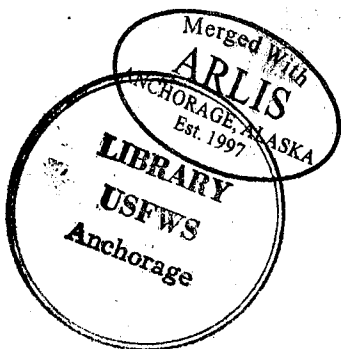


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PROGRESS REPORT: ECOLOGY OF WOLVERINES IN AN ARCTIC ECOSYSTEM

December 1980 .



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Field work on this project, completed in August 1980, totaled 18 months (including all months except December and January) over a 3-year period beginning in May 1978. During the study 23 wolverines were captured, 22 of which were instrumented with radio-telemetry collars (Table 1). Radio relocations of these wolverines made from the air totaled 830 (Table 2). Other data collected during the three field seasons included ground observations of wolverines at dens and rendezvous sites and on hunting forays as well as aerial observations of wolverines hunting, scent-marking, and breeding. While ground-tracking wolverines by snowmachine, we collected scats, located snow tunnels, and recorded scent-marks, caches, food items, and travel routes.

In addition to the field work, wolverine carcasses were collected from trappers and hunters from areas surrounding the study area. These carcasses were necropsied and data collected on body size, age, injuries, internal organ weights, stomach contents, and reproductive condition. Skulls and, in some cases, entire skeletons were donated to the University of Alaska Mammal Collections.

Since data analysis is only in the initial stages at this time, some of the tables and figures in this report will be incomplete and some data will not be presented until a later date. However, each of the topics to be discussed in the final report and the format of those reports will be outlined below.

Table 1. Information on wolverines captured in the study area, 1978-1980.

Wolverine	Sex	Age*	Date of Capture	Body Length** (cm)	Hind Foot Length (cm)	Front Foot Width (cm)	Neck Circum. (cm)	Chest Circum. (cm)	Head Circum. (cm)	Ear Length (cm)	Shoulder Height*** (cm)	Weight (kg)
C2	M	S	15 April 1978	84/106	18	--	--	52	--	--	--	13.1
R3	M	A	15 April 1978	84/106	20	--	--	52	--	--	--	15.8
J5	M	A	17 April 1978	81/103	16	--	--	46	--	--	--	12.9
D6	M	A	17 April 1978	84/106	18	--	--	--	--	--	--	12.9
D8	M	J	29 June 1978	--	17	--	27	36	--	--	44	9.1
J12	M	A	7 May 1979	85/110	19	--	35	48	--	4.0	34/47	14.5
P13	M	J	12 May 1979	51/62	15	8.0	22	33	--	4.0	30	3.6
			30 June 1979	71/89	18	8.0	28	37	--	4.0	25/36	--
			19 August 1979	90/111	19	8.0	33	44	--	4.5	32/44	10.9
			19 November 1979	120/133	18	8.5	31	45	--	4.5	35/48	12.4
T14	M	J	12 May 1979	49/57	14	8.0	23	32	--	4.0	31	3.6
			27 June 1979	67/88	17	8.0	28	36	--	4.0	29/39	7.7
			4 November 1979	114/128	19	10.0	34	48	--	5.2	37/48	15.4
J17	M	A	29 June 1979	82/104	19	8.5	36	45	--	4.2	--	--
K20	M	A	23 February 1980	93/109	18	9.5	36	46	--	4.8	36/48	13.6
B21	M	A	28 February 1980	87/96	20	10.0	37	48	38	3.5	33/49	15.4
B1	F	A	15 April 1978	72/94	16	--	--	47	--	--	--	19.5
P4	F	A	17 April 1978	79/83	15	--	--	43	--	--	--	8.6
			29 June 1979	80/99	16	7.5	32	38	--	--	30/42	9.3
M7	F	A	29 June 1978	--	--	--	--	--	--	--	--	10.9
			21 April 1979	85/104	18	--	29	40	--	5.0	--	10.4
			23 March 1980	82/100	18	9.0	30	38	38	5.0	31/42	9.5
R9	F	S	16 October 1978	78/101	17	8.0	30	42	--	--	42	10.6
H10	F	A	16 October 1978	74/94	16	--	30	39	--	--	38	9.5
			4 November 1979	78/96	18	8.5	31	42	33	4.7	28/41	9.5
			24 February 1980	76/92	18	8.5	29	42	34	4.5	29/40	10.2
B11	F	S	7 May 1979	70/93	16	--	30	37	--	--	30/40	--
D15	F	J	29 May 1979	47/57	13	7.0	24	33	--	3.0	23/31	3.8
			2 July 1979	61/81	17	7.0	27	36	--	--	27/35	7.7
			14 February 1980	79/94	17	8.5	29.5	42	33	4.5	30/41	9.5
R16	F	J	29 May 1979	48.3/58.4	13	7.0	23.5	33	--	3.0	28/22	3.6
A18	F	A	2 November 1979	84/106	17	9.0	33	44	--	4.0	31/44	10.4
A19	F	A	13 November 1979	89/108	--	8.5	29.5	45.5	--	4.8	42/32	10.0
R22	F	S	18 March 1980	75/92	18	8.0	30.5	40	33.5	4.5	27/40	8.8
B23	F	S	25 March 1980	83/104	18	8.5	32	41	32.5	4.0	31/42.5	9.5

*Age is divided into adult (A), subadult (S) which are immature animals over 1 year old, and juvenile (J) which are animals under 1 year old.

**Body length consists of two figures; the first is length from nose to base of tail; the second is from nose to tip of vertebrae.

***Shoulder height consists of two figures; the first is height from shoulder blade to wrist; the second is from shoulder blade to tip of toes.

Table 2. Radio-telemetry relocations for wolverines from 1978 to 1980.

Wolverine	Sex	Age *	Month	Year	Number of Sightings	Total
C2	M	S	April	1978	4	7
			May	1978	3	
R3	M	A	April	1978	4	32
			May	1978	8	
			June	1978	17	
			July	1978	3	
J5	M	A	April	1978	5	24
			May	1978	8	
			June	1978	8	
			July	1978	3	
D6	M	A	April	1978	1	1
D8	M	J	June	1978	2	35
			July	1978	8	
			August	1978	5	
			September	1978	19	
			November	1978	1	
J12	M	A	May	1979	12	27
			June	1979	3	
			July	1979	1	
			August	1979	9	
			September	1979	2	
P13	M	J	July	1979	1	33
			August	1979	12	
			September	1979	2	
			October	1979	2	
			November	1979	4	
			February	1980	5	
			March	1980	7	
T14	M	J	July	1979	2	32
			August	1979	25	
			September	1979	2	
			October	1979	1	
			November	1979	2	
J17	M	A	No relocations			

