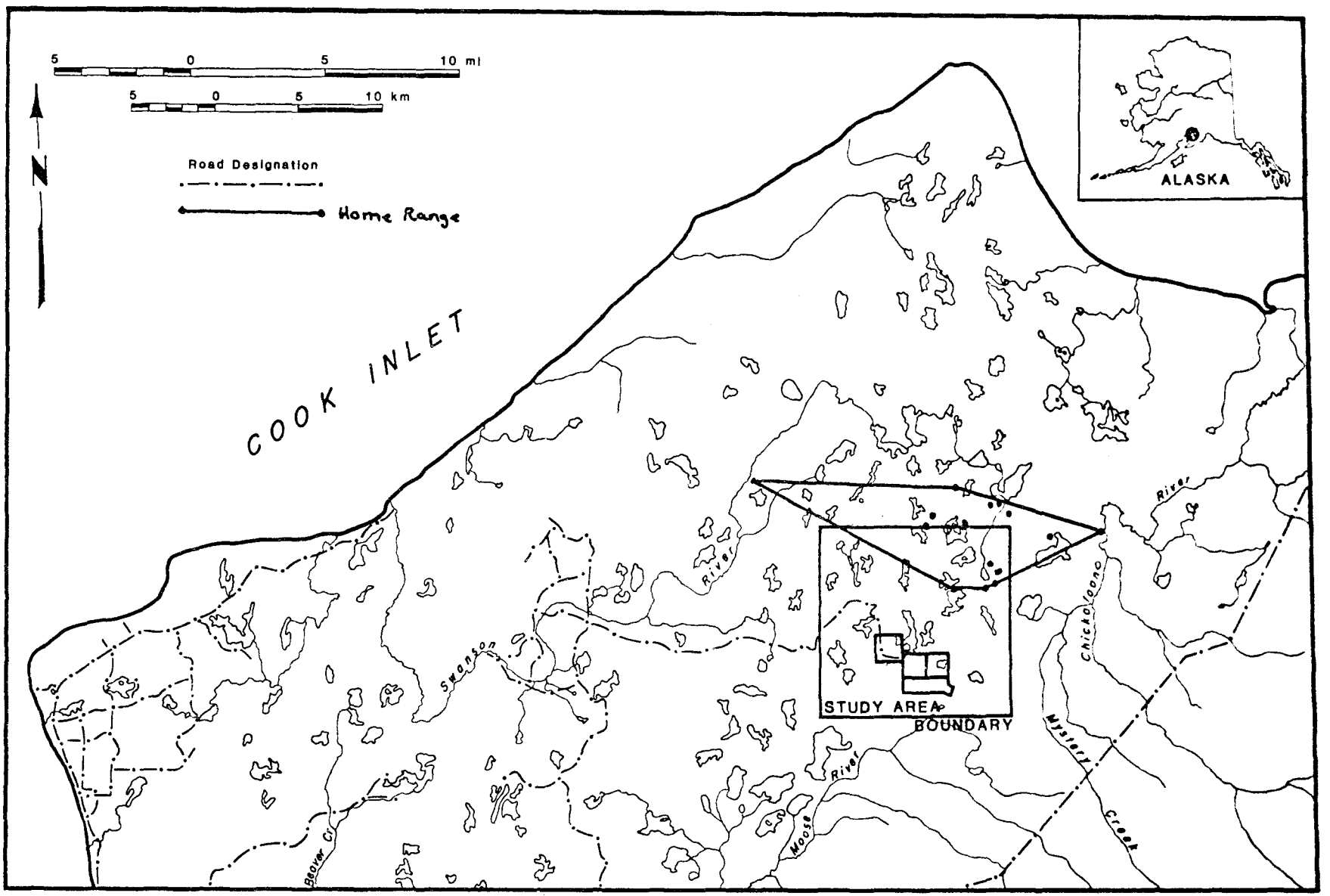

Fig. 14. Home range and movements of adult male B11 in 1981.

