Moose Movements and Habitat Use Along the Upper Susitna River--A Preliminary Study of Potential Impacts of the Devils Canyon Hydroelectric Project

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SUMMARY

During October 1976 and March 1977, 18 radio and 21 visual collars were placed on moose along the Susitna River from the mouth of the Maclaren River downstream to Devil Creek. Radio tracking flights over 13 months yielded 270 observations of radio-collared moose. Visual collars were located 43 times. Movements were slight for radio-collared moose between Jay Creek and Devil Mountain, generally within 48 km^2. One visual collar from Devil Creek was seen near Lone Butte, 84 km east of her tagging location. Movements of moose collared east of Jay Creek were substantially longer, and migrations up to 103 km were observed. Radio-collared moose were found most often (70 percent) in spruce dominated habitats during all seasons. Seven of the eight cows that had calves gave birth in spruce vegetation. The bend of the Susitna River from Goose Creek to the mouth of Tyone River was identified as important winter habitat for moose from many areas of the Susitna River drainage. Lower elevations along the Susitna River were found to be important as both wintering and calving areas for resident populations, particularly on the south side, east of Stephan Lake. Collared moose crossed the Susitna a minimum of 26 times during this study, 15 of which were across that portion which would be inundated by dam construction.

Movement data gathered over a period of only 13 months are insufficient to accurately delineate separate moose populations. Evidence to date suggests that moose from many portions of the Susitna River drainage utilize habitats adjacent to or portions of the area which will be flooded by dam construction. Intensive vegetative studies and research

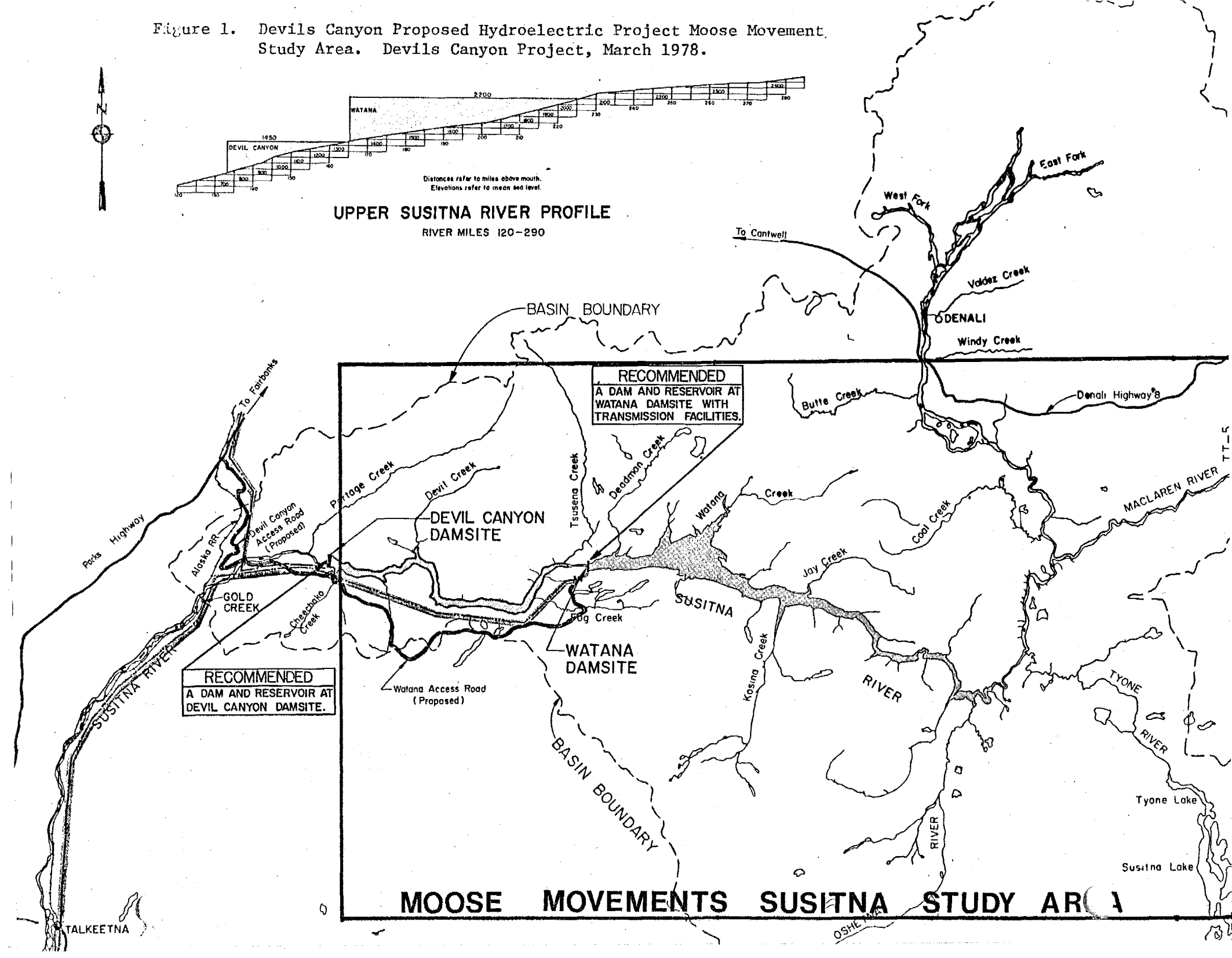
on movements both upstream and downstream are needed to adequately assess the impacts of the proposed construction (Appendix II).

BACKGROUND

Feasibility studies on providing hydroelectric power from the Susitna River to the railbelt area of southcentral Alaska have been conducted since 1948. Potential dam sites were identified by the U.S. Bureau of Reclamation, the Alaska Power Administration and the Henry J. Kaiser Company. Proposed hydroelectric projects have included from 2 to 12 dams within the Susitna River basin, along with associated maintenance facilities and transmission lines to Anchorage and Fairbanks (Dept. of Army 1975).

The Devils Canyon-Watana dam system has been selected by the Army Corps of Engineers as the most viable of several alternatives (Fig. 1). This system would theoretically provide 6.1 billion kilowatt-hours of electrical power annually from a dependable capacity of 1,568 megawatts (Army Corps of Engineers 1975). The Devils Canyon dam would be a concrete structure 193 m high, and the Watana dam would be a rock fill impoundment rising 247 m above the river bottom. A 103 km road from Chulitna to the Watana site including a 198 m bridge across the Sustina would be constructed for transporting materials and personnel to the dam sites. Five hundred eighty-six km of transmission line corridors, 57-64 m wide, would be cut across the mountains between Anchorage and Fairbanks. Warehouses, vehicle storage buildings and permanent living quarters would be erected at the dam sites. The total projected cost of completing this project

Figure 1. Devils Canyon Proposed Hydroelectric Project Moose Movement Study Area. Devils Canyon Project, March 1978.



is $2,100,000,000 (Army Corps of Engineers 1977). The estimated annual cost for operation for 100 years following completion is $104,000,000. Power on the line from the Watana site is scheduled for 1986 and from the Devils Canyon dam by 1990. Construction and maintenance of this system would constitute the largest hydro-power project in North America (Gravel 1977).

Construction of both proposed dam sites would inundate 51,000 acres of the river valley, 132 km upstream to a point between the Tyone and Oshetna Rivers (Fish and Wildl. Ser. 1975). Water levels of the Devils Canyon reservoir are expected to remain almost constant but may fluctuate up to 55 m (ob. cit.). The Watana reservoir is projected to have substantial seasonal fluctuations up to 78 m. Downstream flow is expected to be maintained at a constant rate between 8,000 and 10,000 cubic feet per second, eliminating the flooding action that presently occurs each spring when downstream flows may be as high as 90,000 cfs (Army Corps of Engineers 1975).

The Susitna River Basin has long been recognized as an extremely rugged wilderness area of high esthetic appeal and as an important habitat to a wide variety of wildlife species (ADF&G, unpubl. data). Most important to sport and subsistance users are moose (*Alces alces*) and caribou (*Rangifer tarandus*). Hydroelectric development has been under consideration in this area for a number of years and some very general ungulate population assessment work was begun in 1974 (USF&W 1975). Since then no studies were conducted in the project area until 1976 when limited funds were made available to begin acquiring baseline

information on moose and caribou populations within and adjacent to the project area. The purpose of this report is to present the findings of this one-year study and to discuss their implications in relation to the construction of the proposed hydroelectric project.

DESCRIPTION OF AREA

Moose movements and habitat use were studied in that portion of the Susitna River Basin lying between latitudes 60°30' - 63°15' north and longitudes 146°30' - 149° west (Figure 1). The landscape is primarily mountainous and ranges in elevation from 300 to 1900 m. Semi-arid conditions dominate this area of the basin. Temperatures are generally cool in the summer and overcast days are common. Snowfall is usually moderate and ground accumulation does not often exceed one meter. Prevailing winds are out of the east and north. High winds are common along the river during any season.

Along the banks of the Susitna and its tributaries from the Maclaren River to Devil Creek the dominant vegetative cover is black spruce (*Picea mariana*), interspersed with muskeg bogs on the basin floor. Occasional stands of black cottonwood (*Populus trichocarpa*) are found on the islands in the river. Understory vegetation in the lower elevations includes highbush cranberry (*Viburnum edule*), devil's club (*Echinopanax horridus*), blueberry (*Vaccinium* spp.), lowbush cranberry (*Vaccinium vitis-idaea*) and several representatives of the rose and grass families. Hardwoods such as aspen (*Populus tremuloides*) and birch (*Betula papyrifera*) are often found interspersed among the spruce, predominantly on south-

facing slopes. White spruce (*Picea glauca*) replaces the smaller, stunted black spruce on better drained soils. The understory above 300 m contains blueberry, lowbush cranberry, Labrador tea (*Ledum* spp.), fireweed (*Epilobium* spp.), crowberry (*Empetrum nigrum*), and several mosses and lichens.

Alder (*Alnus* spp.) dominates the reaches just above timberline, particularly along the headwaters of streams. Willow (*Salix* spp.) exists throughout the study area but occurs most frequently at timberline and on riparian sites. Alpine tundra extends above the alder-willow zone about 1200 m. A network of old caribou trails scars the tundra slopes of the mountain foothills throughout most of the area.

PROCEDURES

During October 1976 and March 1977, moose were captured along the Susitna River from its confluence with the Maclaren River downstream to Devil Creek. They were darted from a Bell Jet Ranger helicopter using standard techniques described by Franzmann et al. (1974) with doses of Anectine (Succinylcholine chloride), ranging from 23 to 29 mg. All captured moose were marked with plastic flagging affixed with metal ear tags and with either a radio collar, visual collar, or both. Radio collars were manufactured by AVM Instrument Company (Champaign, Illinois). These collars weighed 1.1 kg and were constructed of machine belting 13 mm thick and 65 mm wide with an adjustable inner circumference of 101 to 106 cm. The belting surrounded the radio components which were encased in dental acrylic, making the unit waterproof. Each radio was equipped with a SB-2 transmitter powered by cold resistant lithium batteries.

All radios operated on frequencies between 150.700 and 151.875 MHz. Each visual collar (as described by Franzmann et al. 1974) had three sets of numerals, one on top and one on each side, to facilitate identification from the air. Visual collars were placed over many of the radios to enable observers to more easily pick out the radioed individual from a group of moose.

When conditions permitted, a lower front incisor was removed from each moose for age analysis using techniques developed by Sargent and Pimlott (1959). Blood and hair samples also were collected to aid in assessing physiological condition using methods described by Franzmann et al. (1975). Several physical measurements were taken when time permitted and general physical condition was assessed according to criteria developed by Franzmann and Arneson (1973). Cows captured in March were rectally palpated using techniques described by Greer and Hawkins (1967) to determine pregnancy.

Radio tracking flights were made monthly in a Piper PA-18 Supercub equipped with two three-element Yagi antennas connected to a four band, 12 channel portable receiver manufactured by AVM Instrument Company. Tracking methods were similar to those described by Mech (1974). Radio locations, vegetation type and miscellaneous notes were recorded for each observation (Fig. 2). During parturition, flights were increased to approximately every 3 to 5 days to more adequately assess initial production and survival of calves.

Figure 2. Survey form used to record data during radio tracking flights along the Susitna River. Devils Canyon Project, 1978.

SUSITNA STUDY

MOOSE RADIO OBSERVATION FORM

Observer: Weather:

Time off: Temp.:

Time On:

Radio #	Channel	Seen	Calves	Location	Vegetation	Notes
8583	4-7-4.0					
8584	4-8-2.0					
8586	4-10-3.2					
8589	4-12-3.0					
8580	4-6-2.0					
8038	4-3-2.8					
8573	2-9-3.5					
8576	3-6-0.0					
8022	1-4-2.5					
8588	4-12-2.4					
8040	4-11-.5					
8578	4-4-3.9					
8579	4-5-1.9					
8031	3-8-2.5					
8035	3-12-1.4					
8018	1-2-3.8					
8030	3-7-1.5					
8575	2-12-4.2					

FINDINGS

Numbers of Moose Captured

Thirty-nine moose were captured and collared during October 1976 and March 1977 along the Susitna River in the vicinity of that portion of the river which would be inundated by the construction of the proposed dams at Devils Canyon and Watana Creek. Although the 13 moose collared in October were not originally part of this study, the data from these animals is included in this report. Collaring location and other pertinent tagging statistics are summarized in Table 1. Eighteen moose were fitted with radio transmitters and 21 wore numbered visual collars only. Twenty-seven incisor teeth were collected during the collaring operation, and cementum layer analysis indicated the average age for females was 6.7 years with a range from 2 to 13 years. Yearlings were generally avoided during the collaring operation. Of 21 females palpated, 18 were pregnant (85.7 percent).