Table 2. continued

Wolverine	Sex	Age	Month	Year	Number of Sightings	Total
K20	M	A	February	1980	1	51
			March	1980	9	
			April	1980	1	
			May	1980	12	
			June	1980	11	
			July	1980	8	
			August	1980	9	
			B21	M	A	
March	1980	5				
B1	F	A	April	1978	4	17
			May	1978	9	
			June	1978	4	
P4	F	A	April	1978	6	53
			May	1978	12	
			June	1978	8	
			July	1978	3	
			March	1979	4	
			April	1979	1	
			May	1979	3	
			June	1979	1	
			August	1979	2	
			March	1980	3	
			April	1980	1	
			May	1980	1	
			June	1980	4	
			July	1980	3	
			August	1980	1	
M7	F	A	June	1978	2	
			July	1978	8	
			August	1978	6	
			September	1978	15	
			March	1979	8	
			April	1979	6	
			May	1979	25	
			June	1979	14	
			July	1979	3	
			August	1979	27	
			September	1979	2	
			October	1979	2	
			November	1979	2	
			February	1980	5	
			March	1980	9	
April	1980	4				

Table 2. continued

Wolverine	Sex	Age	Month	Year	Number of Sightings	Total			
M7 (continued)			May	1980	18				
			June	1980	31				
			July	1980	13				
			August	1980	8	208			
R9	F	S	March	1979	12				
			April	1979	5				
			May	1979	18				
			June	1979	4				
			July	1979	1				
			August	1979	15				
			September	1979	1				
			November	1979	1	57			
			H10	F	A	March	1979	9	
April	1979	6							
May	1979	21							
June	1979	5							
July	1979	1							
November	1979	2							
February	1980	4							
March	1980	11							
April	1980	6							
May	1980	14							
June	1980	22							
July	1980	15							
August	1980	9				125			
B11	F	S				May	1979	11	
						June	1979	4	15
D15	F	J	February	1980	3				
			March	1980	9				
			April	1980	5				
			May	1980	14				
			June	1980	20				
			July	1980	15				
			August	1980	8	74			
R16	F	J	No relocations						
A18	F	A	No relocations						

Table 2. continued

Wolverine	Sex	Age	Month	Year	Number of Sightings	Total
A19	F	A	November	1979	2	23
			February	1980	4	
			March	1980	10	
			April	1980	5	
			May	1980	2	
R22	F	S	March	1980	4	8
			April	1980	4	
B23	F	S	No relocations			

*
A = Adult
S = Subadult
J = Juvenile

Four areas of wolverine ecology were emphasized during this research project and will be treated in four separate articles in scientific journals.

These areas are as follows:

- A. Home range and movements
- B. Food habits and habitat use
- C. Social behavior
- D. Population dynamics

Where data analysis is sufficient, the preliminary results are presented in the following sections. Discussion of the complete results will appear in the final publications.

Home Range and Movements

We have adequate data to determine the home ranges of 12 individual wolverines. Figure 1 is a map of the study area and Figures 2 through 4 show the ranges of radio-collared wolverines for 1978 through 1980, respectively. We also constructed home ranges on a month-to-month basis for 3 wolverines (two adult females and a juvenile female) (Figures 5 through 7) in order to show the seasonal variability in home range size and shape. In the final report these figures will also be constructed for all wolverines with 6 or more relocations per month so that comparisons can be made between the different sex and age groups. Some of the factors which could influence the differences observed include breeding condition, food availability, and the presence or absence of kits. The distances

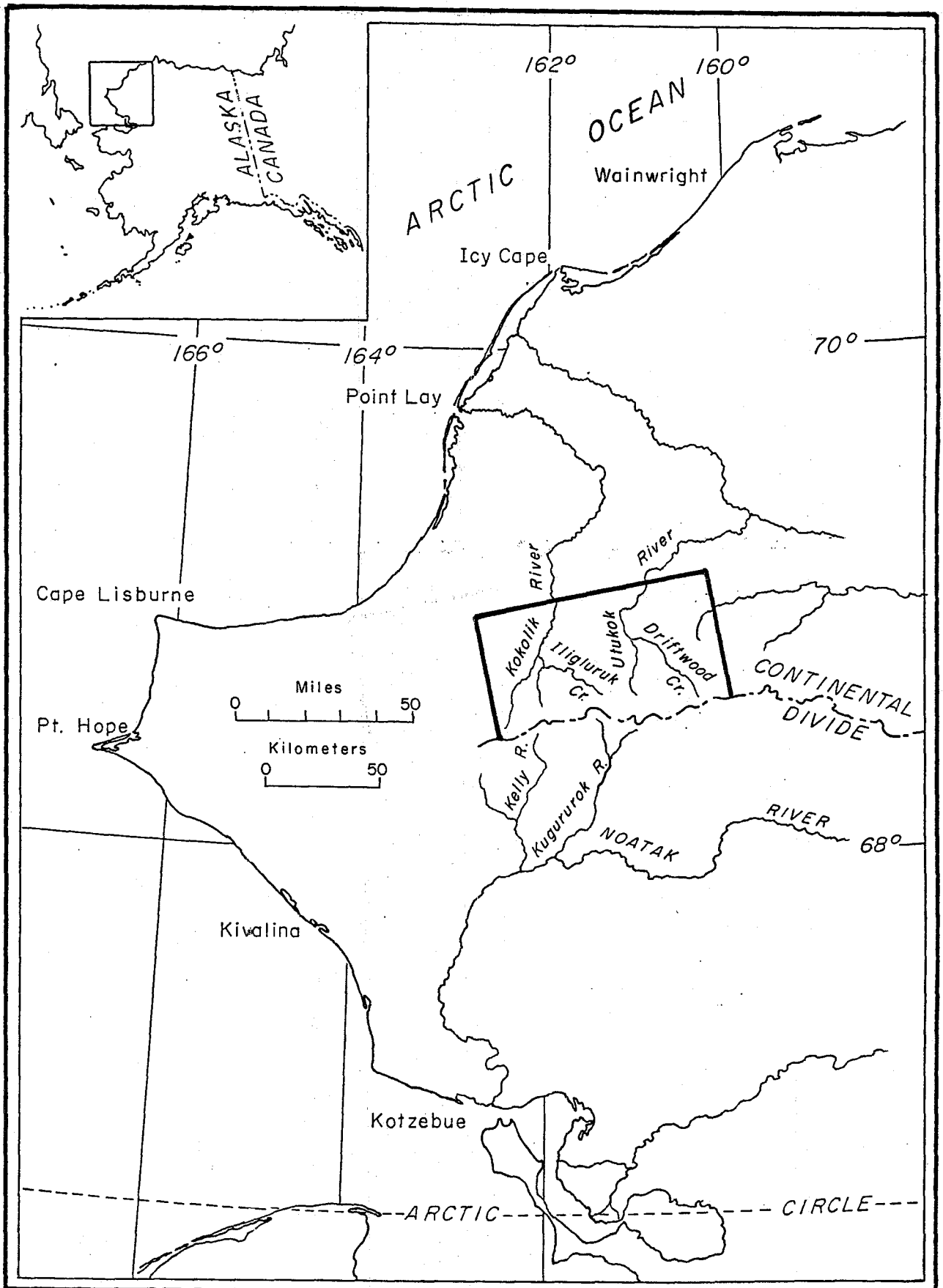


Figure 1. Location of the study area.