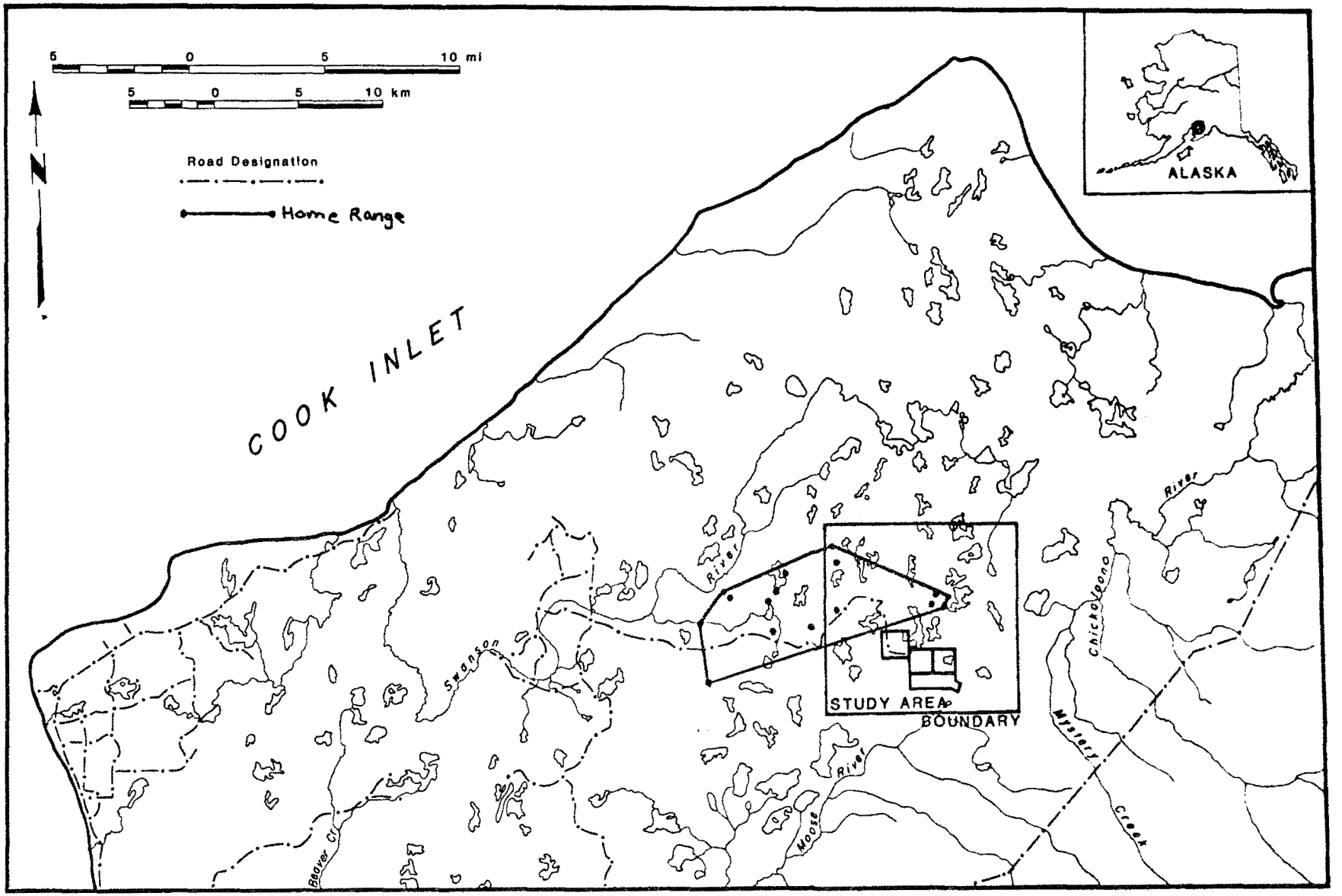

Fig. 15. Home range and movements of adult male B16 in 1981.

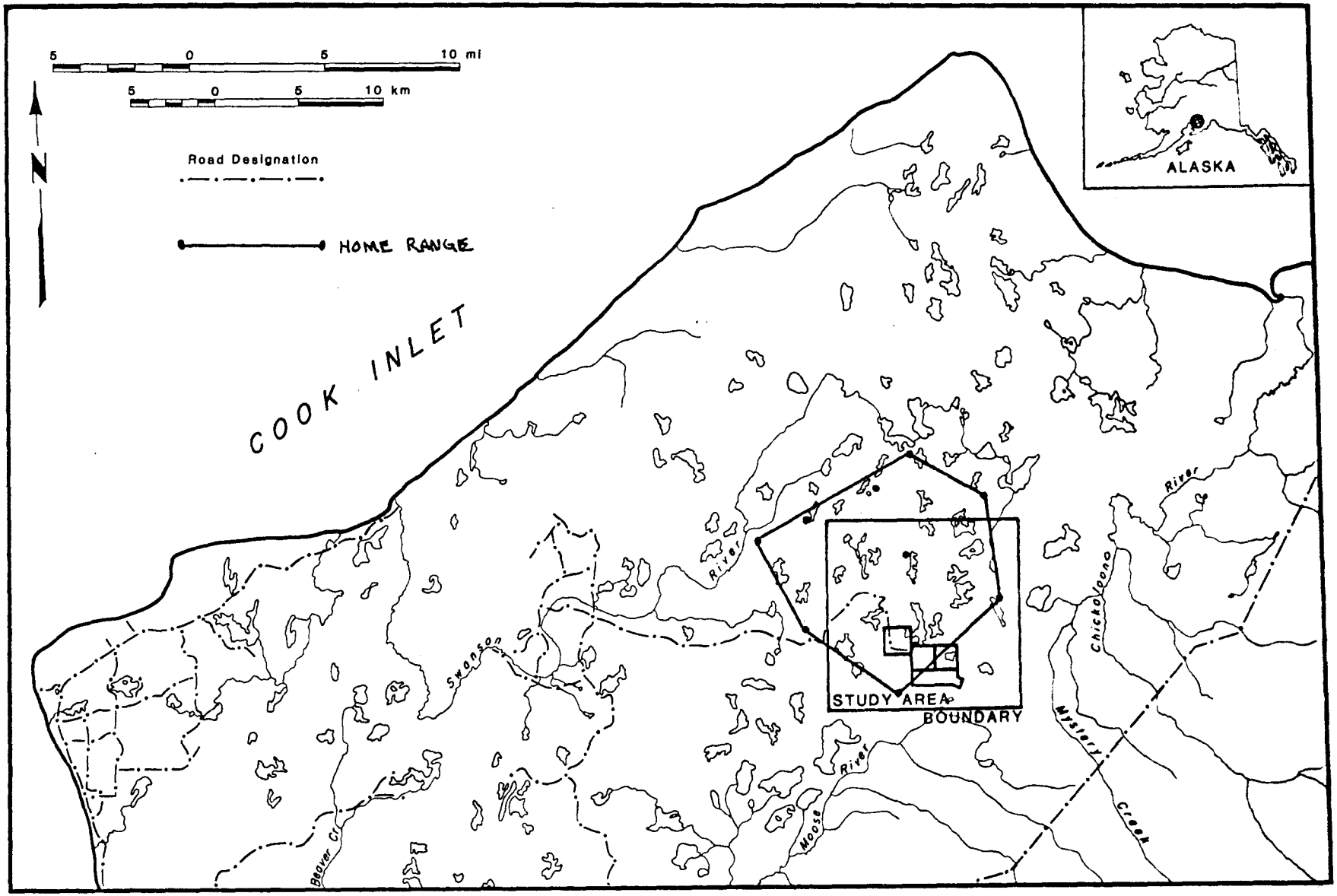

Fig. 16. Home range and movements of adult male B25 in 1981.