Blood and physical measurement data were combined with those from other moose studies and were presented elsewhere (Ballard and Taylor, in prep.). Briefly, the pooled blood parameters tested were very comparable to values obtained from other studies of populations considered to be in good condition. Some parameters tested (hemoglobin and pack cell volume) from the Devil Mountain area were lower than those from the other tagging sites, but it is not known if those differences were statistically significant since no tests have as yet been performed.

Table 1. Date, location and general information of female moose radio and visual collared along the Susitna River. Devils Canyon Project, March 1978.

Collar Number	Collaring Date	Location	Anectine Dosage	Cementum Age (years)	Condition*	Pregnant**
8583	3/18/77	E. of Devil Mtn.	27 mg.	4	6	No
8584	3/18/77	E. of Devil Mtn.	25 mg.	-	6	Yes
8586	3/18/77	Devil Mtn.	23 mg.	10	4	Yes
8589	3/18/77	E. of Devil Mtn.	27 mg.	-	-	No
8580	3/18/77	Devil Mtn.	23 mg.	-	-	--
8038	10/27/76	Watana	-- --	9	-	--
8573	3/19/77	Susitna-Watana	27 mg.	-	7	Yes
8576	3/19/77	Susitna-Watana	28 mg.	8	6	--
8022	10/28/76	Upper Watana	29 mg.	10	7	--
8588	3/19/77	Upper Jay Creek	29 mg.	8	7	--
8040	10/28/76	Upper Watana	29 mg.	-	7	--
8578	3/20/77	Susitna-Tyone	27 mg.	2	5	No
8579	3/20/77	Susitna-Tyone	25 mg.	3	6	Yes
8031	10/22/76	S. Bend-Susitna	27 mg.	-	7	--
8035	10/27/76	S. MacLaren Flats	-- --	-	7	--
8018	10/27/76	Butte Creek	29 mg.	2	6	--
8030	10/22/76	W. of Ballard L.	25 mg.	6	6	--
8575	3/21/77	Lower Maclaren	29 mg.	11	7	Yes
2 Blue	10/22/76	N. Oshetna R.	-- --	9	-	--
4 Blue	10/22/76	Susitna-Tyone	-- --	4	-	--
5 Blue	10/22/76	Susitna-Tyone	27 mg.	6	7	--
6 Blue	10/22/76	Susitna-Tyone	27 mg.	5	-	--
7 Blue	10/22/76	Susitna-Tyone	25 mg.	6	-	--
71 Blue	10/28/76	Jay Creek	29 mg.	3	-	--
50 Blue	3/22/77	Lower Maclaren R.	27 mg.	8	6	Yes
51 Blue	3/22/77	Lower Maclaren R.	25 mg.	3	6	Yes
52 Blue	3/22/77	Lower Maclaren R.	27 mg.	7	7	Yes
53 Blue	3/22/77	Lower Maclaren R.	27 mg.	-	5	Yes
54 Blue	3/22/77	Lower Maclaren R.	25 mg.	4	-	Yes
56 Blue	3/22/77	Lower Maclaren R.	27 mg.	7	7	Yes
58 Blue	3/22/77	Lower Maclaren R.	27 mg.	12	7	Yes
60 Blue	3/20/77	Susitna N. of Tyone	28 mg.	13	-	--
61 Blue	3/20/77	Susitna N. of Tyone	25 mg.	-	7	Yes
63 Blue	3/20/77	Susitna Bend	27 mg.	5	7	Yes
64 Blue	3/20/77	Susitna Bend	27 mg.	11	7	Yes
75 White	3/19/77	Jay Creek	28 mg.	-	-	Yes
79 White	3/19/77	Jay Creek	28 mg.	-	-	--
80 White	3/18/77	E. Devil Mtn.	25 mg.	4	-	Yes
81 White	3/18/77	E. Devil Mtn.	27 mg.	-	7	Yes

*Condition was determined by general appearance and relative amount of fat over rump and ribs. Scale of 1-10, 10= excellent. See Franzmann et al. (1974) for criteria.

**Only cows collared in March and palpated are included in this column.

A total of 270 observations were recorded for 18 radio collared moose between late October 1975 and mid November 1977. One radio collared moose was found dead two weeks after collaring. The cause of death was undetermined; we suspect, however, that it was drug related. Another moose was lost from the sample when we were unable to relocate it after one month of tracking. Its loss was attributed to a faulty transmitter.

Movements

Radio-collared moose occupied areas ranging from 21 km^2 to 520 km^2 (Table 2). Significantly smaller areas were occupied in the rugged terrain between Jay Creek and Devils Canyon than east of Jay Creek where the terrain becomes more open and level. The correlation between the number of sightings and size of range for each moose was $r = 0.50$. Observed locations and detailed movements of each radio-collared moose are presented in Appendix I. A brief description of radioed moose movements follows.

Devil Mountain Area

Three moose (#s 8583, 8584 and 8586) were radio-collared on Devils Mountain on 18 March 1977, approximately 3 km north of the Susitna River (Fig. 3). All three remained in the vicinity of their tagging location until spring when #8583 moved 8 km east. Both #8584 and #8586 remained on their winter range through April. At the end of May, during the peak of calving, #8584 and #8586 were located 10-11 km to the southeast on the other side of the Susitna River within 2 km of each other. Three

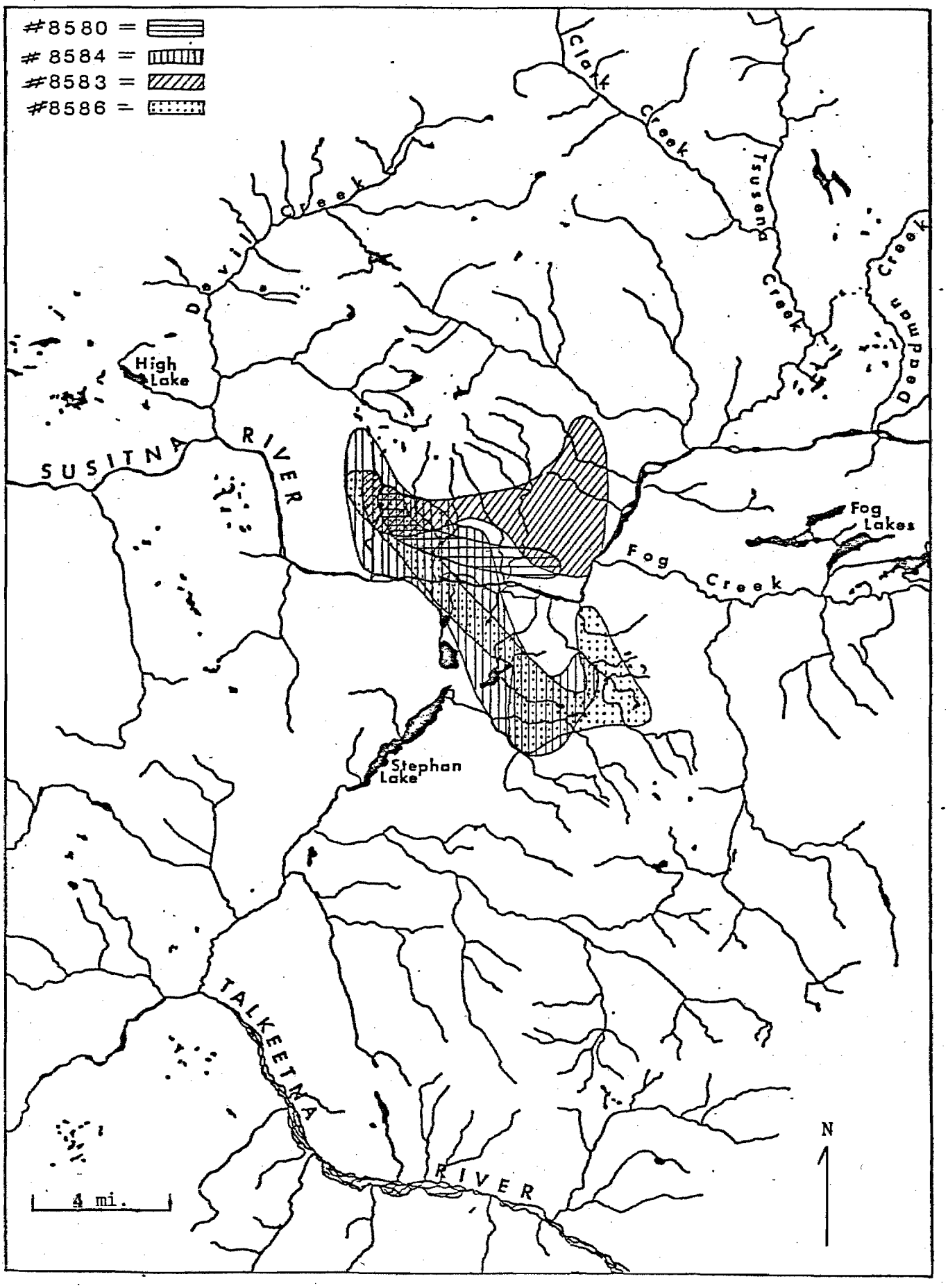
Table 2. Range size, number of locations and minimum number of river crossings of radio collared moose along the Susitna River. Devils Canyon Project, March 1978.

Collar Number	Number of Locations	Range Length km.	Range Width km.	Total Area km^2	Minimum number of river crossings
8583	12	11.6	4.8	30.9	0
8584	12	17.7	4.5	37.3	3
8586	10	17.7	5.3	30.9	1
8589	2	--	--	--	-
8580	3	--	--	--	-
8038	19	14.2	9.3	51.5	0
8573	14	14.8	7.9	47.6	2
8576	12	6.9	6.4	20.6	0
8022	18	24.8	17.2	180.2	1
8588	11	13.5	8.2	39.9	1*
8040	19	17.1	6.4	49.9	0
8578	17	14.3	5.5	32.2	1
8579	10	30.6	11.9	173.2	2
8031	26	16.1	12.1	74.7	0
8035	23	62.3	14.0	373.4	0
8018	18	65.0	18.7	520.1	2
8030	24	55.5	21.2	415.8	2
8575	20	103.0	10.5	291.4	0
	270 Total		Ave. range size 148.1 km^2		15 Total

* Cow observed on island.

Correlation between number of sightings and size of range for each moose = .50.

Figure 3. Location and General Range Size for Radio-Collared Moose Along the Susitna River near Devil Mountain. Devils Canyon Project, March 1978.



days later #8584 was seen with two new calves and #8586 was seen with one. Number 8583 was not pregnant when palpated in March. She remained on the north side of the river within a 3 km radius of her April location. Number 8586 lost her calf within two weeks and remained through the fall within 6 km of her calving location. Moose #8584 lost one calf within the first two weeks and the other prior to the first week in July. She was found on the north side of the river on 28 June and on the south side on 5 July where she remained through the fall. All three moose remained at elevations below 950 m during the time they were monitored. Some seasonal fluctuation in elevation occurred just prior to calving as #8584 and #8586 moved down from the south facing slope of the riverbank and crossed the river to calve. Seasonal home ranges for all three moose appeared to be small, probably not in excess of 20 km^2.

Watana Creek Area

Three radios were placed on cows along upper Watana Creek in October. Two of these females, #8040 (Fig. 4) and #8022 (Fig. 5), were collared together. Both moved to lower elevations as winter progressed and remained there until June. Number 8040 was seen with twins on 8 June but on 16 June the calves were missing and were never seen again. The cow returned to upper Watana Creek and remained within a 2 km radius throughout the fall. Number 8022 traveled considerably farther than #8040 as she crossed the Susitna sometime in February and returned in March. On 1 June she was seen in the same vicinity as #8040 on lower Watana Creek. On 16 June they were again found in close proximity. Her movements indicated no distinct migration between winter and summer

Figure 4. Location and General Range of Radio Collared Moose Numbers 8038, 8040 and 8573 Along Watana Creek. Devils Canyon Project, March 1978.