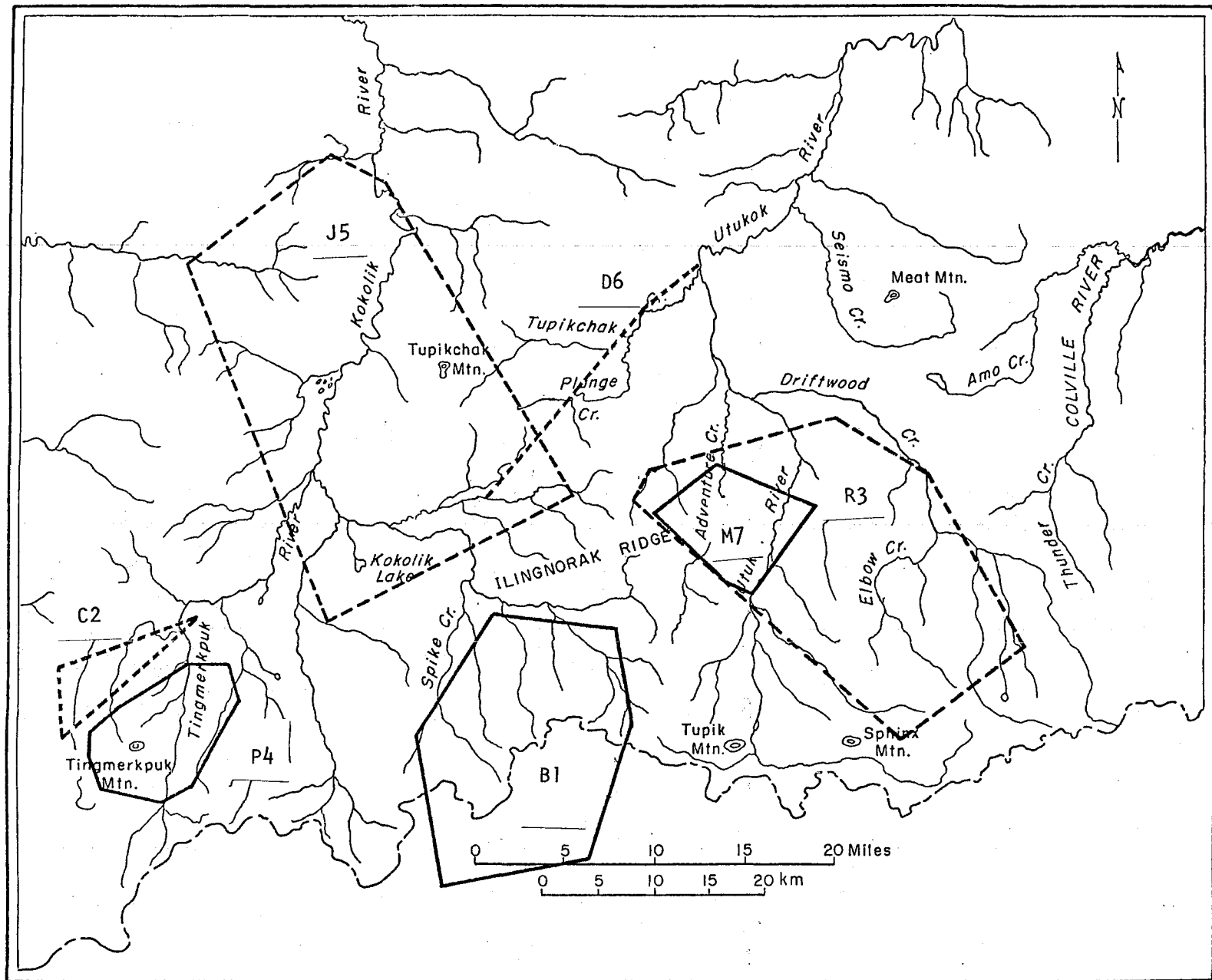


Figure 2. Home ranges of wolverines radio-collared in 1978. Solid lines are females; dashed lines are males. Male D6 only had three locations.

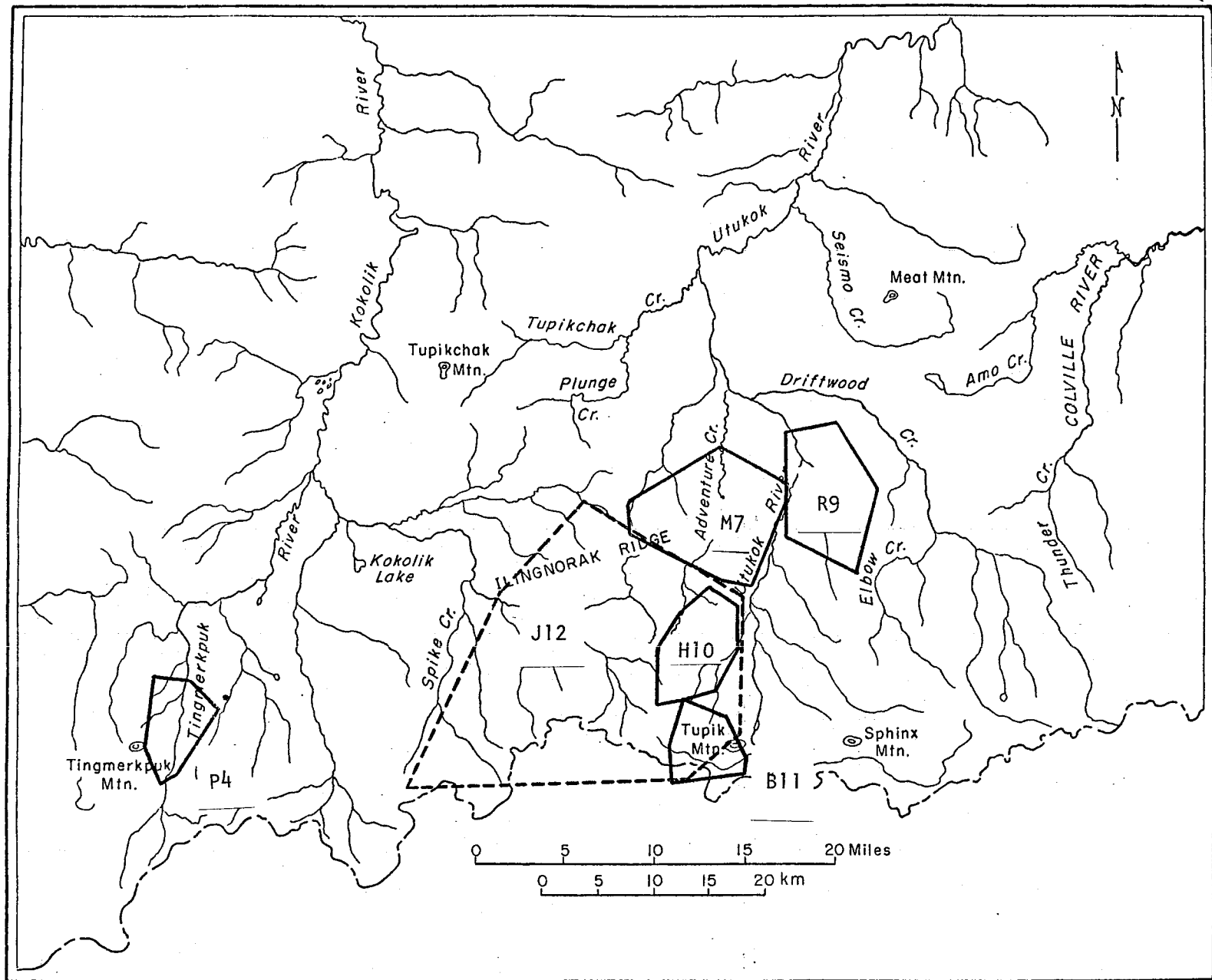


Figure 3. Home ranges of wolverines radio-collared in 1999. Solid lines are females; the dashed line is a male. Male J17 only had one location.