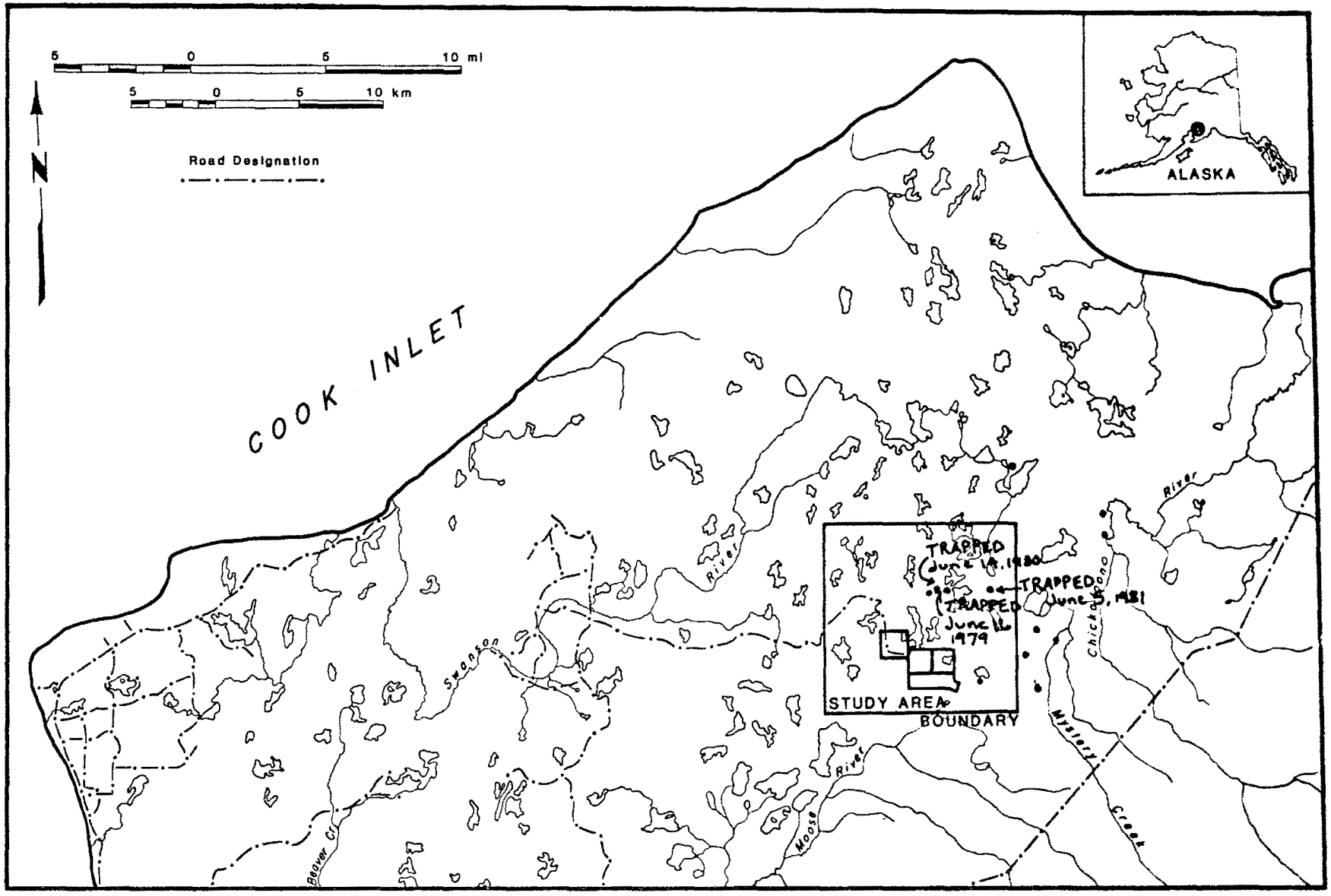

Fig. 17. The following points are movements of adult male B27 in 1981. Captured in 1979 and eartagged only. He was captured in 1980, and again in 1981 when he was radio-collared.