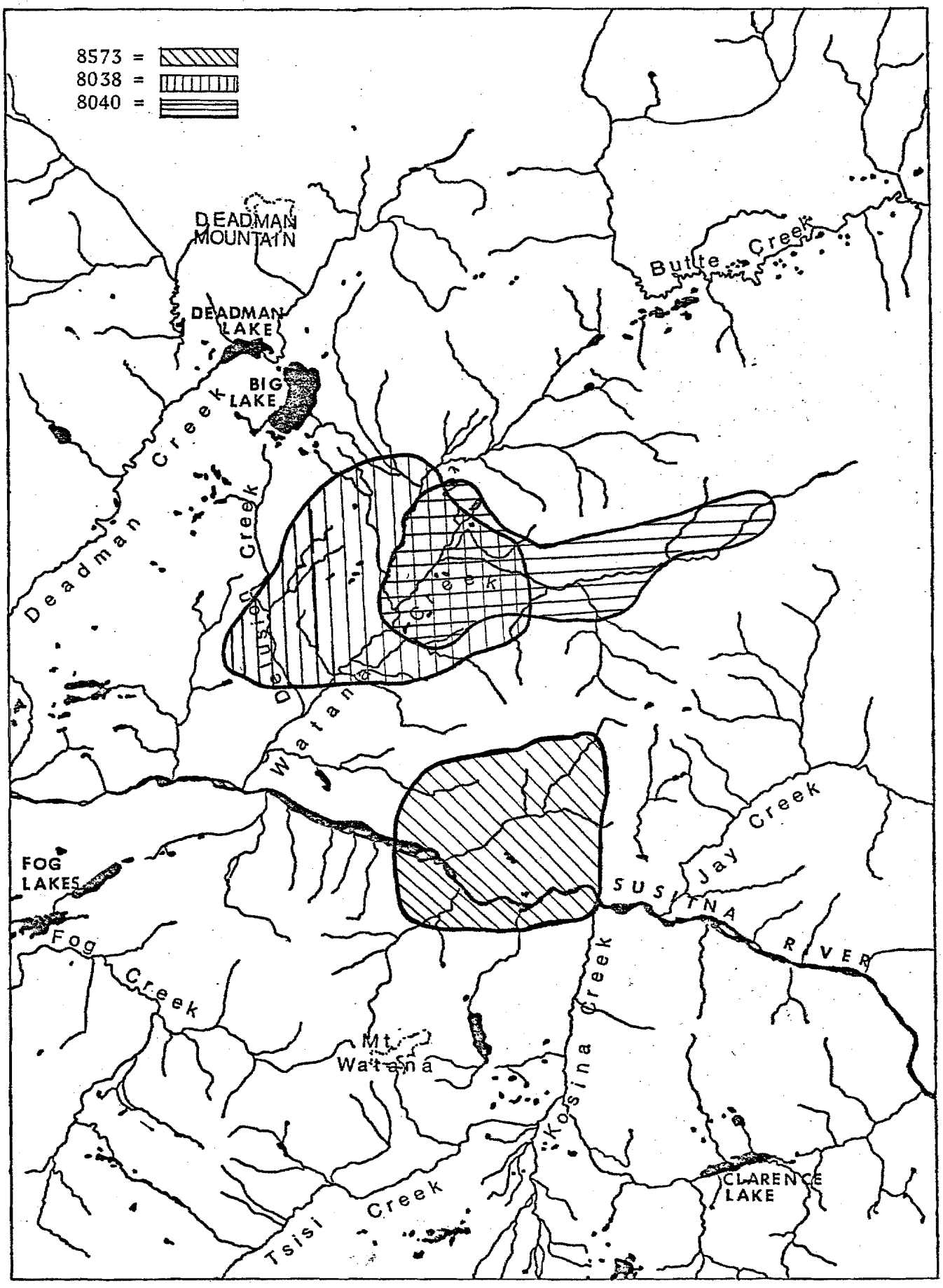
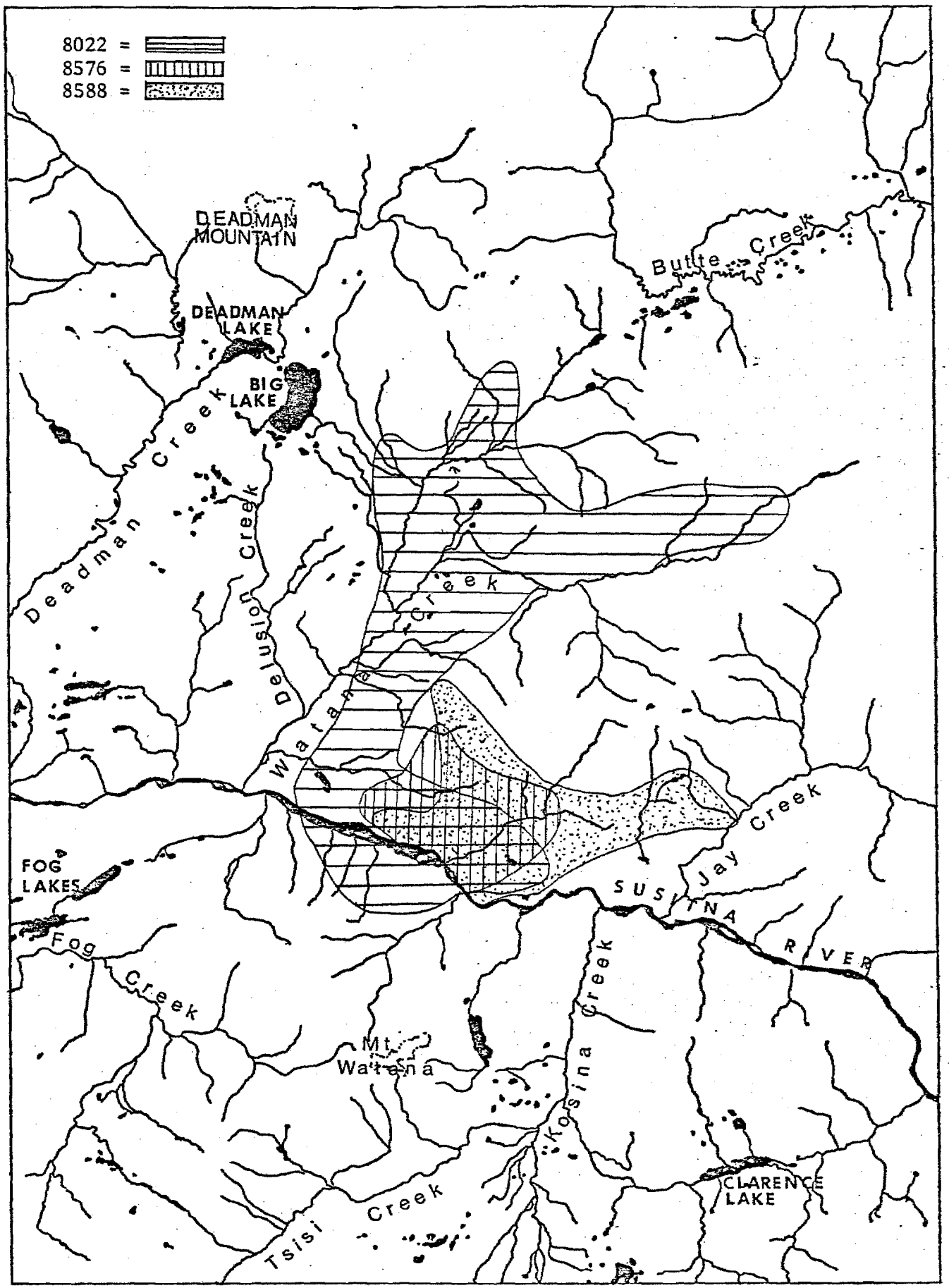


Figure 5. Location and General Range of Radio Collared Moose Numbers 8022, 8576 and 8588 Along Watana Creek. Devils Canyon Project, March 1978.



ranges. Number 8022 was never seen with a calf. During the calving season she was found in four different locations.

Number 8038 was collared 5 km south of Big Lake. During all 19 observations this moose was between 600 m and 950 m elevation (Fig. 4). Although she was observed with a new calf on 26 May, when checked again on 31 May the calf was missing. From June through fall she appeared to move constantly, and ranges used throughout this period overlapped that of winter observations.

On 19 March three females (#s 8573, 8576 and 8588) were collared on the north side of the Susitna between Watana and Jay Creeks. Number 8576 moved less extensively than any of the other radio collared females (Fig. 5). She was observed 12 times, all on the north side of the river within an area of approximately 28 km^2. When last observed on 30 November she was within 2 km of her tagging location. Female #8588 also wintered along the north bank of the Susitna. She moved to an island in the river in early June and was observed again on the north bank on 8 June where she remained through November (Fig. 5). Number 8573 wintered along the north shore of the Susitna and crossed to the south bank during calving season (Fig. 4). She was never observed with a calf, although it was determined that she was pregnant when collared. However, she was not visually observed between 26 May and 3 June. She remained on the south side of the river until July when she returned to her collaring location. She stayed there until 30 November when, after a moderate snowfall, she moved to lower elevations near the mouth of Watana Creek.

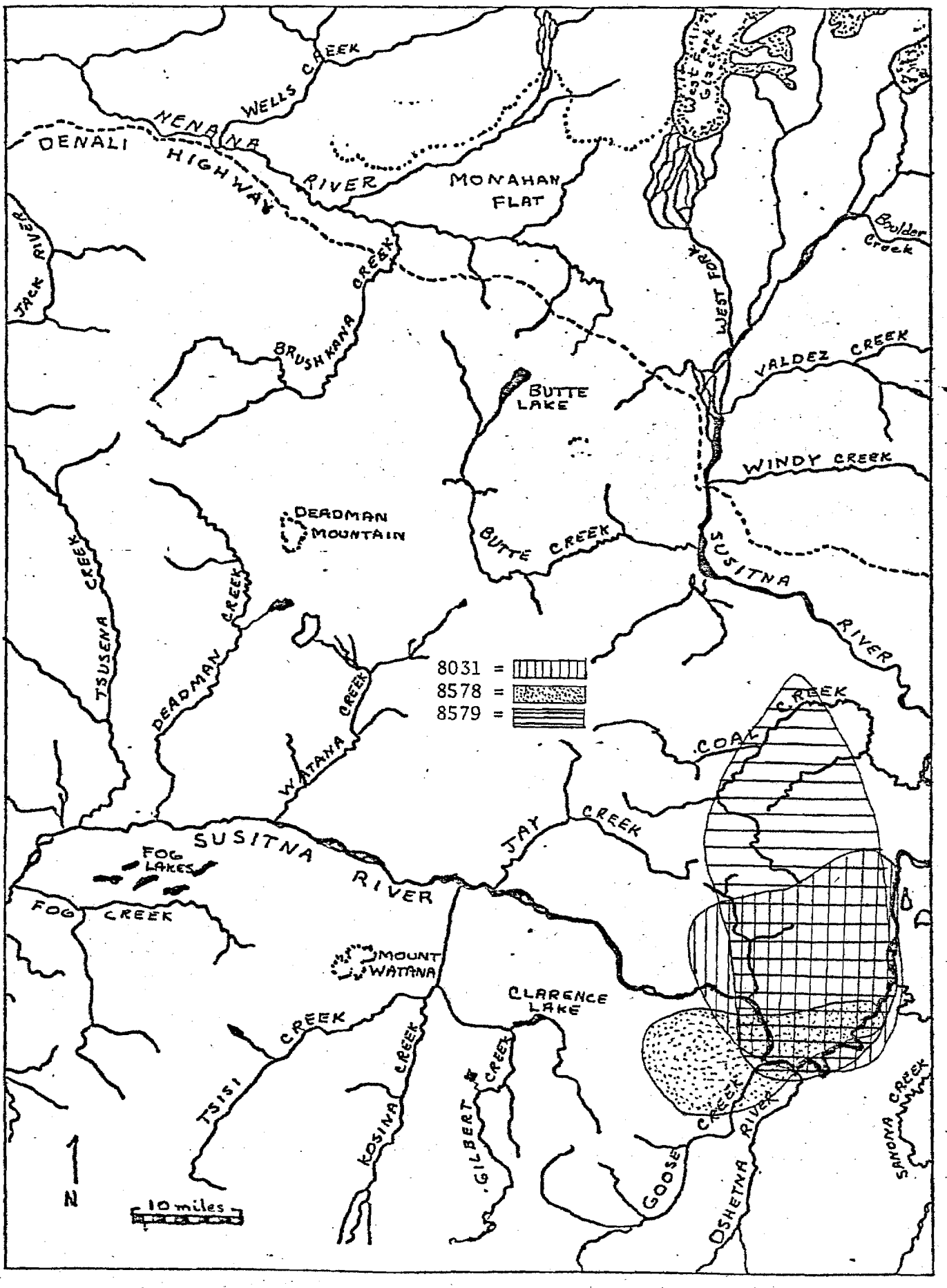
Susitna Bend Area

Movements were more extensive for those moose collared east of Jay Creek. Number 8031 was collared in October 1976 on the north side of the Susitna near the mouth of the Tyone River. Two others, #s 8578 and 8579, were collared in the same vicinity in March 1977. Number 8031 was observed almost exclusively between 600 m and 950 m in spruce habitats along the north and west banks of the Susitna (Fig. 6). She was never observed on the south bank of the river. She had a calf when tagged which survived the winter, but she was never observed with a calf the following spring. No seasonal range preference is discernible from her movement pattern.