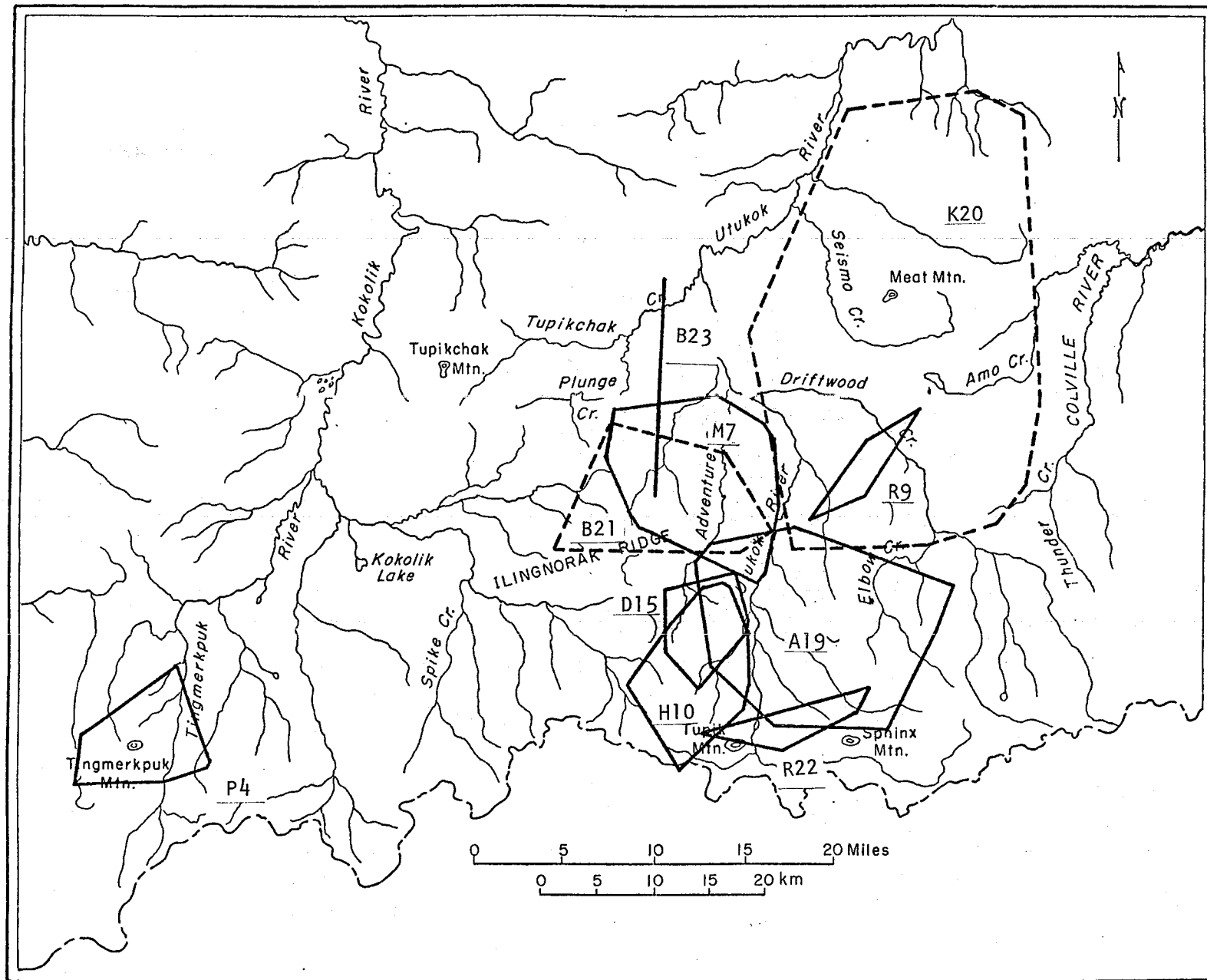


Figure 4. Home ranges of wolverines radio-collared in 1980. Solid lines are females; dashed lines are males. Female B23 only had two locations; female R9 only had four locations in 1980.

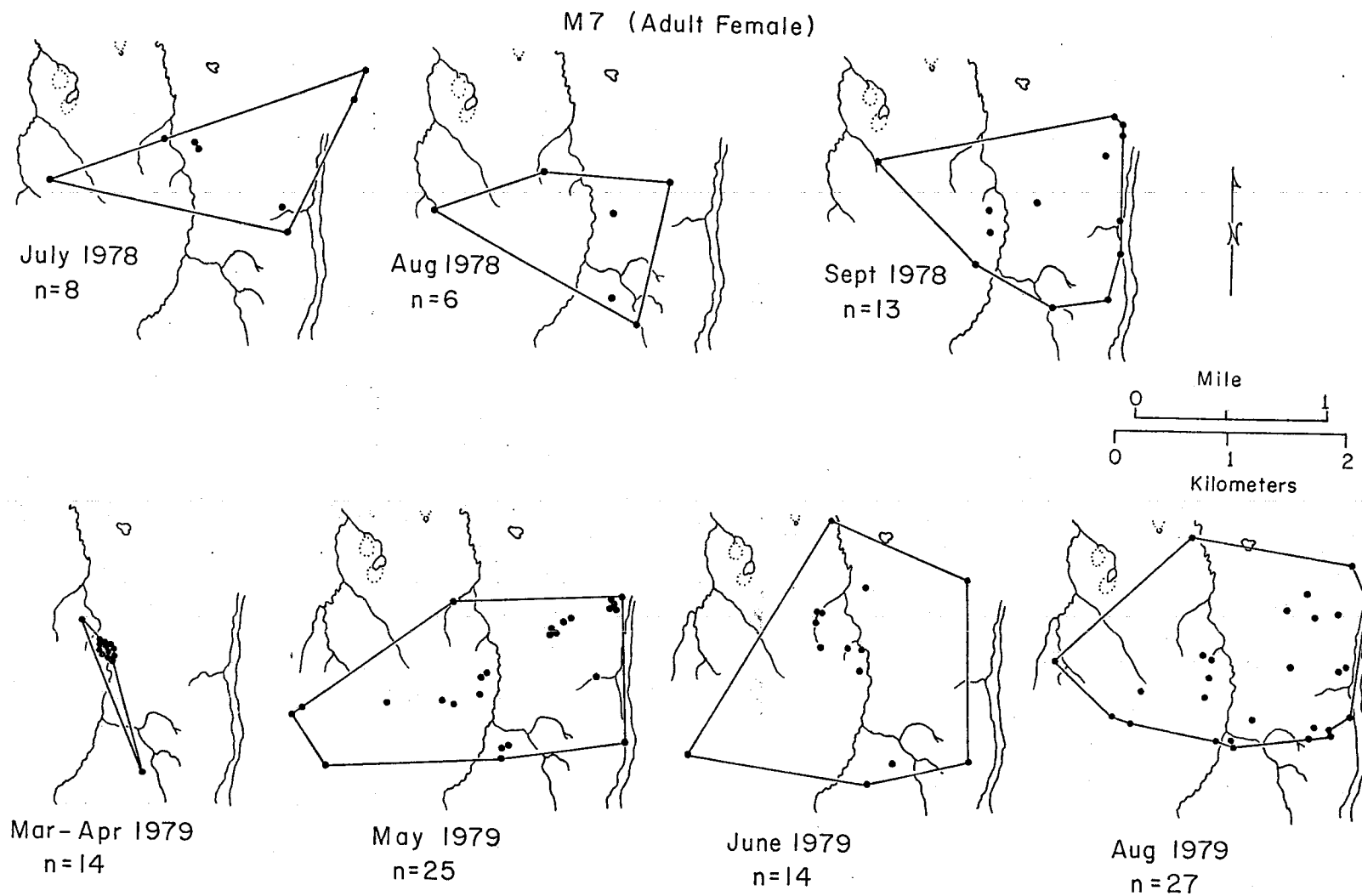


Figure 5. Home range by month for female M7 for 1978 and 1979. Only those months with six or more sightings are shown.