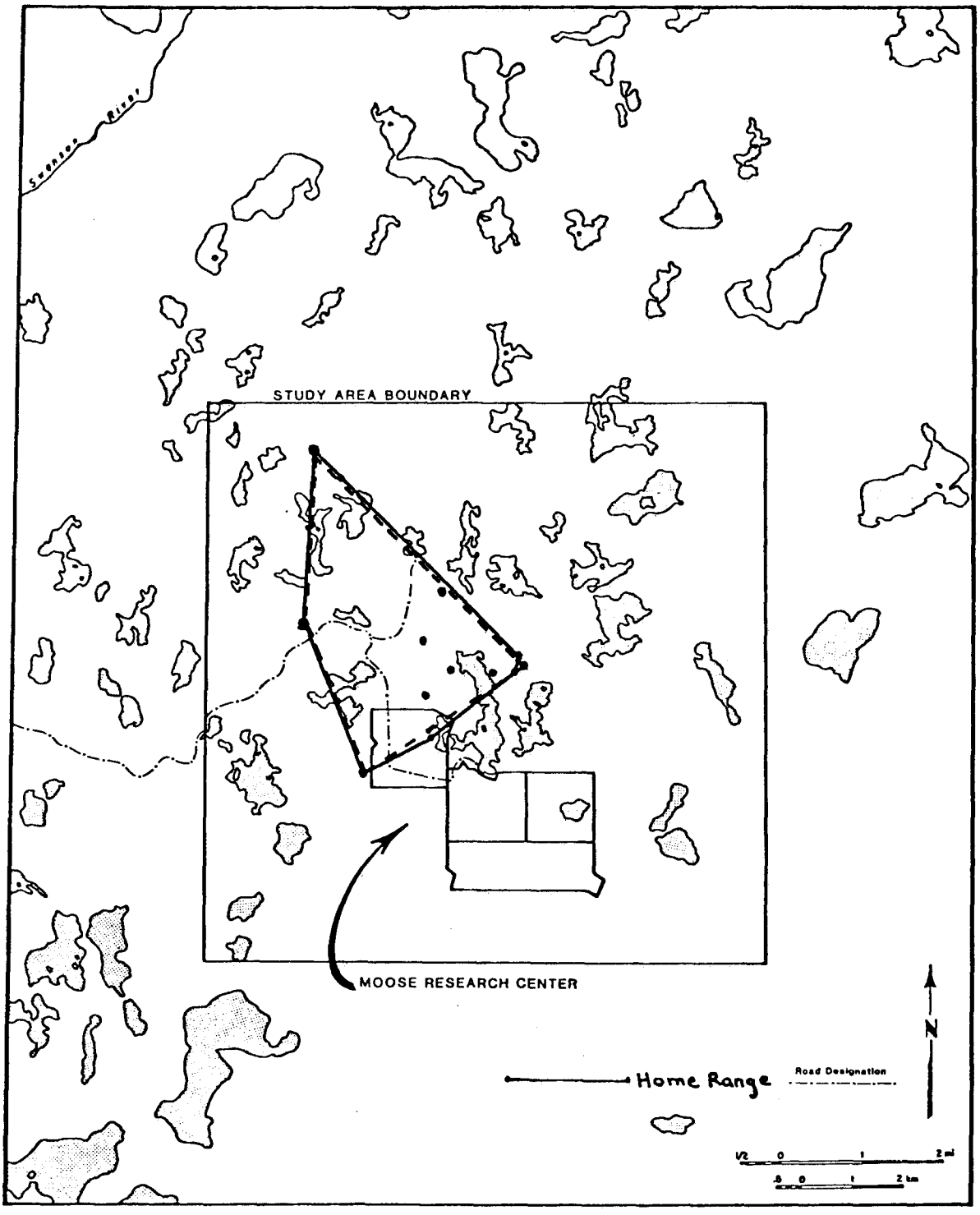

Fig. 18. Home range and movements of yearling male B41 in 1981. The solid line represents his mother's (B15) home range in 1981.

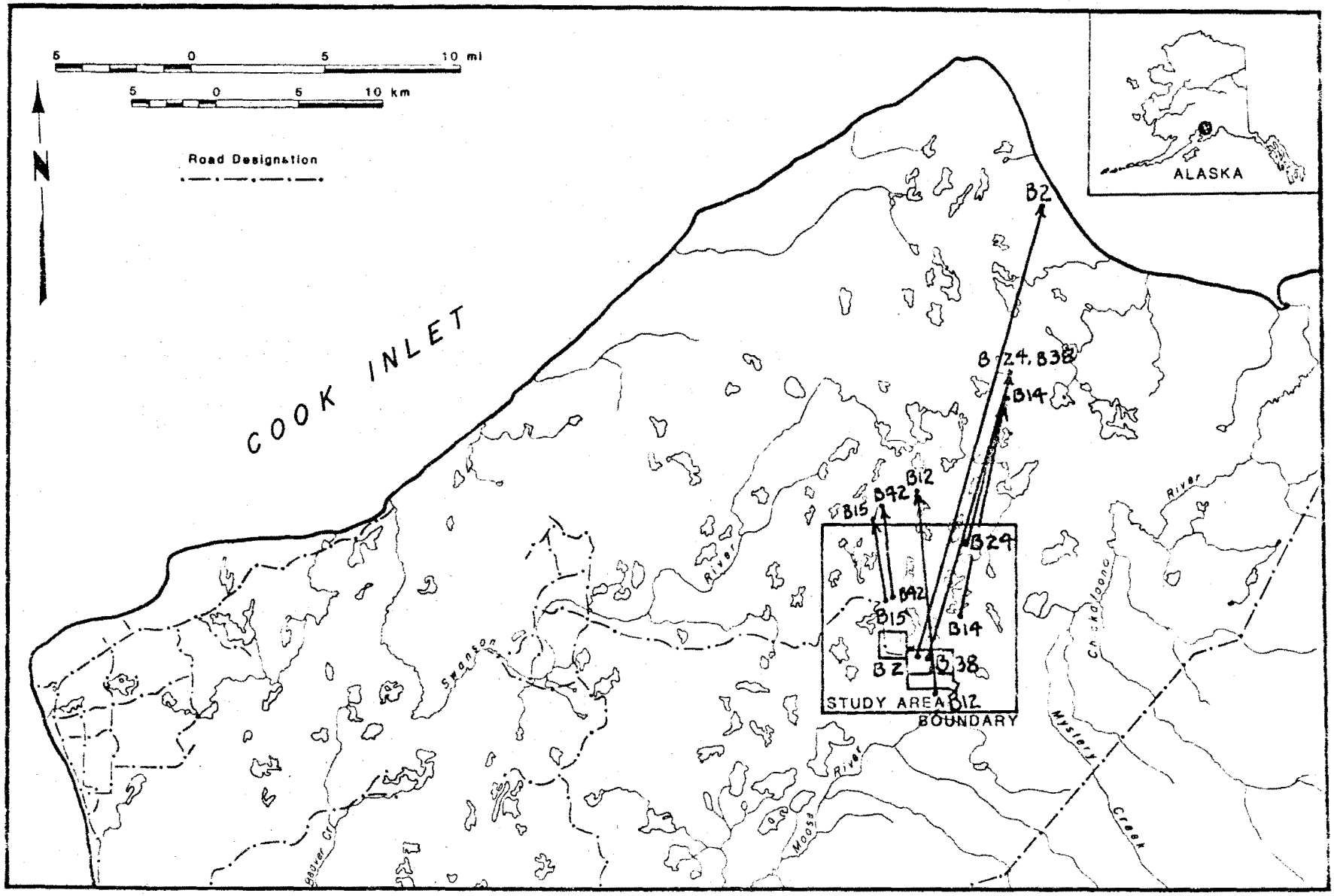

Fig. 19. Direction of movement and general location of summer feeding areas for resident female black bears in 1981.