Number 8579 was once found 30 km from where she was collared (Fig. 6). She wintered along the Susitna and crossed to the mouth of Goose Creek in May. She returned to the north side and moved to higher elevations near the headwaters of Coal Creek during calving where she remained through November. She was not located during June and was not observed with a calf in July, although it had been determined in March that she was pregnant. She remained in the high country through November.

Cow #8578 wintered in the same vicinity as 8579 and then crossed the Susitna to the mouth of the Oshetna River (Fig. 6). She never returned to the north side and spent the remaining summer months and fall in an area of approximately 7 km^2, west of the mouth of Goose Creek. Number 8578 was not pregnant when collared in March.

Figure 6. Location and General Range of Radio Collared Moose Numbers 8031, 8578 and 8579 Downstream from the MacLaren River. Devils Canyon Project, March 1978.

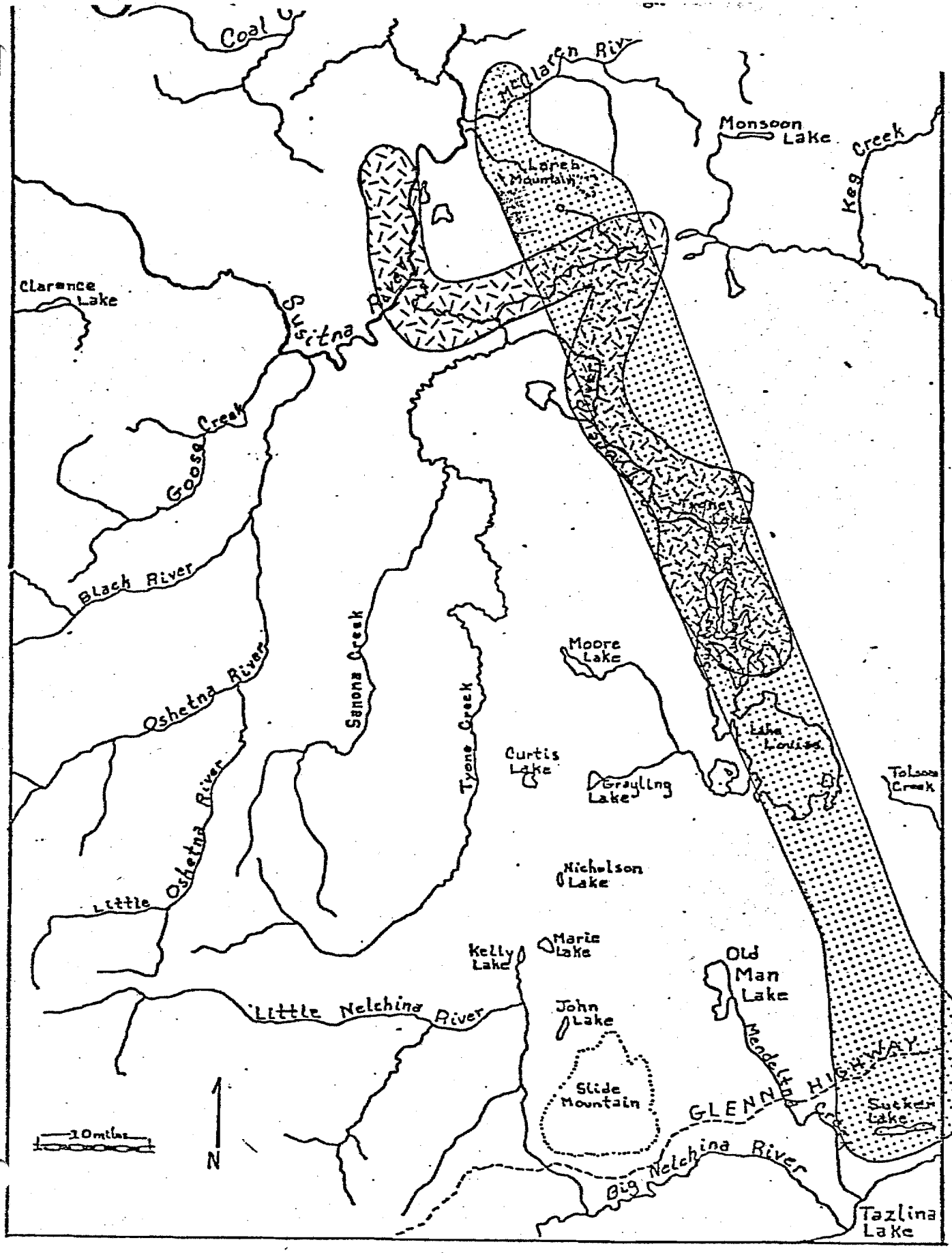


Number 8030 was collared very close to #s 8031, 8578 and 8579, but her movement patterns were totally dissimiler (Fig. 7). She moved south across the Susitna River and wintered along the drainage of the Tyone River. By 10 May she had moved 2 km to an island in Susitna Lake and was observed there with a calf on 30 May. She remained with her calf through August in the vicinity of Tyone Village and returned on 5 October to within 1 km of her collaring location.

Maclaren River Area

Two females, #s 8035 and 8575, were collared along the Maclaren River. Number 8035, collared on 27 October 1976, moved 59 km during November and early December to the mouth of the Oshetna River where she remained through March (Fig. 8). On 22 April she was observed returning to the vicinity of her tagging location. She was observed on several occasions in this area without a calf throughout the summer and fall. By 22 November she had returned to the mouth of the Oshetna River, 50 km from her previous location. During April 1977, #8575 migrated 103 km, the longest movement recorded during this study, from the lower Maclaren River to Sucker Lake south of the Glenn Highway near Tazlina Lake (Fig. 7). She was pregnant when collared in March but was never observed with a calf. This moose remained near Sucker Lake through May and moved 11 km north to Tolsona Ridge during June where she spent most of July and August. She returned once to Sucker Lake and made one trip to Lost Cabin Lake, but both times moved back to Tolsona Ridge. On 30 September she was observed moving back towards her tagging location on the Maclaren. By 5 October she had returned 82 km and was within 9 km of her collaring location.

Figure 7. Location and General Range of Radio Collared Moose Numbers 8030 and 8575 Southeast from the MacLaren andSusitna Rivers. Devils Canyon Project, March 1978.



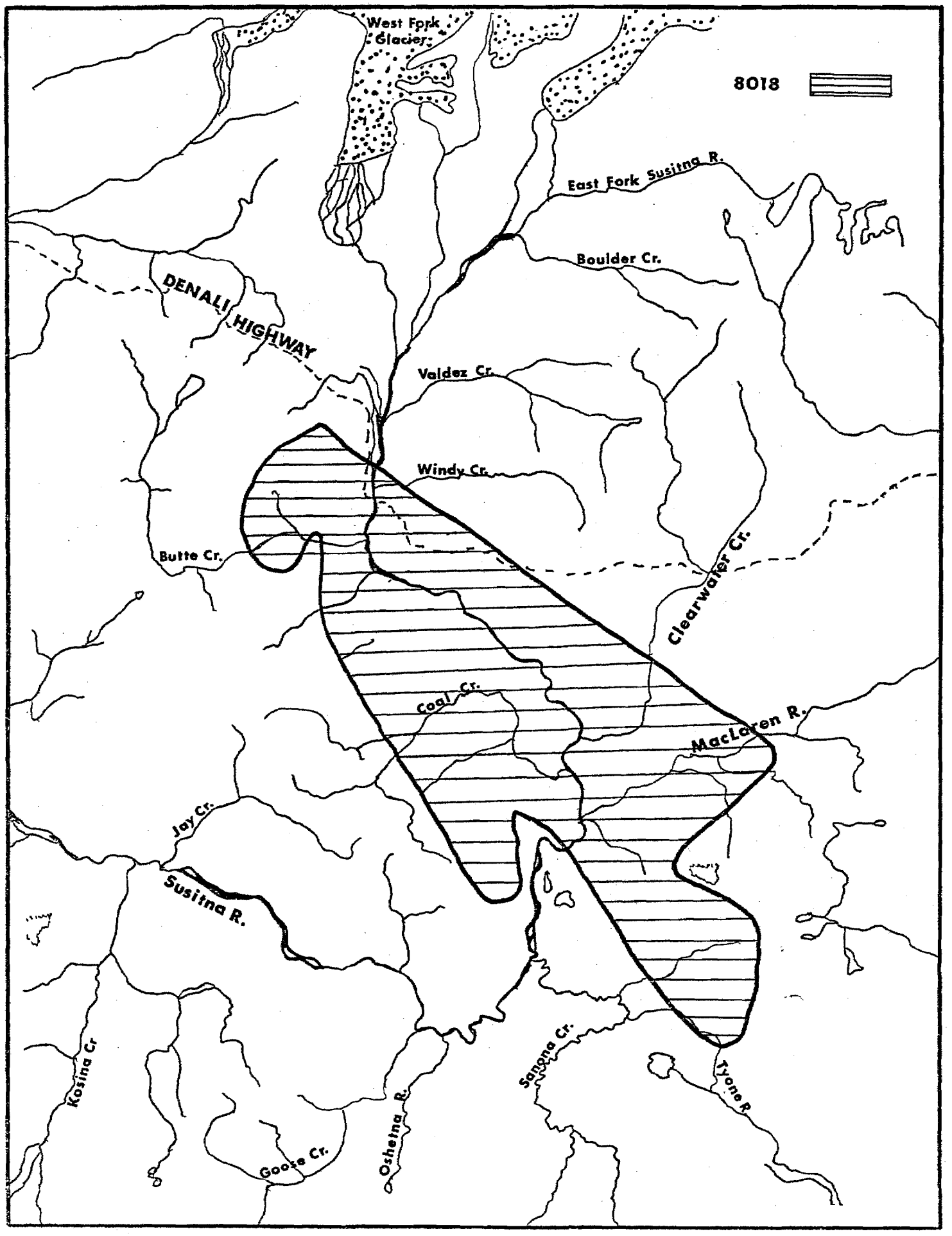
Female #8018 was collared in October along Butte Creek. She was accompanied by a calf and remained in the Butte Creek vicinity through January (Fig. 9). On 7 February she and her calf were observed across the Susitna, 43 km away on the north side of Kelley Lake. She wintered there with her calf and began moving up the Maclaren in April. On 30 May she was seen with a new calf which was observed until 10 June. By 12 July she had returned 30 km in the direction of her tagging location and remained in the same vicinity she had inhabited the previous fall through November.

Radio-collared moose movement data were supplemented somewhat by incidental observations of visually collared moose. Eleven additional river crossings were documented and possible migratory directions were identified (Fig. 10). The second longest movement during this study occurred when the moose wearing visual collar #80 was found near Lone Butte, 84 km southeast of her tagging location at Devils Mountain. Of the moose collared west of Jay Creek, she alone showed any migratory movement of significant distance. Collar number 60 was tagged in March 1977 just north of the mouth of Tyone Creek and was found 78 km to the northwest between the Nenana River and West Fork Glacier in August. One moose, #10, collared along Butte Creek in October 1976 moved down Watana Creek to the Susitna where she was found in August. Another, #67, was collared near Susitna Lodge in March 1977 and was located in November at the headwaters of Jay Creek.

Habitat Use

Habitat types being utilized by collared moose were noted during

Figure 9. Location and General Range of Radio Collared Moose Number 8018 Along the Maclaren and Susitna Rivers. Devils Canyon Project March 1978.



radio-tracking flights, and observations were categorized in nine groups (Table 3). Because spruce is the dominant vegetation over much of the study area and is widely variable in density, three categories were used to describe it. One hundred and seventy-two habitat observations of radio-collared moose were noted during tracking flights. Seventy percent of all observations were in spruce dominated habitats. Moose were most often (29.7 percent of observations) found in medium spruce areas where trees ranged from six to 15 m high in stands of moderate density.

Calving took place primarily in open spruce areas, most often at lower elevations where stands of trees four to 14 m high were interspersed with openings. Eight calves, including one set of twins, were born in spruce habitats while one cow gave birth to a set of twins in alder dominated habitat. Alder and willow areas at and above timberline were utilized during the rutting season until late in the fall when snow depths approached one meter.

Between Devil Creek and Watana Creek, radio-collared moose remained throughout the year almost exclusively at the lower spruce dominated elevations. Moose collared along upper Watana Creek were observed more often in willow-alder communities except during late winter when they were generally found in spruce habitats at lower elevations.

DISCUSSION

Movement patterns of moose are highly variable. Studies throughout North America (Edwards and Ritcey 1956, Houston 1968, Goddard 1970,

Table 3. Number of observations of radio collared moose in vegetation types along the Susitna River between October 1976 and December 1977. Devils Canyon Project, March 1978.