M7 (Adult Female)

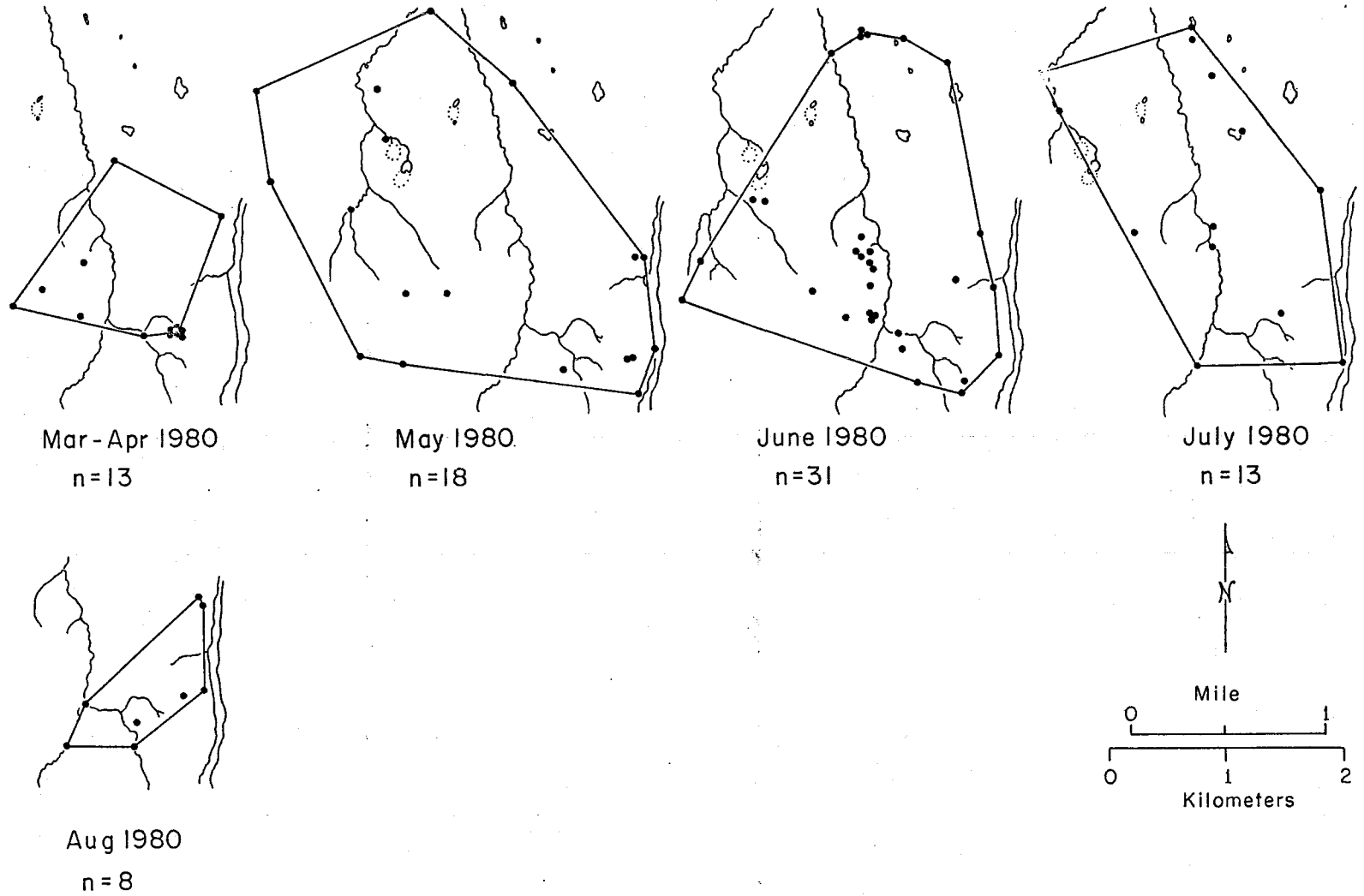


Figure 6. Home range by month for female M7 for 1980. Only those months with six or more sightings are shown.

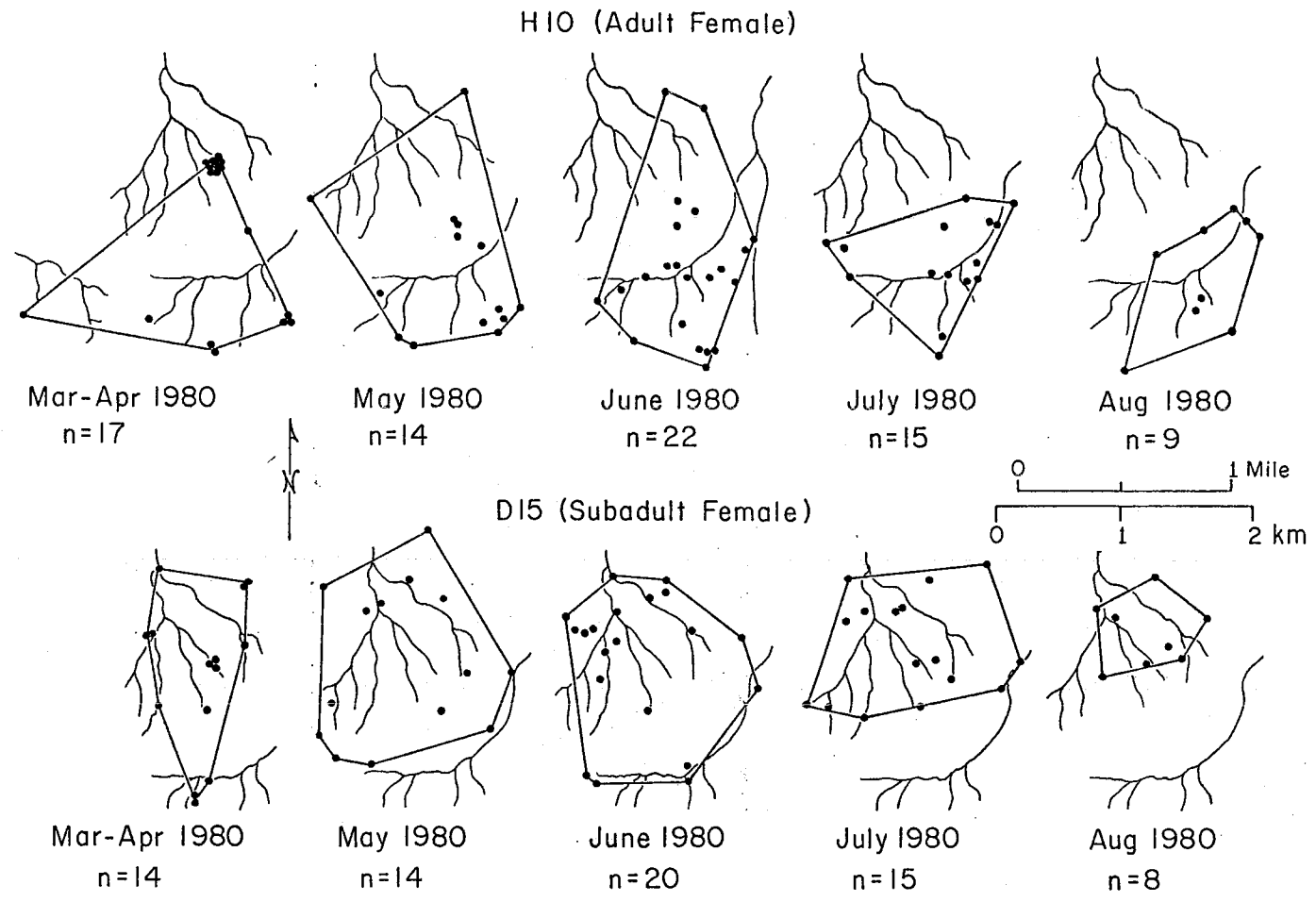
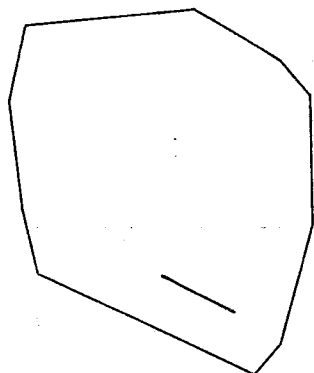