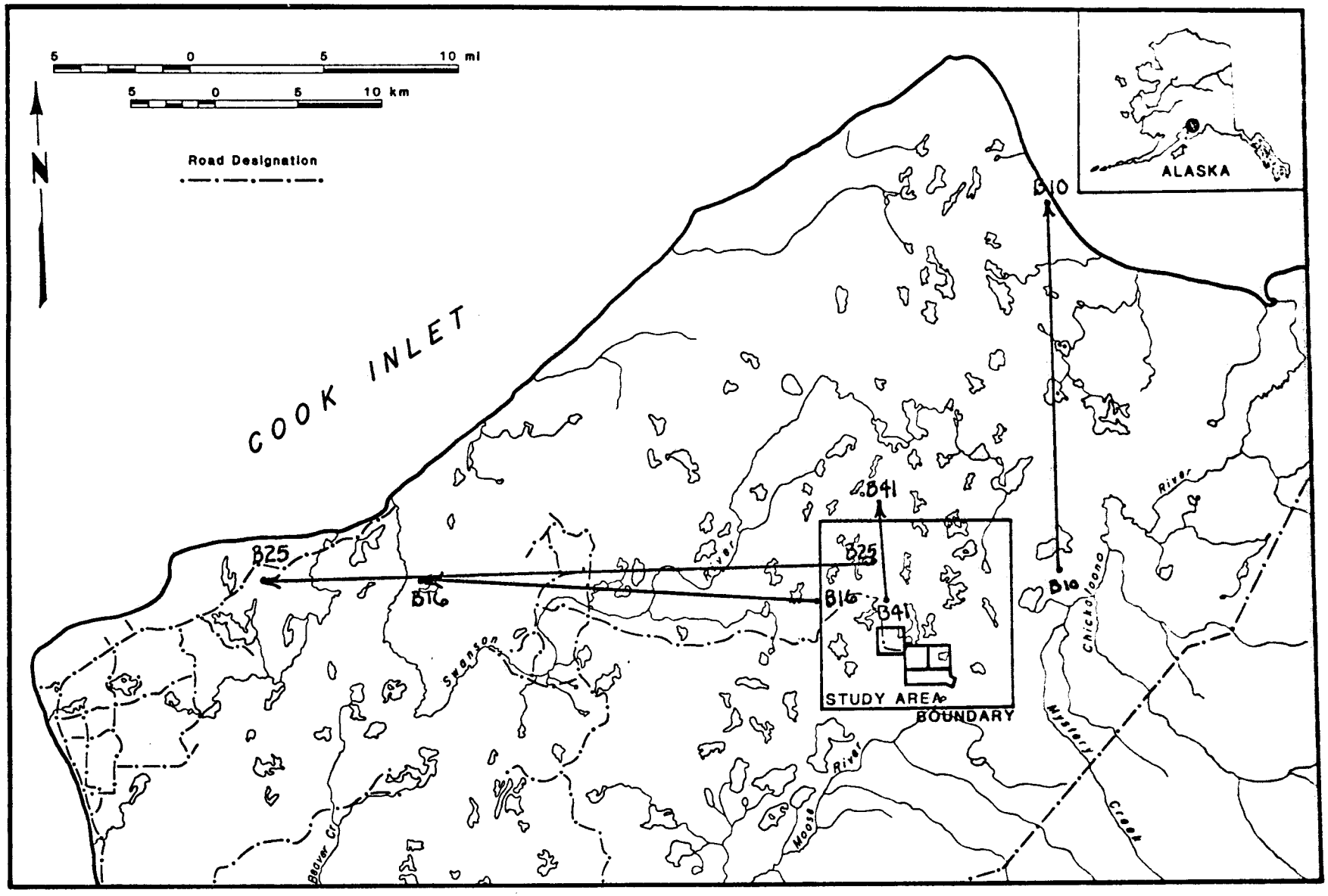

Fig. 20. Direction of movement and general location of summer feeding areas of resident male black bears in 1981.