Collar Number	Total Sightings	Open Spruce*	Medium Spruce	Dense Spruce	Spruce/ Hardwood**	Alpine Tundra	Alder	Willow	Riparian Willow	Open
8583	10	4	2	1	3					
8584	9	5	2	1	1					
8586	7	3	4							
8589	1			1						
8580	2		1	1						
8038	13	5	4	1		1			1	1
8573	10		6	1	1		1	1		
8576	12	3	8				1			
8022	8	1	2				3	1	1	
8588	9	2	3	1			1	2		
8040	10	1					6	1	2	
8578	12	6		1	1	2	1	1		
8579	9	1	1	2	1	2		1	1	
8031	11	1	7	2				1		
8035	12	3	3	1		1		1	3	
8018	11	3	2			1	2	2	1	
8030	11	2	3	6						
8575	15	3	3	7			1		1	
	172	43	51	26	7	7	16	11	10	1
Percent of Total	100.0	25.0	29.7	15.1	4.1	4.1	9.3	6.4	5.8	.6

*Spruce categories include both white spruce (*Picea glauca*) and black spruce (*Picea mariana*).
**Hardwoods in this category include aspen (*Populus tremuloides*) and birch (*Betula papyrifera*).

LeResche 1972) support the hypothesis that movement patterns in moose may range from being sedentary to seasonal migrations of great distances. Peterson (1955) believed that many moose spend their whole lives in an area of 32-800 km^2. This appears to be true for many of the moose in the Susitna study area. Nine of the 16 moose radio-collared and tracked for 13 months along the Susitna River occupied areas smaller than 52 km^2. All but one of these were collared west of Jay Creek where the river valley is fairly narrow and is surrounded by mountains.

LeResche (1974) found that home range seldom exceeds 5-10 km^2 during a given season. Because radio-collared moose were only monitored for 8 to 13 months during this study, data were inadequate to allow computation of seasonal home range sizes. It was noticed, however, that several of the radio-collared moose were found repeatedly in areas less than 10 km^2 in extent. Others appeared to be more nomadic, particularly those collared in the eastern portion of the study area where they wandered across areas up to 50 km^2 during the spring and summer.

Areas of low elevation are often inhabited by both migratory and nonmigratory moose during winter and spring (LeResche 1972). This was apparent in the Devil Mountain area where #80 was collared. Between March and September 1977 she moved a straight line distance of 84 km to the southeast while a cow collared at the same time in the same location remained within 11 km of her collaring site throughout the year. This was also true of the wintering area between the Tyone River and Goose Creek to which many moose migrated considerable distances. Number 8031 remained in this area throughout the 13 months of this study.

Edwards and Ritcey (1956) noted that increasing snow depths above timberline triggered moose migrations out of the high country to their wintering areas in the lowlands. Their observations have been supported in Alaska by Rausch (1958) and LeResche (1974), both of whom concluded that the fall migration in Interior Alaska is closely related to snow conditions. Snow depths along the Susitna River during the winter of 1976-77 were below normal until late March. They appeared to be greater along the eastern portion of the study area than west of Jay Creek. Shortly after accumulated snow reached its maximum depths, most collared moose east of Jay Creek either migrated short distances where a considerable drop in elevation was possible, or made long treks to their wintering areas, gradually moving to lower elevations. Except for #80, those west of Jay Creek showed no tendency to migrate at all. Radio collared moose in this area may be representative of a sedentary population, but it is recognized that data collections over a 13-month period which includes subnormal snow depths are inadequate to accurately assess the migratory nature of moose along this stretch of the Susitna River. If data from this small sample are representative of the moose population currently inhabiting this stretch of the Susitna River, construction of the Devils Canyon dam would have a highly detrimental effect on the population as the dam would inundate a major portion of the winter habitat presently available. Destruction of this winter range would substantially reduce the carrying capacity of a major portion of the Devil Creek drainages.

Some of the possible migratory routes represented by data accumulated thus far are illustrated in Fig. 10 and others are illustrated in Appendix I. The relative significance of each of these is unknown at this time,

although it is apparent that a substantial number of moose migrate to and utilize the area near the mouth of the Tyone and the Oshetna Rivers for winter range. Coady (1974) noted that the depth, density and hardness of snow are appreciably lower in coniferous and deciduous tree communities making them more favorable to moose under stress from severe winter snow conditions. The lower, spruce-covered reaches of the Watana Creek Valley are probably critical for the majority of moose inhabiting this area during a severe winter. A major portion of this area would be inundated by construction of the Watana dam. Additional observations of moose during normal or severe winter conditions are necessary to determine the importance of this area as winter range. If this area is used as winter range during more severe winters which would normally occur in this area, construction of the Watana Dam would substantially reduce the carrying capacity of this portion of the study area.

Present information indicates moose depend heavily upon the river bottoms and adjacent areas for winter habitat both above and below the Watana and Devils Canyon damsites. Lack of adequate wintering areas in the lower Susitna Valley has been a major limiting factor to moose population growth there in the past (Chatelain 1951). Most existing winter range is along the major rivers where periodic flooding has caused rechanneling of the main stream, allowing riparian willow to colonize the dry stream beds. Regulating the flow of water from the dam at Devils Canyon could have a highly detrimental effect on growth of riparian vegetation downstream to the mouth of the Susitna. It is possible that maintaining a steady flow of 8,000 to 10,000 cu. ft./sec. from the Devils Canyon dam would effectively prevent the flooding activity

that presently occurs periodically. This could create a short-term abundance of winter range along the riverbanks that might last 30 or more years. The net long-term effect could well be a negative one, however, as it is suspected that the present natural flooding activity of the Susitna River produces favorable conditions for browse production. Without these annual floods, these riparian areas could become mature stands of hardwoods after 25 or 30 years and provide little or no winter forage. Research on riparian vegetation habitat types and associated moose usage downstream of dam construction is essential to determine potential impacts on moose populations.

CONCLUSIONS

The emphasis of this telemetry study focused almost exclusively on the north side of the Susitna River upstream from the Devils Canyon dam site. Information on migratory routes and annual movement patterns was limited by the small sample of radio-collared moose (18), many of which were observed for less than nine months. Moose which were collared in October 1976 were monitored through the winter of 1976-77 which was considered to be mild. Information pertinent to identifying critical wintering areas is most appropriately obtained during winters of high to severe snow depths as moose tend to congregate in greater densities on the most vital ranges as snow depths increase. Acquisition of moose movement information downstream and on the south side of the Susitna River is essential in order to evaluate the full effects of the proposed hydroelectric project. Downstream effects on moose would be expected to be significant since vegetation composition would be altered substantially as a result of regulated water flow.

Annual moose harvests within the immediate drainages along the upstream portion of the Sustina River have averaged 146 moose since 1974 (ADF&G, unpublished data). Approximately 475-500 sportsmen participate in moose hunts in this area each fall (ob. cit.). How significantly dam construction might reduce or increase this level of activity is difficult to project with the limited data available. Construction of an access road to the Watana site would substantially increase hunter pressure in the area, creating a corresponding increase in total man days spent hunting. The quality of the hunting experience would probably decline, however, as well as the rate of hunter success. Dam construction and maintenance schedules are projected on a basis of a dam life of 100 years. If impacts of the project reduced local moose populations by 50 percent this would amount to a corresponding loss of harvest of 7,300 moose during the life of the dam.

Construction of the Devils Canyon dam would flood a 45 km portion of the Susitna River having a surface area of 7,500 acres (USF&WS, 1975). The riverbanks along this portion of the river are generally steep and provide marginal habitat for moose. The low density of moose tracks in this area throughout the winter of 1977-78 indicates that little utilization occurs during winters of moderate snowfall. Since water levels in the Devils Canyon reservoir are expected to remain fairly constant, low mortality rates associated with ice shelving and steep mud banks would be expected.

Construction of the Watana dam would result in inundation of 43,000 acres along Watana Creek and the Susitna River. Approxiamtely 35,000

acres sustain moderate to heavy utilization by moose during an average winter (USF&WS 1975). Much of it supports moderate moose densities during the spring and summer seasons as well. The preliminary movement data gathered thus far from radio collared moose indicate that moose from several surrounding areas of the Susitna Basin migrate across or utilize this portion of the river during some period of the year. The Alaska Department of Fish and Game recorded observations of 2,037 moose during their fall 1977 sex and age composition counts of these areas (ADF&G, unpublished data). LeResche and Rausch (1974) concluded that an observer generally sees between 43 to 68 percent of the moose in an area during an aerial census. Using 50 percent to extrapolate roughly, the resident population utilizing this portion of the basin probably falls between 4,000 and 5,000 moose. Random stratified counts weighted with an accurate sightability index are needed to accurately assess numbers of moose.

Effects of the construction of the Watana dam on these moose populations could be substantial. The resident nonmigratory segment of the population could be eliminated. The immediate loss of a major portion of the winter range along Watana Creek and parts of the Susitna River to flooding would have the effect of reducing the carrying capacity of the habitat at higher elevations used only during the warm seasons and mild winters. The Watana Reservoir would be 87 km long and may during some seasons prove to be an effective barrier to migrations. The resulting disruption of movements to traditional breeding grounds may adversely affect productivity. Increased mortality of neonates during post calving movements might occur. Since water levels are expected to fluctuate as much as 78 m, ice shelving could become a significant cause of mortality as well.

Calving is a common occurrence in these portions of the study area. The loss of calving habitat notwithstanding, fluctuating water levels would convert the presently timbered slopes from the Watana dam site to the Oshetna River to enormous mud banks. Calf mortality from slipping downhill or getting stuck in the mud could become a common occurrence.

RECOMMENDATIONS

Collection of baseline biological data and completion of resource assessment in the area affected by the proposed hydroelectric project in far greater depth than this study is an essential prerequisite to understanding the possible impacts of the proposed action (Appendix II). Identification of moose populations, movement patterns, and habitat use downstream and on the south side of the Susitna River is essential to predict both negative and beneficial impacts of the proposed prject. Habitat studies should be conducted concurrently to determine seasonal use and degree of dependency of populations on habitat to be impacted by the project. Alternate areas suitable for habitat rehabilitation to mitigate range losses should be investigated as well as suitable methods for habitat enhancement.