Figure 7. Home range by month for female H10 and her daughter D15 for 1980. Only those months with six or more sightings are shown.

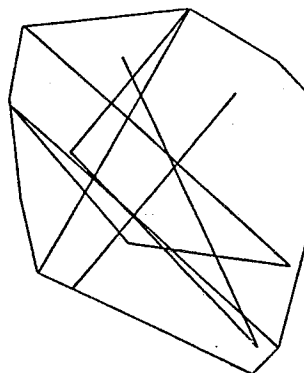
between relocations also varied seasonally as indicated by Figures 8 through 10. Relocations of wolverines were irregular due to budget restrictions and weather conditions, but when possible, relocations were made at least every 4 days during 1978 and every 2 days for 1979 and 1980. In Figures 8 through 10 straight lines were drawn between the locations that were made at 2-day intervals for 2 adult females. We chose the 2-day interval because it provided us with both the greatest number of possible data points and a consistent means of comparing the movements of different individuals and of the same individual within different years. Of course, wolverines do not travel in straight lines and in a 2-day period their actual movements will cover a significantly greater distance than is indicated by Figures 8 through 10.

Rates of travel calculated from radio-telemetry sightings can be misleading when the animal's actual movements between two locations is not known. For this reason, a number of wolverines were observed from an aircraft continually for 1 hour during which their exact movements were recorded on aerial photographs (Figure 11). From this information, actual travel rates were computed and compared with rates of travel derived just from straight lines connecting the beginning and ending points. As these figures indicate, travel rates based on radio relocations may be either quite close to the actual travel rate or very different from it, depending on the wolverine's activity and direction of travel. None of the 1-hour periods included resting time which would have significantly affected any calculations of travel rates.

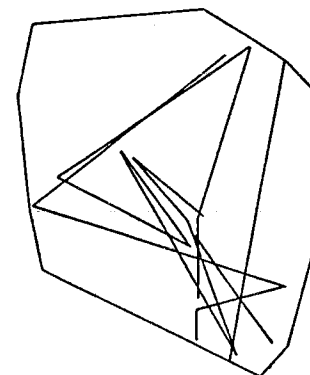
M7 (Adult Female)



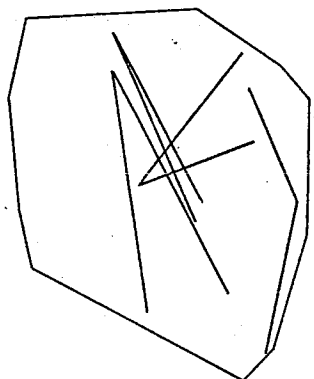
Mar 1980
n=4
Av. Distance 0.7 km



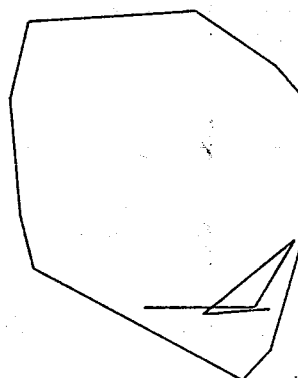
May 1980
n=9
Av. Distance 4.4 km



June 1980
n=13
Av. Distance 6.0 km



July 1980
n=8
Av. Distance 5.8 km



Aug 1980
n=4
Av. Distance 3.3 km

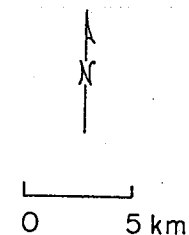
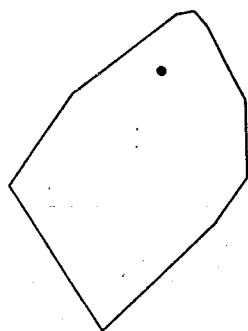
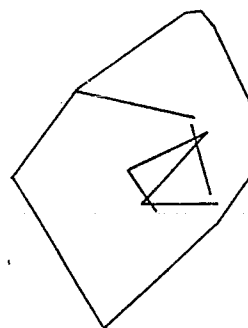


Figure 8. Distances between radio relocations, made on alternate days for female M7. The average distance between locations changes monthly.

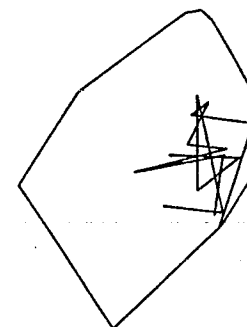
H10 (Adult Female)



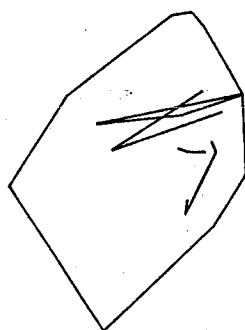
Mar 1980
n=4
Av. Distance 0.0km



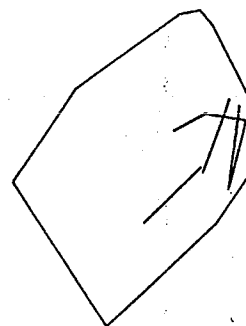
May 1980
n=7
Av. Distance 2.8 km



Jun 1980
n=13
Av. Distance 2.2 km



July 1980
n=10
Av. Distance 3.2 km



Aug 1980
n=6
Av. Distance 3.2 km

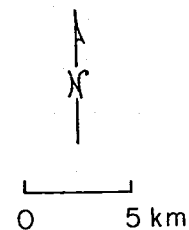
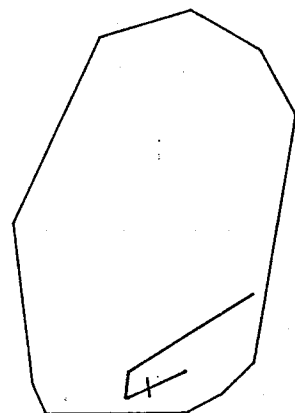
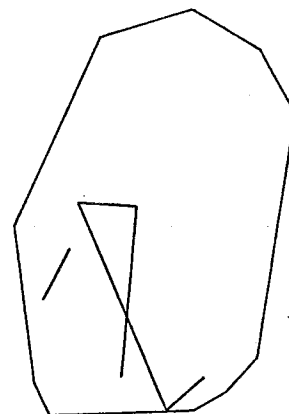


Figure 9. Distances between radio relocations made on alternate days for female H10. The average distance between locations changes monthly.