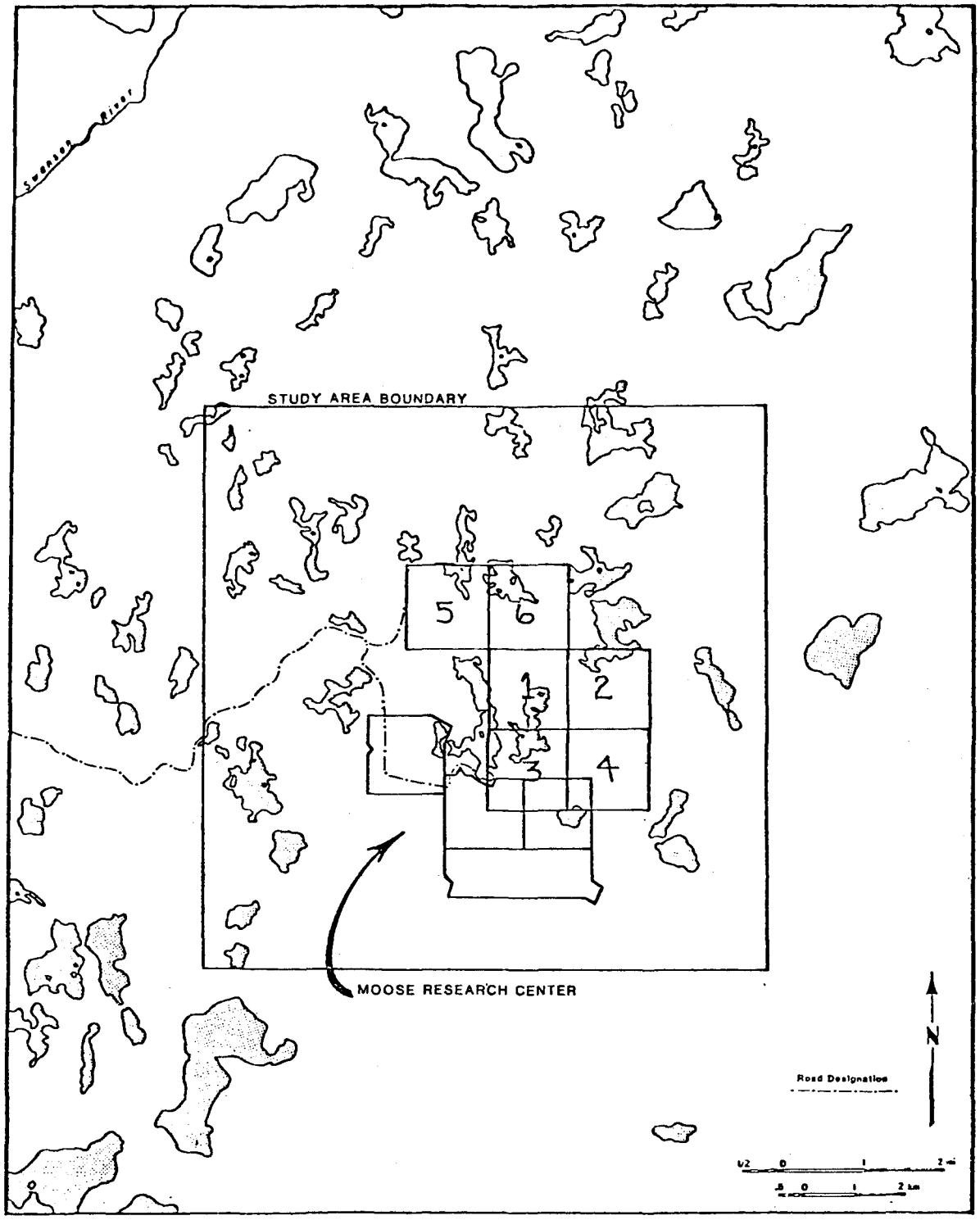

Fig. 21. Location of six 1 mi^2 areas used to estimate black bear density within the MRC study area in 1980.

Table 9. Individual black bear density estimates for six 1 mile^2 areas within the Moose Research Center study area in 1981.

Bear Number	Sex	1	2	3	4	5	6
B2	F	0.090	0	0.122	0.040	0.078	0.010
B14	F	0.067	0.143	0.022	0.108	0	0.039
B15	F	0.033	0	0	0	0.125	0.008
B16	M	0.003	0	0	0	0.043	0.023
B25	M	0.021	0.020	0.016	0.002	0.021	0.021
B35	F	0	0	0	0	0	0.019
B38	F	0.102	0	0.432	0.030	0	0
B41	M	0.015	0	0	0	0.105	0
B42	F	0.019	0	0	0	0.110	0
All females		0.301	0.143	0.577	0.178	0.313	0.076
All males		0.039	0.020	0.016	0.002	0.169	0.044
All bears		0.340	0.163	0.593	0.180	0.482	0.120
mi2/bear		2.94	6.13	1.69	5.56	2.07	8.33

Table 10. Age and sex of black bears in the MRC, Kenai Peninsula, Alaska, study area from 1978-1981. Data represents the number of radio-collared bears and their offspring.

Year	1978			1979			1980			1981			Total All Years			
Sex	M	F	UKS 1/	M	F	UKS	M	F	UKS	M	F	UKS	M	F	UKS	All
Age (yrs.)																
cubs	0	2	2	3	2	2	3	3	4	0	0	0	6	7	8	21
1	0	0	0	0	2	2	3	2	2	3	3	4	7	6	8	21
2	0	2	0	0	0	0	2	2	0	1	1	0	3	5	0	8
3	3	3	0	4	2	0	0	0	0	1	0	0	8	5	0	13
4	1	1	0	1	5	0	4	2	0	0	0	0	6	8	0	14
5	1	1	0	2	1	0	1	5	0	1	2	0	5	9	0	14
6	1	0	0	0	2	0	3	1	0	1	3	0	5	6	0	11
7	1	0	0	0	0	0	0	2	0	3	2	0	4	4	0	8
8	0	1	0	1	1	0	0	0	0	0	0	0	1	2	0	3
9	2	0	0	0	0	0	1	1	0	0	1	0	3	2	0	5
10	1	0	0	2	0	0	1	0	0	1	1	0	5	1	0	6
11	0	0	0	0	0	0	2	0	0	1	0	0	3	0	0	3
12	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	2
$\bar{x}$	5.9	3.75		5.4	4.6		6.0	5.1		7.4	6.3		6.2	5.0		5.6
(n)	10	8		10	11		14	13		11	10		45	42		87
Unit 15 kill																
$\bar{x}$	5.3	5.2		6.1	5.0		4.5	4.8		-	-		5.3	4.9		5.2
(n)	33	24		59	19		55	38					147	81		228

1/ UKS = unidentified sex

The lack of cub production and a high yearling mortality, in the study area coupled with a high hunting harvest in the spring and fall resulted in a density of bears almost 57% below that of 1980.