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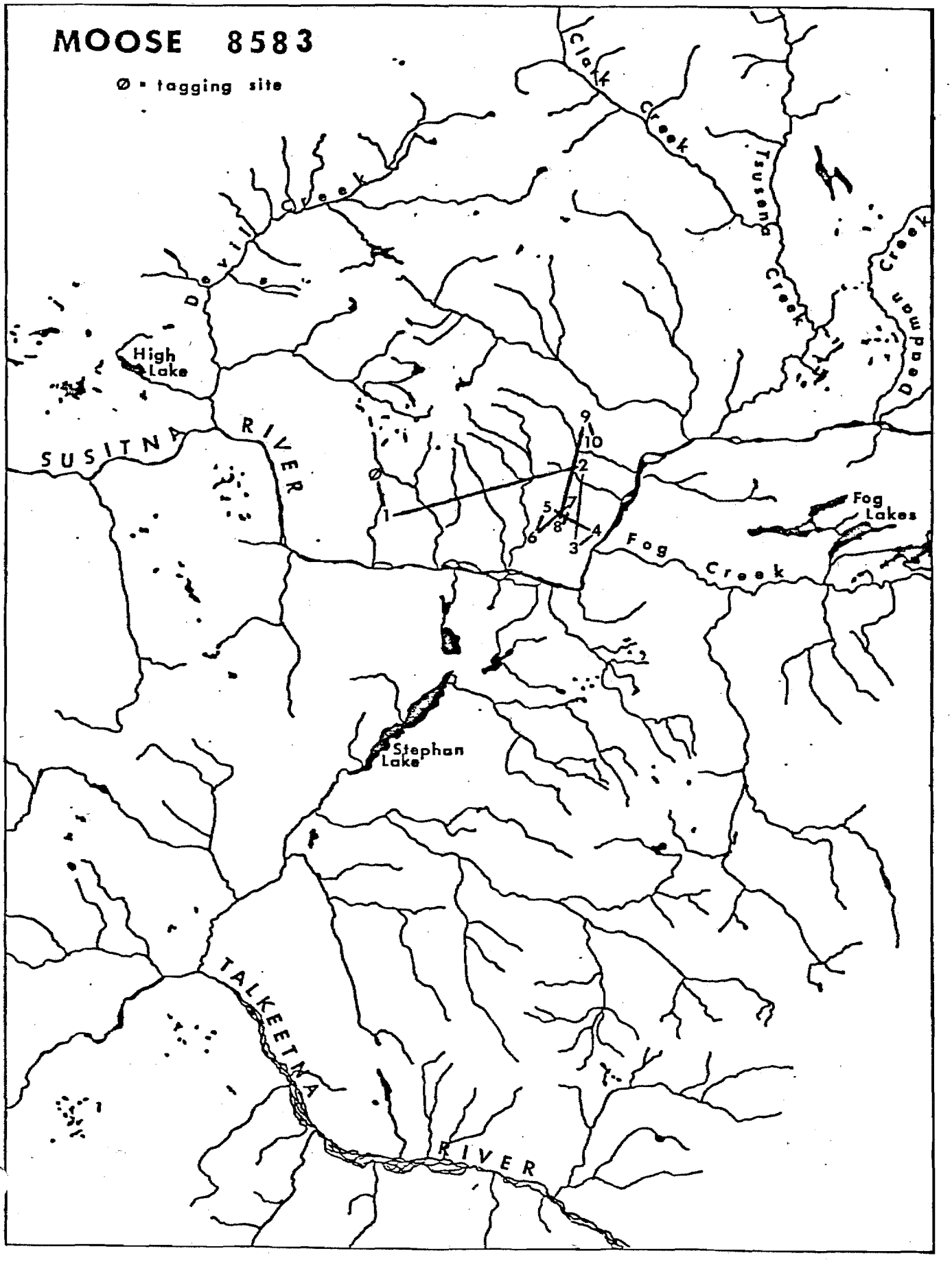
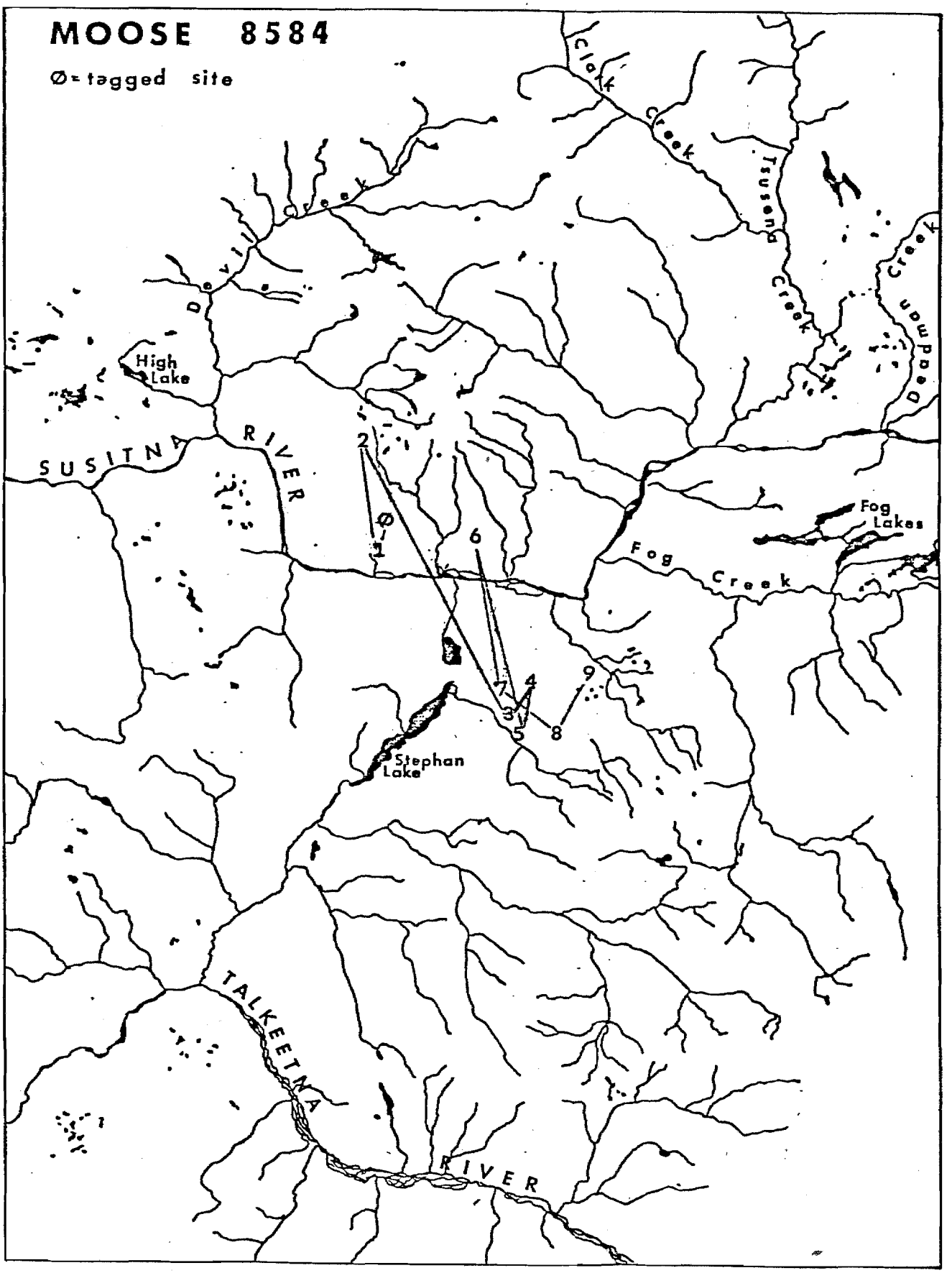
Appendix I. Individual Observations and Locations of each Radio Collared Moose Between October 1976 and November 1977. Devils Canyon Project, March 1978.



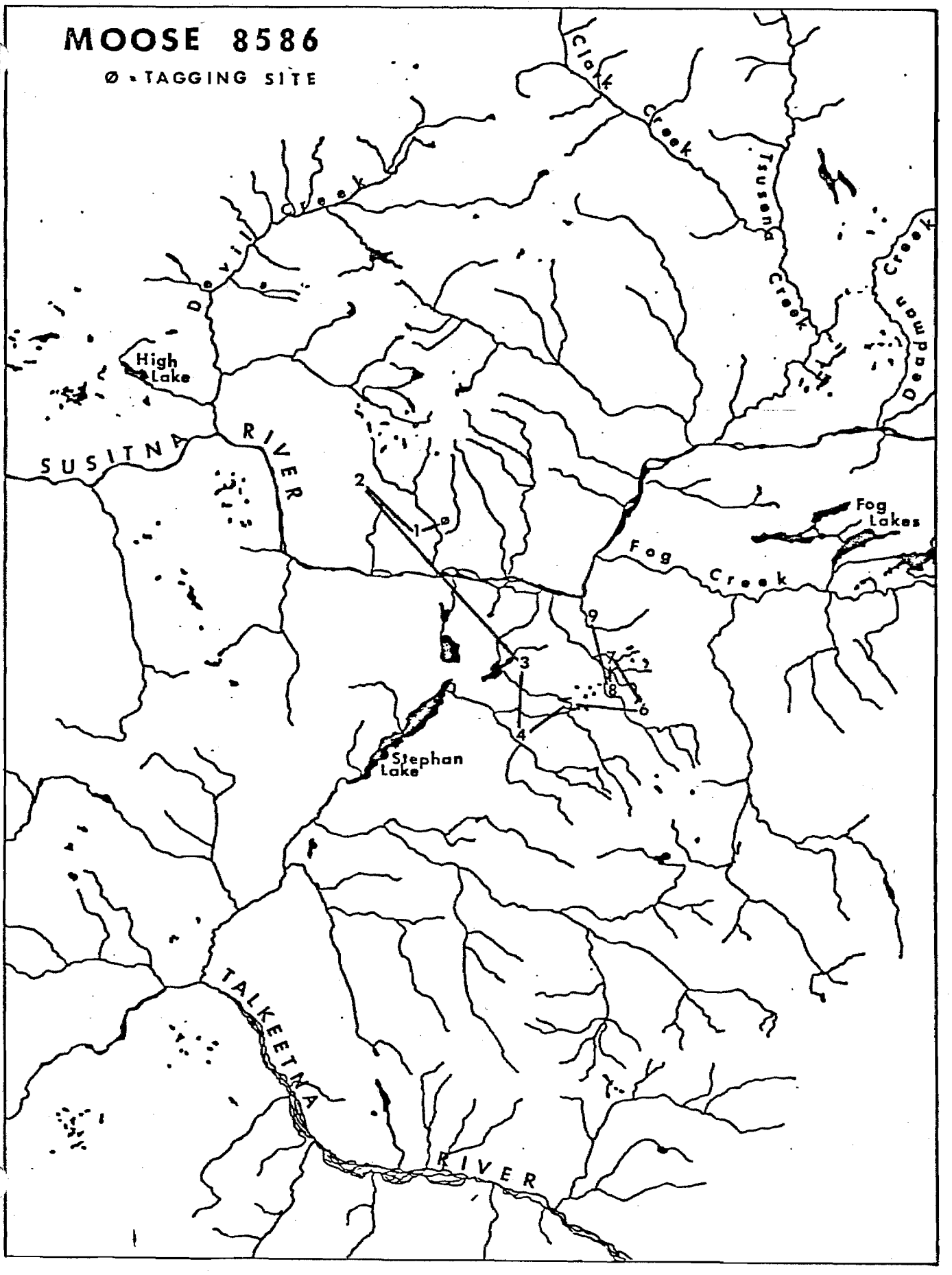
Number	Collar Color	Collar Number	Date	Remarks
8583	Orange	7	18 March 1977	Not pregnant, alone, snow 2" above moose belly
Observations				
	1		31 March 1977	With #8580, no visual observation (SE-KB)
	2		22 April 1977	Alone and spooky, medium spruce-upland, condition 5 or 6 (WB-KB)
	3		26 May 1977	Alone, 1600', riparian spruce (Egbert-KB)
	4		31 May 1977	Alone, spruce/hardwood (?B)
	5		3 June 1977	Alone, heavy spruce (KT)
	6		8 June 1977	Alone, spruce (KT)
	7		28 June 1977	Alone, spruce/hardwood (KT)
	8		5 July 1977	Alone, open spruce (KT)
	9		5 August 1977	Alone, tall open spruce/hardwood (TB)
	10		5 October 1977	With large bull, spruce (KT)
	11		30 November 1977	Alone, open medium spruce (KT)


MOOSE 8584
Ø= tagged site
Clark Creek
Tsusena Creek
Deadman Creek
Devil Creek
High Lake
SUSITNA RIVER
Fog Lakes
Fog Creek
Stephan Lake
TALKEETNA RIVER
1
2
3
4
5
6
7
8
9

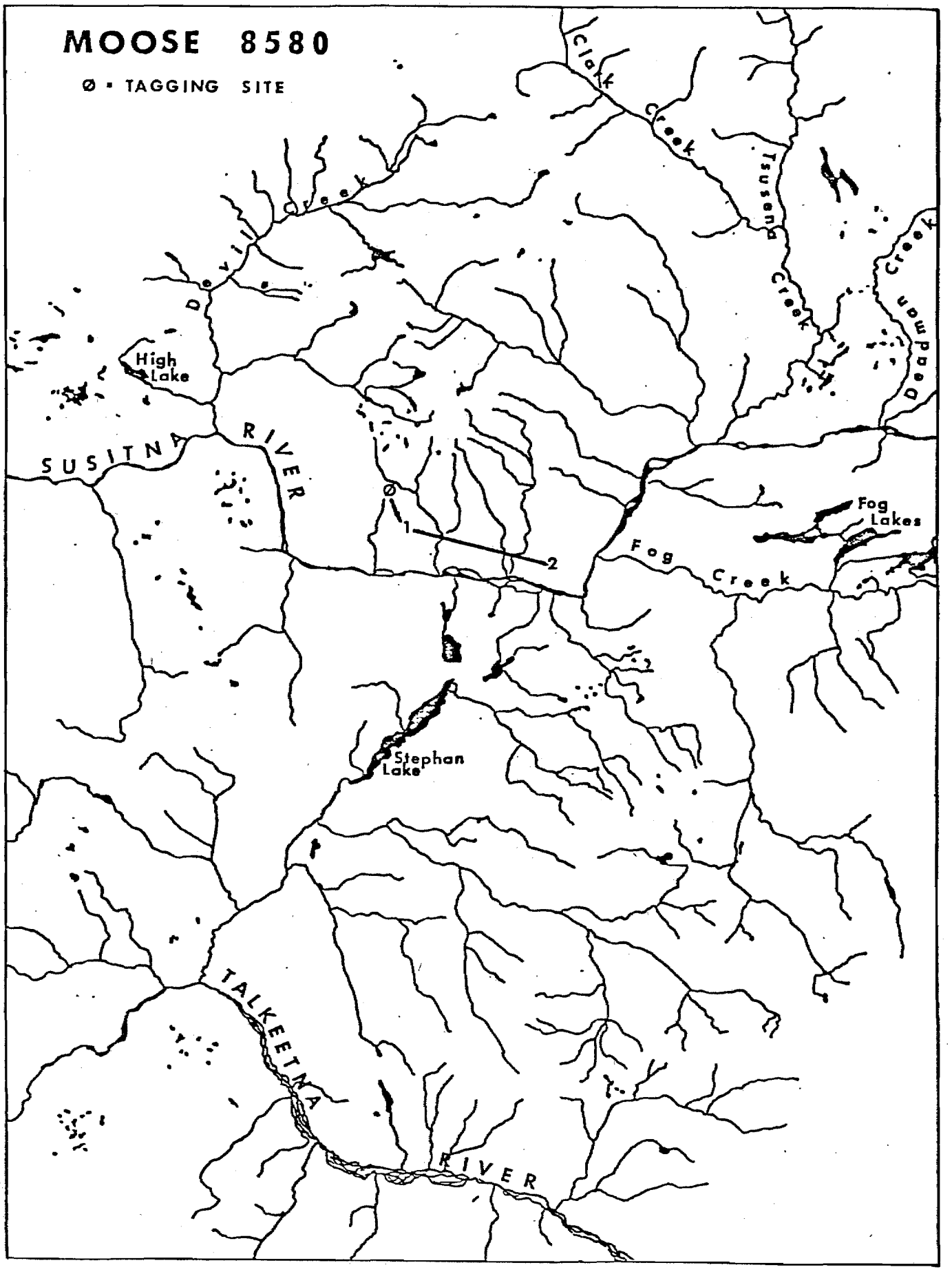
Number	Collar Color	Collar Number	Date	Remarks
8584	Orange	9	18 March 1977	Pregnant