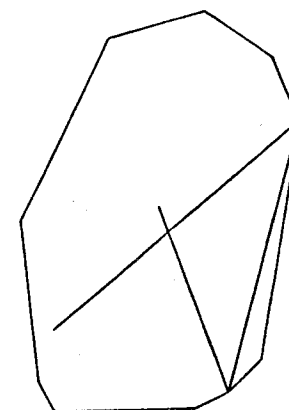
K20 (Adult Male)



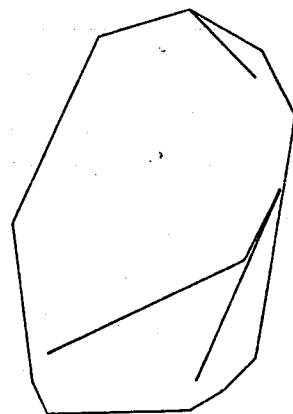
Mar 1980
n=4
Av. Distance 4.2 km



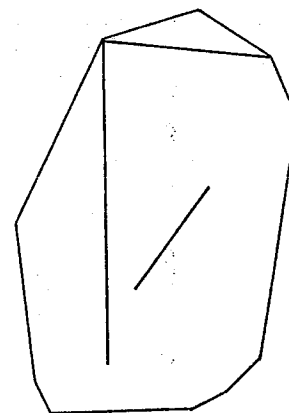
May 1980
n=5
Av. Distance 8.0 km



June 1980
n=3
Av. Distance 9.8 km



July 1980
n=4
Av. Distance 9.7 km



Aug 1980
n=3
Av. Distance 9.8 km



Figure 10. Distances between radio relocations made on alternate days for male K20. The average distance between locations changes monthly.

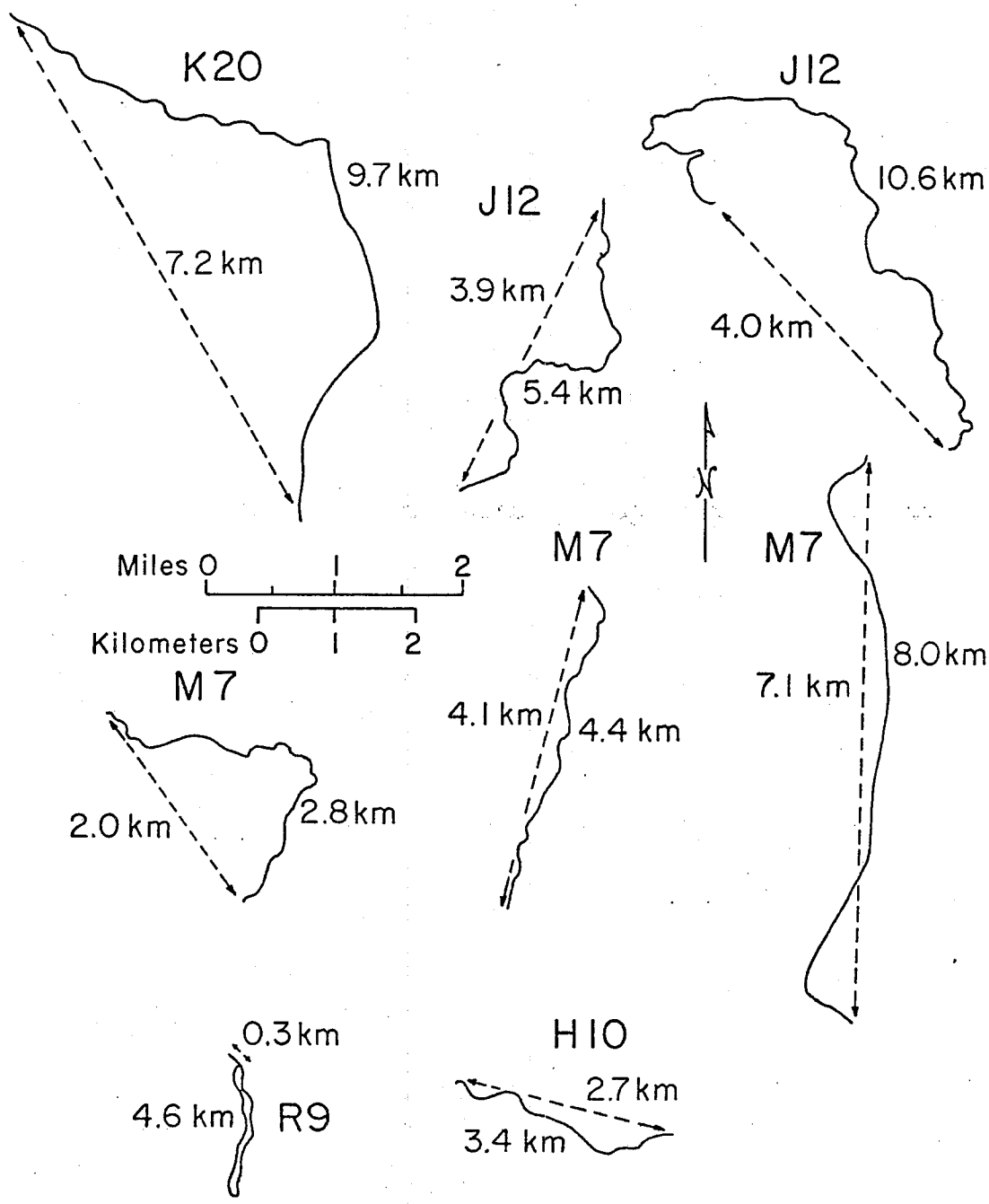


Figure 11. Exact routes traveled by wolverines under constant watch from an aircraft for a period of one hour. The distance of the travel route and the straightline distance between the beginning and ending points are given.

Food Habits and Habitat Use

Much of the information for this section of the report has not been analyzed yet. Analysis of scats collected during the field work is underway at this time. Table 3 presents some preliminary data. The stomach contents of carcasses collected in areas surrounding the study area will be analyzed as well. Additional data on food habits are available from observations of wolverines during radio-tracking flights or while observing wolverines on the ground. Correlation of activities related to food gathering (observed while radio-tracking) with habitat type will be carried out. Table 4 is a summary of habitat utilization patterns by activity type for 483 radio relocations in 1979 and 1980. The study area will be mapped by habitat type and the locations of wolverines in each habitat correlated with the availability of each type in the wolverine's home range. The final report will discuss the seasonal availability of food for wolverines and the importance of each habitat type.