Denning Ecology

We examined 13 winter dens of black bears within the MRC study area in 1981. All were located by radio-tracking study area bears to their dens. Measurements of all dens were made in the spring and summer after the bears had left.

The general shape and design of the dens investigated (Fig. 22) consisted of: (1) an entrance, (2) a tunnel of varying length, and (3) a nest chamber with nest of vegetation. Dens were measured and classified as to newly constructed or used as previously described by Schwartz and Franzmann (1981). Dens were located in all habitat types, but in general were located in upland areas or hillsides that had good drainage. The only exception to this was female B14 and her yearlings B43 and B44 who denned in a wet sedge meadow. The den was excavated in a raised area formed by an old tree stump and roots and was less than 60 cm above the surrounding wet area. When visited in early spring for marking, the den had a hole in the roof and the sow and yearlings were readily visible. When measured in mid-July, most of the roof and tunnel had caved in. The den chamber was excavated in peat and was totally soaked with water. The condition of B14 (54 kg) was extremely poor when she was trapped on 27 June, and her yearlings B43 (8.8 kg) and B44 (8.9 kg) were also very thin when handled on 13 May 1981. The denning location of B14 probably would have been adequate for denning in a "normal" winter. However, winter 1980-81 was exceptionally mild with most precipitation in the form of rain rather than snow, and daytime temperatures above freezing on several days. This unusually warm wet winter made B14's denning location very wet and probably cold.

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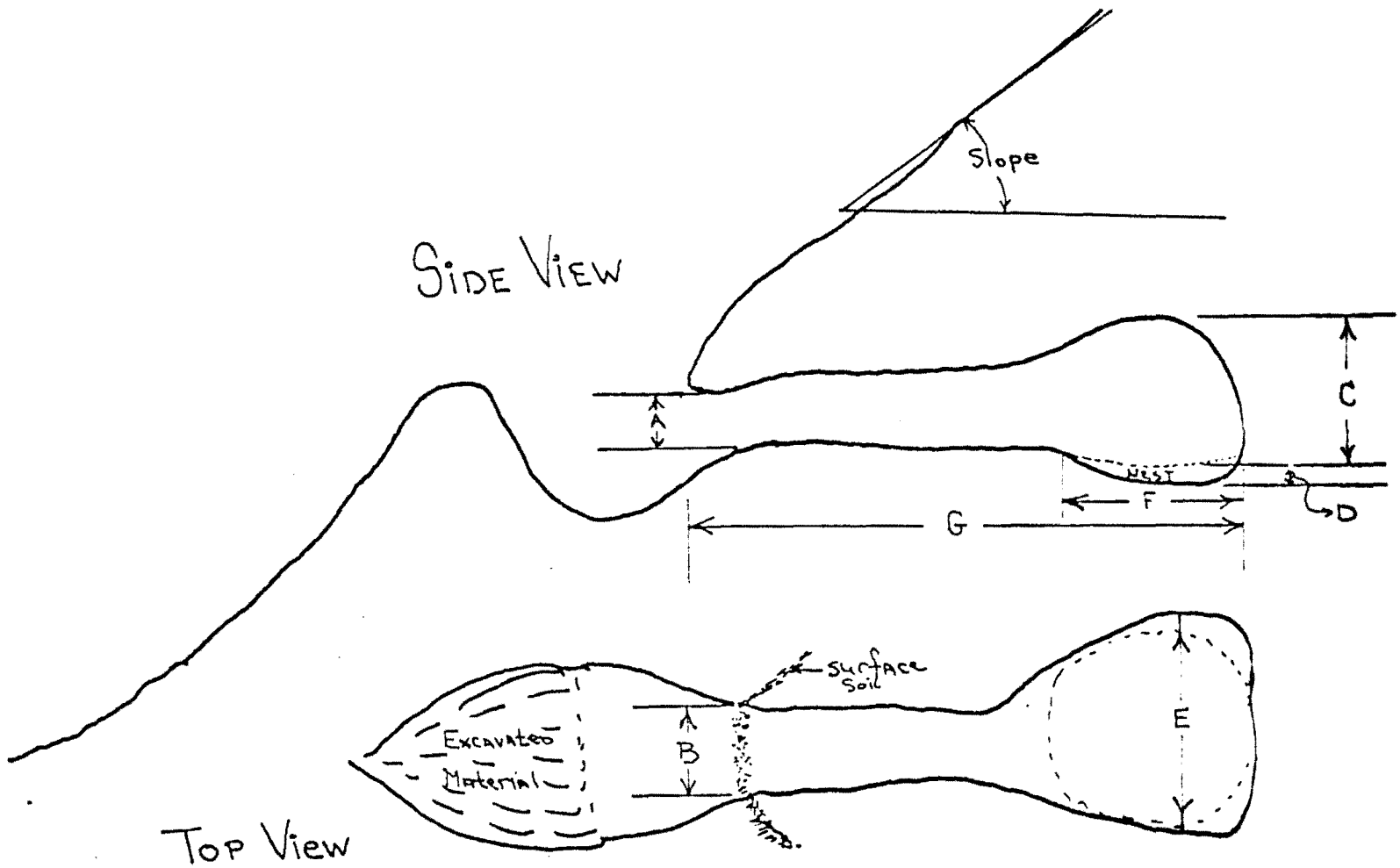
Fig. 22. Schematic of a typical black bear den on the Kenai Peninsula, Alaska showing locations of measurements listed on Table 11.

A= entrance height
B= entrance width
C= chamber height
D= nest thickness
E= chamber width
F= chamber length
G= den length



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APPENDIX A. Field data sheet, Hawk Inlet brown bear project.