Observations

1	(3:20 PM)	31 March 1977	Alone in spruce (SE-KB)
2	(8:30 AM)	22 April 1977	Alone, upland spruce and some willow, condition 7 (WB-KB)
3		31 May 1977	No calf seen tall spruce (TB)
4		3 June 1977	With 2 new calves, open spruce (KT)
5		8 June 1977	No visual (KT)
Ø		16 June 1977	With one calf, location not recorded (Erickson)
6		28 June 1977	No visual contact, spruce/hardwood (KT)
7		5 July 1977	Alone, open spruce (KT)
8	(11:30 AM)	5 August 1977	1/2 mile from bull and 2 cows, med. spruce (TB)
9		5 October 1977	With large bull and 3 cows, open spruce (KT)
10		30 November 1977	With one cow, open medium spruce (KT)


MOOSE 8586
Ø - TAGGING SITE
Cloff Creek
Tsusena Creek
Deadman Creek
High Lake
SUSITNA RIVER
Fog Lakes
Fog Creek
Stephan Lake
TALKEETNA RIVER
1
2
3
4
6
7
8
9

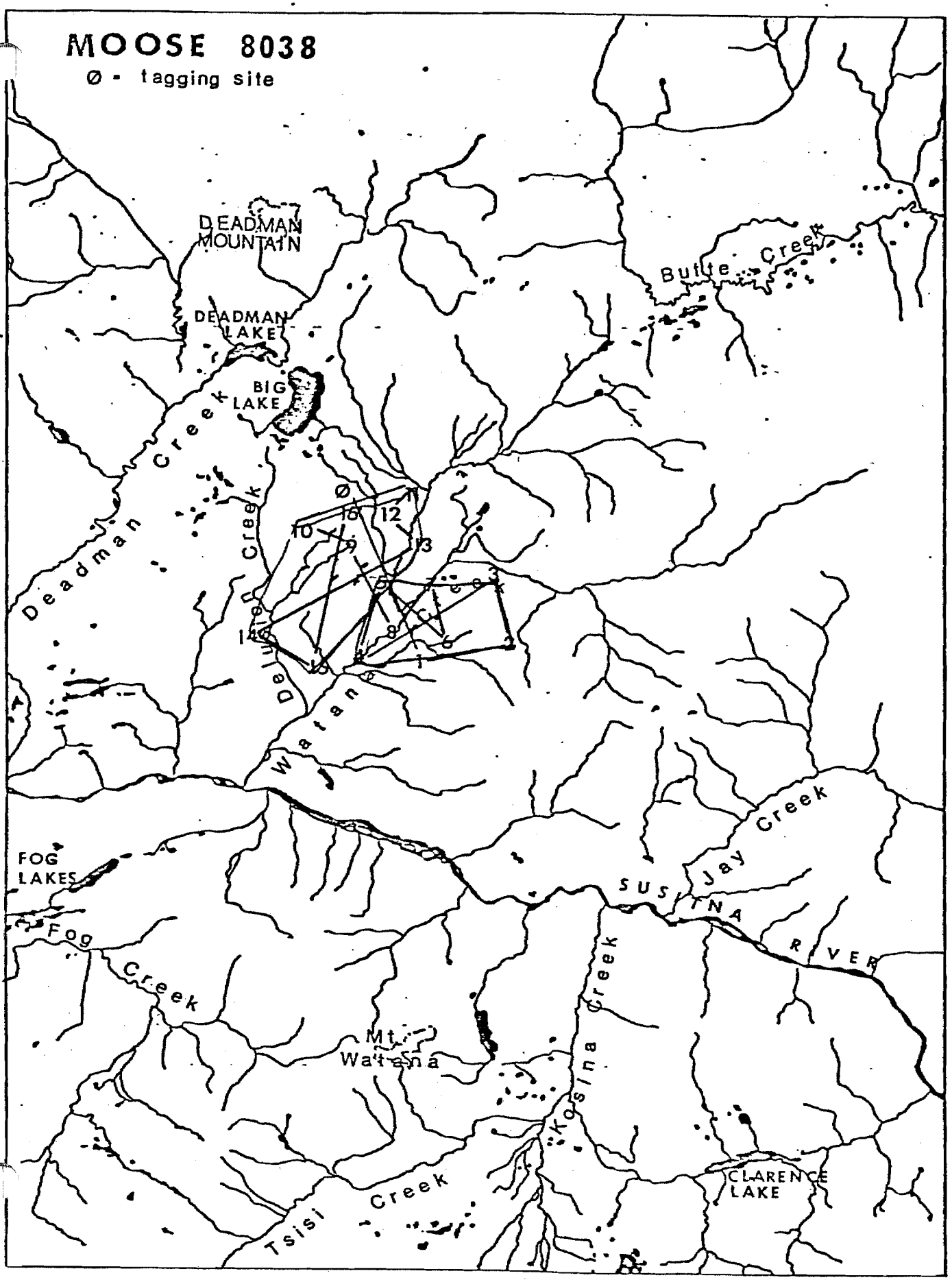
Number	Collar Color	Collar Number	Date	Remarks
8586	Orange	11	18 March 1977	Pregnant, with one calf and 3 cows 1/4 mile
Observations				
	1		31 March 1977	With 1 calf and 1 moose 1/4 mile away
	2		22 April 1977	With 1 calf, 2 cows and 1 small bull within 100 yds medium spruce-riparian
	3		3 June 1977	With one new calf, spruce
	4		8 June 1977	With 1 calf, spruce
	5		16 June 1977	Alone, open spruce
	6		28 June 1977	Alone, open spruce
	7		5 July 1977	Alone, spruce
	8	(11:30 AM)	5 August 1977	With 3 cows
	9		5 October 1977	Alone
	10		30 November 1977	Could not pick up signal


MOOSE 8580
Ø = TAGGING SITE
Cloff Creek
Tsusena Creek
Deadman Creek
Devil Creek
High Lake
SUSITNA RIVER
Ø
1
2
Fog Lakes
Fog Creek
Stephan Lake
TALKEETNA RIVER

Number	Collar Color	Collar Number	Date	Remarks
8580	none	none	18 March 1977	Down only 5-10 minutes, collar too small, no pregnancy test, with cow and calf 1/4 mile and 2 others

Observations

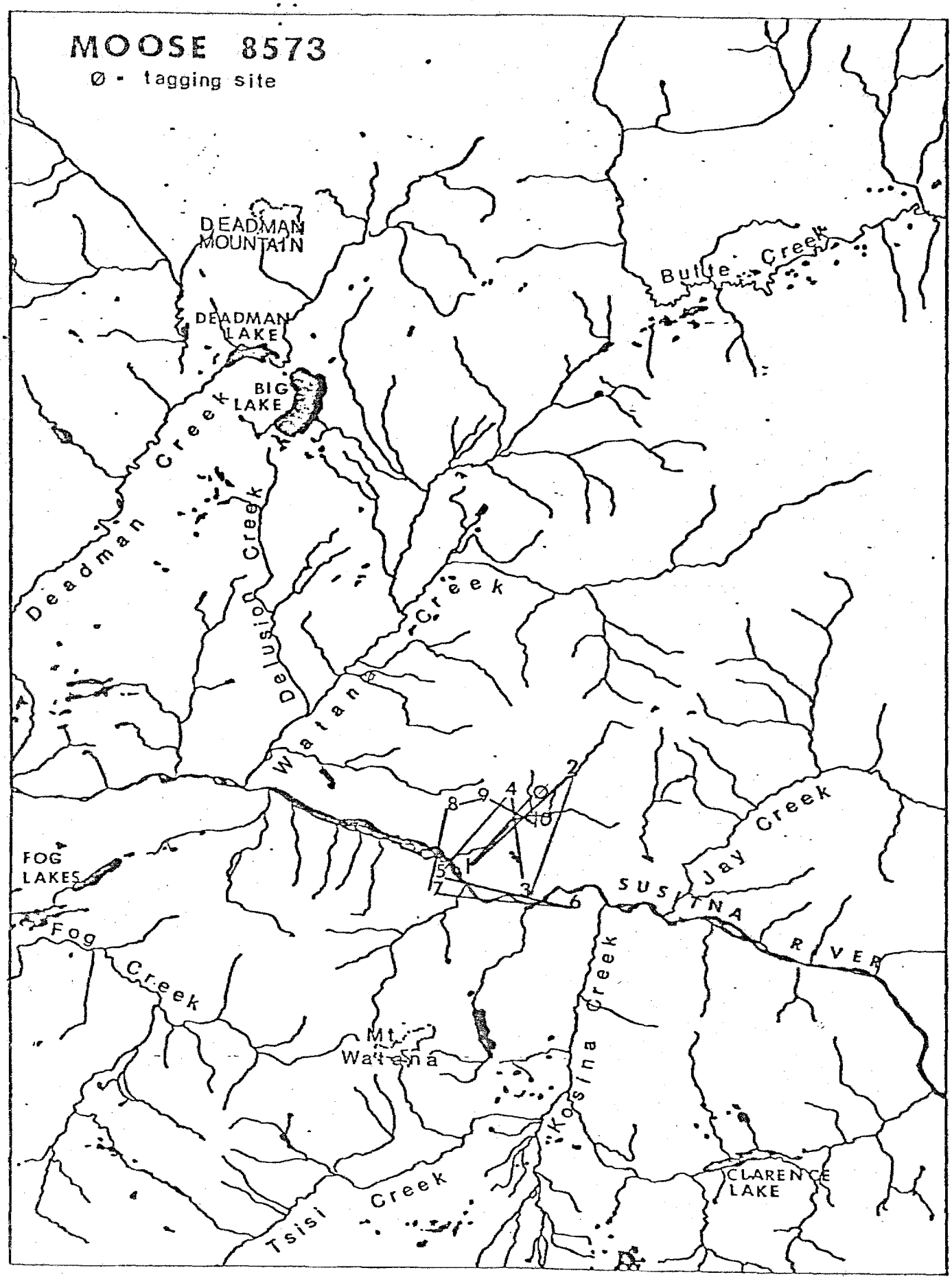
1 (3:00 PM)	31 March 1977	With 1 adult, spruce (SE-KB)
2	22 April 1977	Alone, no ear tags, tall riparian spruce (WB-KB)


MOOSE 8038
Ø - tagging site
DEADMAN MOUNTAIN
DEADMAN LAKE
BIG LAKE
Deadman Creek
Butte Creek
Ø
16
12
10
9
13
5
3
14
8
6
7
2
Deluvial Creek
Watana
FOG LAKES
Fog Creek
Jay Creek
SUSITNA RIVER
Mt. Watana
Kosina Creek
Tsisi Creek
CLARENCE LAKE

Number	Collar Color	Collar Number	Date	Remarks
8038	Red	NA	27 October 1976	With DA#3, 1 cow and one small bull