One of the features of wolverine habitat in the Arctic is the occurrence of snowdrifts which form along streambanks and drainage lines. These drifts began forming in September or October and usually last through most of the summer. Besides providing protection from weather and predators, the tunnels provided convenient food storage sites. The tunnels were repeatedly visited, not only by the animal that excavated them but also by other wolverines as well. The final report will include sketches and measurements of the snow tunnels that were excavated during the study.

Table 3. Major food items in 61 wolverine scats collected in 1978-1980.

Food Item	Number of Scats with This Item	(% of Total Scats)	Number of Scats with Over 50% of This Item	(% of the Number of Scats with This Item)
Large mammal (caribou, moose)	47	77	34	72
Ground squirrel	14	23	7	50
Microtines	24	39	14	58
Bird	20	33	0	--
Vegetable	46	75	0	--

Table. 4. Number of sightings for each activity per habitat type, 1979 and 1980.

Habitat	Drainages (Other Than River Valleys)		Riparian Willow		Tussock		Sedge		Dry Hillside		Rock		Snowdrift		All Activities		
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	Total
Traveling	2	3	15	14	18	60	4	8	5	13	3	5	17	20	64(60%)	123(33%)	187(39%)
Resting	0	4	11	17	5	41	0	2	3	5	0	15	9	92	28(26%)	176(47%)	204(42%)
Hunting	0	2	2	10	8	40	1	15	1	4	1	1	2	5	15(14%)	77(20%)	92(19%)
TOTAL	2	9	28	41	31	141	5	25	9	22	4	21	28	117	107	376	483
% Occurrence Per Habitat	2	2	26	11	29	38	5	7	8	6	4	6	26	31			

Social Behavior

This section of the final report will discuss socio-ecology emphasizing spacing and scent-marking behavior, breeding behavior, and mother/infant interactions. From the spacing patterns we documented in this study, adult female wolverines appear to use home ranges that generally exclude other adult females at least from April through September (Figures 2 through 4). The data is not adequate, however, to discuss whether or not male wolverines exclude other males from their home areas. However, it does appear that males tolerate the presence of one or more females in their home areas, so that overlap in the home ranges of males and females does occur. Data for juvenile animals are limited. The information that is available indicates that at least some female offspring may remain in their mother's home range for more than a year. Two cases of immature males dispersing from the study area have been documented and circumstantial evidence supports the theory that 2 additional immature males and 2 immature females dispersed between 9 and 14 months of age. Circumstantial evidence suggests that aggressive behavior on the part of resident adult wolverines may be related to the dispersal of immature animals that have remained in their mother's home range up until the onset of the breeding season.

Three agonistic interactions were observed between wolverines. The first 2 were between a radio-collared adult female and an untagged wolverine of unknown sex and age. These encounters were made on 26 April and 28 April during which the female fought with the untagged wolverine and appeared to drive it away. On 24 April a young radio-collared female (probably a

subadult) was observed fighting with an unmarked wolverine. The second wolverine was believed to be a female since it was similar in size to the collared female. (All immature animals are essentially adult size by their first winter.) The young female had only recently been radio-collared so that home range data was not yet available for her; within 2 days after her agonistic confrontation with the other wolverine, she disappeared from the study area.

Two adult males captured in April had fresh wounds on their faces. Though fighting by males was never observed, all adult males which we collared carried scars.

Some form of territoriality probably exists in the social system of wolverines. Since direct aggression would be a costly means of maintaining territories, wolverines have probably evolved a method for "defending" their territories which reduce the chances of bodily injury and energy expenditure. For most other mammalian species that maintain territories, scent-marking is believed to be important to territory maintenance. During this study, scent-marking was observed by wolverines of all sex and age groups, even by kits less than 4 months old. Scent-marking may be in the form of urination, defecation, or scent-gland secretions. Frequent observations of wolverine scent-marking were made both from the ground and from the air. However, it was difficult to differentiate between the different types of scent-marking unless the animal rubbed vigorously while depositing scent. The rubbing of scent-glands on terrain features was easily observed from the air, but it was quite possible that scent was deposited when no rubbing was

evident. Only observations of captive animals depositing scent, urine, and feces will clarify the difference in posture, if any, that occurs between marking types. Scent-marking was observed while animals were traveling, hunting, and breeding. The intensity of marking varied between individuals and under different situations by the same individual. The final report will present data on scent-marking frequencies observed from aircraft.

Wolverine breeding behavior was observed in three instances during this study. These are the first records of wolverines observed breeding in the wild. In 1978 a young female wolverine (R9) was observed copulating on 6 August. She apparently did not produce kits from this mating which is believed to have been her first. This same wolverine was again observed mating with a young adult male (K20) the following year on 11 June. The third observation was of an adult female (M7) and an older adult male (B21) on 5 June 1980.

Kits are born about mid-March in the study area. In 1978, 1 male kit (D8) was born to female M7. The following year she produced two more male kits (P13, T14) and the female in the adjacent territory produced two female kits (D15, R16). Data on the growth rate of these kits are provided in Table 1. The natal den of M7 was not located in 1978 though her capture site is believed to have been very close to the site of the natal den. In 1979 this female's den was observed in April and May until she moved her kits to a new area sometime during the first week of May. The neighboring female also moved her kits from her natal den about the same time. The move

was probably triggered by spring meltwater entering the dens. Human disturbance was not believed to be a factor. Through the months of May and June, the females would periodically move their kits to new rendezvous sites which were most often remnant snowdrifts with tunnels formed by meltwater. The kits would remain at the site while the female hunted. She would return to the site with food or would lead the kits to a new site where she had previously cached food items. The kits began regularly traveling with their mother by July. By August they were spending a considerable amount of time on their own. Play behavior was a normal part of the social behavior of females and their kits. Play behavior continued late into the fall when kits would meet their mother in her home range and was even observed between a female (H10) and her 17-month-old daughter (D15), though the immature animal was no longer sharing much of her mother's home range. This play behavior occurred when the two met at the boundary of their adjoining areas. Play behavior was also observed between a juvenile male (D8) and an uncollared wolverine which was believed to live in an area adjacent to his mother's home range. A wolverine similar in coloration to the uncollared animal was caught and collared the following year in that area and proved to be an adult female (A19). This incident occurred in September when the male was approximately 6 months old. He was near the boundary of his mother's home range at the time of the incident. The final report will provide details on the relative locations of kits and their mothers during the kits' first year.

On a number of occasions, a collared wolverine was seen in the company of an unmarked wolverine which was not its offspring (of that year at least). The age and sex of the unmarked animals were not known. Unless breeding behavior was imminent, these meetings were usually of short duration. On a number of occasions, an adult male (J12) visited an adult female (H10) with 2 kits (D15, R16) during May, but the female would chase the male whenever he approached. In an observation made from the air on 7 May, an adult male (J12) approached a young female (B11) (probably a yearling) while he was traveling through her home range. The two approached each other cautiously, sniffed, and separated traveling in opposite directions. This male frequently visited the female's home range in May and June. From tracks in the snow, it was evident that they spent some time together.

Population Dynamics

This section of the final report will discuss the population dynamics of wolverines in an arctic ecosystem utilizing the data gathered in the study. Comparisons will be made with other wolverine populations and management implications will be discussed.

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