BEAR NO. _____ SEX _____ EST. AGE _____ EST. WEIGHT _____

RADIO FREQUENCY _____ COLLAR COLOR _____

RADIO MAKE/MODEL/SIZE _____

EAR TAG MAKE/SIZE _____

RIGHT EAR TAG NO. _____ COLOR _____ FLAG COLOR _____

LEFT EAR TAG NO. _____ COLOR _____ FLAG COLOR _____

TATTOO: LOCATION/MARKS _____

_____

SPECIFIC CAPTURE LOCATION _____

_____

DATE OF CAPTURE _____ RESIGHTINGS _____

_____

EXTERNAL MEASUREMENTS: NECK _____ TOTAL LENGTH _____ TOOTH COLL. _____

PRODUCTIVITY: NO. CUBS: 0.5 YR. _____ 1.5 YR. _____ 2.5 YR. _____

MAMMAE LENGTH _____ COLOR _____ LACTATING: YES__ NO__

TAGGING TEAM _____

DRUG NAME(S)/DOSAGE _____

_____

LOCATION OF HIT _____

TIME OF HIT _____ TIME DOWN _____ TIME TO BECOME IMMOBILE _____

RECOVERY TIME _____ TOTAL TIME DOWN _____

GROSS EXTERNAL OBSERVATIONS _____

_____

REMARKS _____

_____

APPENDIX B. Brown bear, mountain goat and black-tailed deer location data

Header Information

Animal	Survey Type	Observer	Date (Yr., Mo., Day)	Julian Date

Weather Data

Air Temp.	Wind Dir. (deg)	Wind Speed (mph)	Clouds (%)	Precipitation

0-

Observation Data

Number	Elevation (ft)	Habitat	Canopy (%)	Terrain	Slope()	Time (hrs)

Cover (%)	Snow Depth (in.)	Grp. Size	#Males	#Females	#Adults	#Juven.

Acc.	Animal Location xloc	yloc	Aspect	%Spruce	Vol	Drainage	Risk	Patchiness

APPENDIX B (cont'd). Data codes.

Animal	Survey Type	Observer		Clouds	Preciptiation
1=goat	1=aerial	1=John	5=Charlie	% Cover	1=no rain
2=deer	2=ground	2=Matt	6=Gordon		2=intermittant rain
3=bears		3=Nate	7=Dave		3=steady rain
		4=Jack	9=Lars		4=snow

Wind Direction	Wind Velocity
° Magnetic	MPH
O, Variable=111	

Habitat

01=Beach
02=Beach fringe (old growth forest less than 100 yards from beach)
03=Old growth conifer forest
04=Early successional clearcut (0-15 years)
05=Mid successional clearcut (16-30 years); deciduous dominating
06=Mid successional clearcut (16-30 years); conifers dominating
07=Even aged regrowth (31-200 years); deciduous dominating
08=Even aged regrowth (31-200 years); conifers dominating
09=Deciduous brush (slide or avalanche chute)
10=Muskeg
11=Subalpine
12=Alpine tundra
13=Rocky outcrop; cliff face
14=Permanent ice-snowfield
15=Frozen lake-river
16=Wet meadow
17=Riparian
18=Tidal flats

Canopy	Terrain	Snow Cover (%) and Depth (in)	Snow Type
% cover	1=smooth 2=broken	(in general vicinity of animal	0=no snow 1=soft 2=hardpack 3=crust

Accuracy

1=accurate location within 25 acres-habitat accurate
2=accurate location within 25 acres-habitat uncertain
3=accurate location within 100 acres-habitat uncertain

Animal Location (from map)

First 3 values are the X (EW) coordinate
Last 3 values are the Y (NS) coordinate

APPENDIX B (cont'd). Data codes (cont'd).

Aspect (from map)

01=Flat	04=E	07=SW	10=Ridgetip
02=N	05=SE	08=W	
03=NE	06=S	09=NW	

Slope

degrees-#contour lines/grid
1-15 = 1-2
16-30 = 3-5
31-45 = 6-9
46+ = 10+

Group Size

# of individuals observed in each class within group

% Spruce	Volume	Age	Drainage	Risk	Patchiness
0	1 <8	1 Even	1 Poor	1 Low	1 Low
0	2 8-20	2 Uneven	2 Moderate	2 Moderate	2 Moderate
0	3 20-30		3 Well	3 High	3 High
0	4 30-50				
0	5 50+				
99	0 No Data				

Appendix C

Elevation was recorded to the nearest 30 m using the aircraft altimeter. Slope and aspect were determined from the map. Slope was recorded to the nearest 5° and aspect was recorded as flat, north, northeast, east, southeast, south, southwest, west, northwest, or ridge top.

Fifteen general habitat types were defined. These were beach, beach-fringe forest (old-growth forest less than 100 m from beach), old-growth spruce-hemlock forest (uneven-aged and silviculturally overmature), early successional clear-cut (0-30 years), even-aged second growth with deciduous or conifer species dominating (31-200 years), deciduous brush (e.g., slides and avalanche chutes), muskeg, subalpine, alpine, rocky outcrop-cliff, permanent ice-snowfield, and frozen lake or river.

Overstory species composition was recorded as percent spruce to the nearest 5%. Timber volume was recorded in thousand board feet per ac (mbf/a) by volume class (<8, 8-20, 20-30, 30-50, >50 mbf/a). Stand age was described as even or uneven; soil drainage as poor, moderate, or well drained; risk as high, moderate, low; and patchiness as low, moderate, high.

Overstory canopy coverage was estimated from the air and recorded to the nearest 5%. The character of the terrain was recorded as either smooth or broken. Percent snow cover and depth of snowpack in the general vicinity of the animal were estimated from the air.

Location accuracy was estimated as follows: position accurate to within 10.4 ha (25.6 a) and landscape attributes accurate; position accurate but landscape attributes uncertain; and position accurate only to within 40 ha (100 a) and all landscape attributes uncertain.