Observations

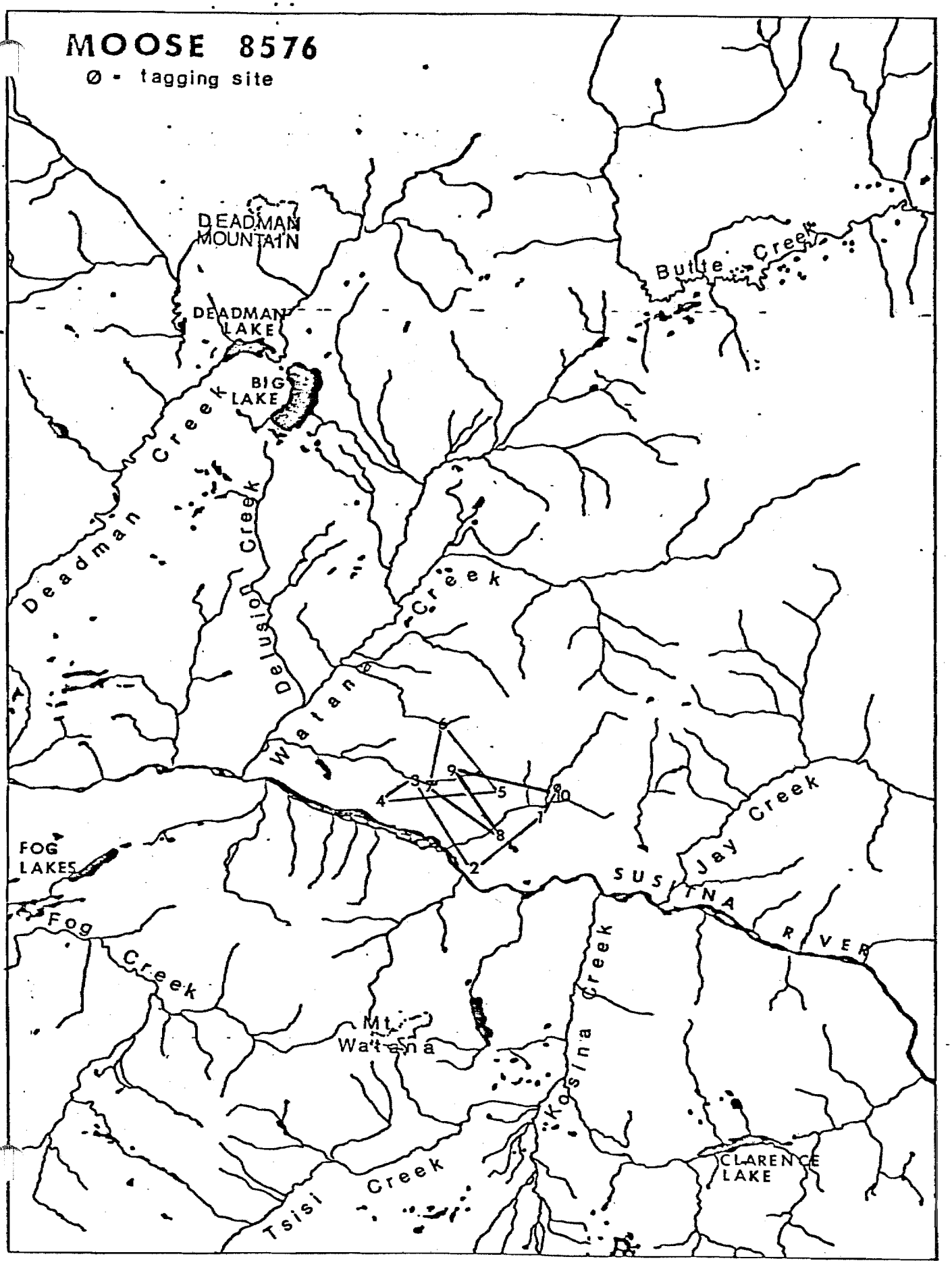
1	(11:40 AM)	22 November 1976	Unable to visually observe due to dense vegetation and poor snow.
2	(1:30 PM)	3 December 1976	Alone
3	(11:00 AM)	24 December 1976	With 2 cows
4	(9:35 AM)	19 January 1977	With 3 cows and 1 small bull
5		4 February 1977	Not visually observed due to high winds
6	(10:30 AM)	3 March 1977	With 1 cow
7	(6:05 PM)	6 April 1977	With 2 moose, sparse tall spruce
8	(9:15 AM)	22 April 1977	With 6 moose (1 bull), sparse tall spruce and cottonwood, condition 6
9		26 May 1977	With new calf, medium medium spruce
Ø		31 May 1977	Alone, medium medium spruce
10		3 June 1977	Alone, sparse medium spruce
11		8 June 1977	Alone, sparse medium spruce
12		16 June 1977	Alone, sparse medium spruce
13		28 June 1977	Alone, sparse medium spruce
14		5 July 1977	Alone, medium medium spruce
15		5 or 6 August 1977	With 1 bull, medium medium spruce
16		5 October 1977	With 2 cows and 1 bull, sparse medium spruce
17		30 November 1977	With 2 cows, small spruce


MOOSE 8573
Ø - tagging site
DEADMAN MOUNTAIN
DEADMAN LAKE
BIG LAKE
Deadman Creek
Delusion Creek
Watana Creek
Butte Creek
Susitna River
Jay Creek
FOG LAKES
Fog Creek
Mt. Watana
Kosina Creek
CLARENCE LAKE
Tsisi Creek
1
2
3
4
5
6
7
8
9
10

Number	Collar Color	Collar Number	Date	Remarks
8573	Orange	5	19 March 1977	Pregnant

Observations

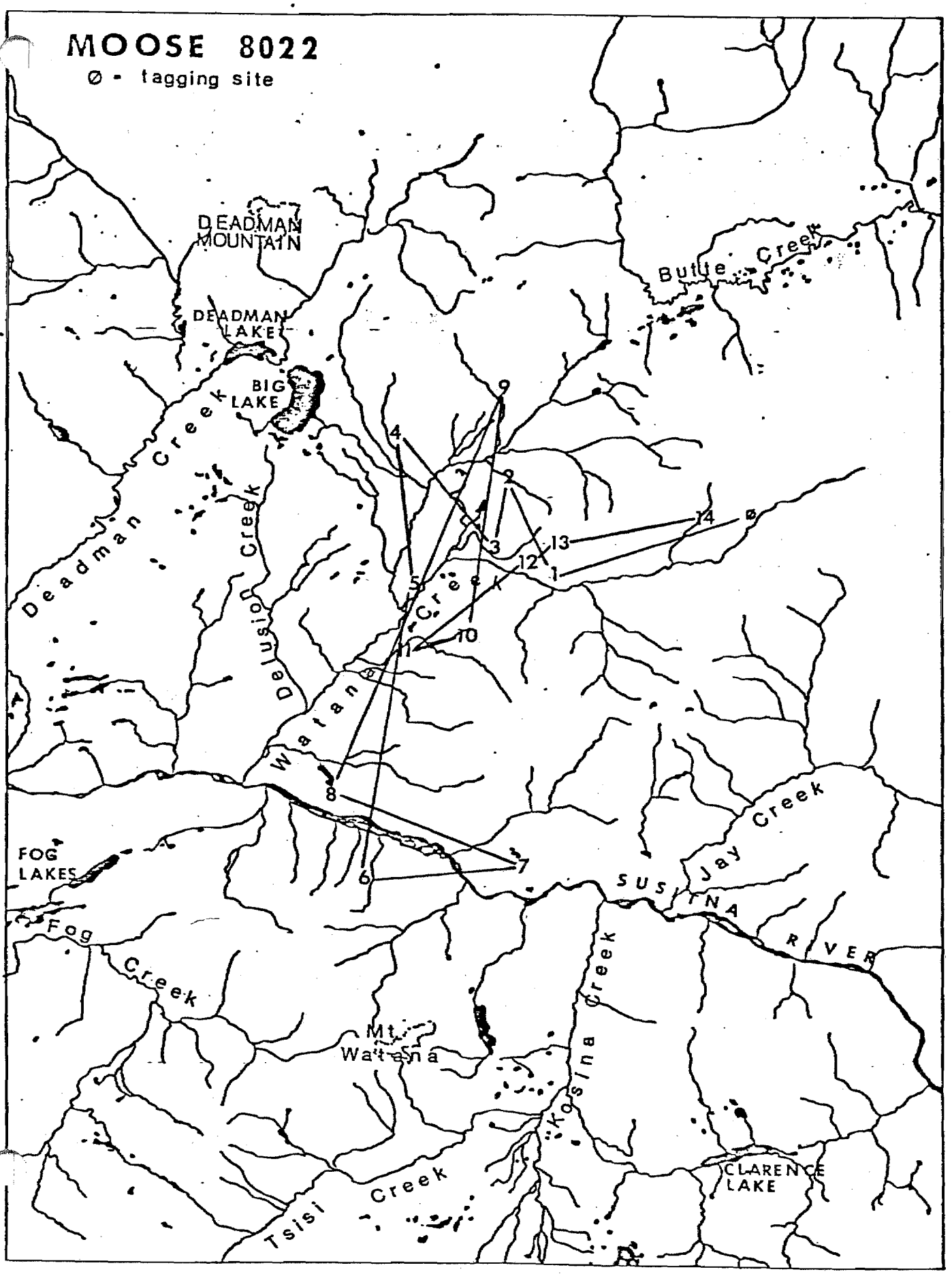
1		6 April 1977	
2	(10:15 AM)	22 April 1977	With 1 cow, sparse short spruce, condition 7
3		26 May 1977	With 1 cow, dense tall spruce
4		31 May 1977	Not visually observed
Ø		1 June 1977	Not visually observed, dense tall spruce
5		3 June 1977	Alone, medium medium spruce
6		8 June 1977	Alone, medium medium spruce
Ø		16 June 1977	Alone, medium medium spruce
7		28 June 1977	Not visually observed, alder
8		5 July 1977	Alone, medium medium spruce
9		5 August 1977	With 2 cows and white #75
10		5 October 1977	Alone, medium medium spruce
11		30 November 1977	With 1 cow, willow


MOOSE 8576
Ø - tagging site
DEADMAN MOUNTAIN
DEADMAN LAKE
BIG LAKE
Deadman Creek
Delusion Creek
Butte Creek
Watana Creek
Jay Creek
SUSITNA RIVER
FOG LAKES
Fog Creek
Mt. Watana
Kosina Creek
Tsisi Creek
CLARENCE LAKE
1
2
3
4
5
6
7
8
9
10

Number	Color	Collar Number	Collar Date	Remarks
8576	Orange	6	19 March 1977	With 1 bull, pregnancy status unknown

Observations

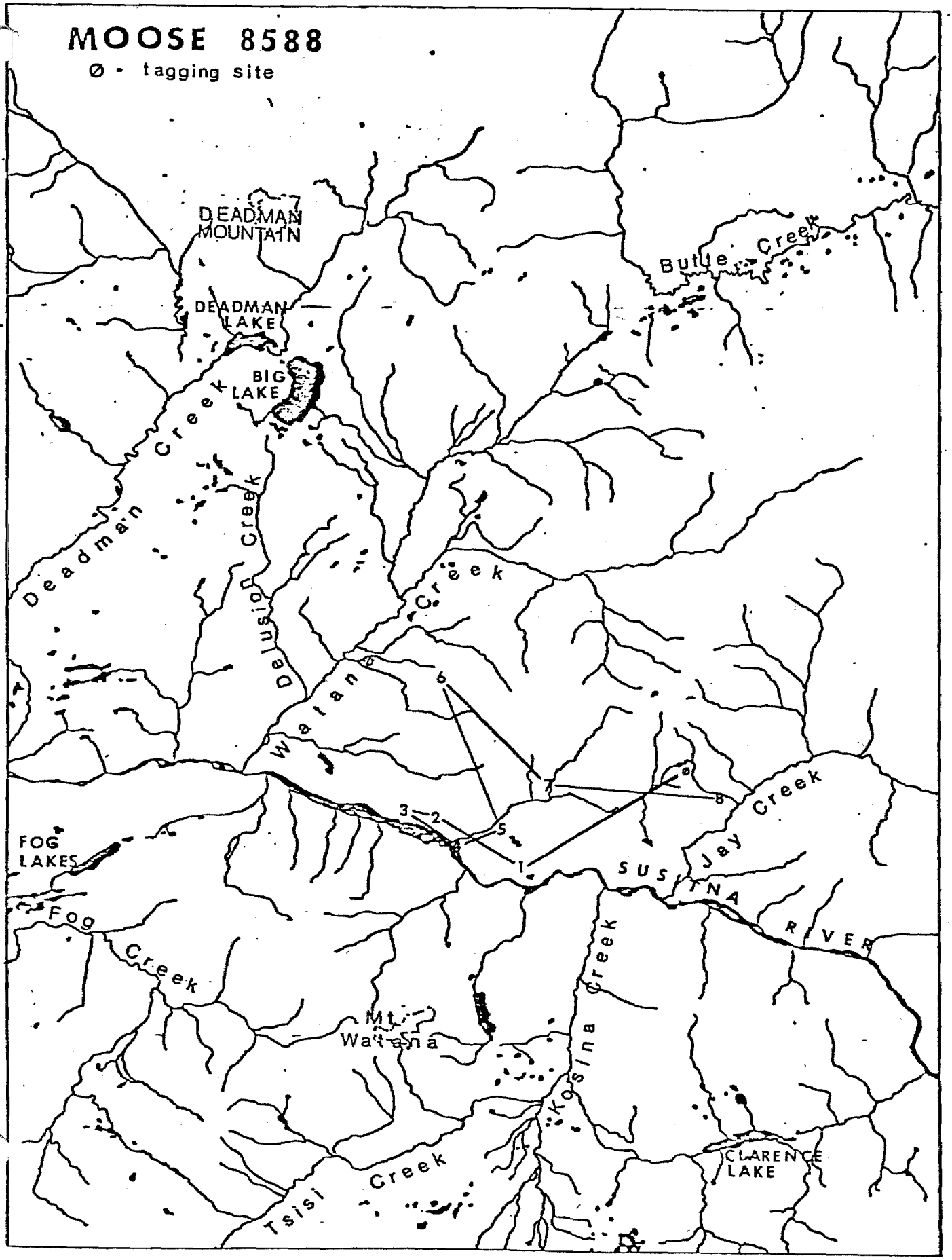
1	(3:50 PM)	6 April 1977	Alone, in spruce (SE-KB)
2		22 April 1977	With 2 cows, medium tall spruce, near radio 8588
3		26 May 1977	Alone, medium short spruce
4		3 June 1977	Alone, sparse medium spruce
5		8 June 1977	Alone, medium medium spruce
6		16 June 1977	Alone, medium medium spruce
7		28 June 1977	Alone, medium medium spruce
8		5 July 1977	Alone, medium medium spruce with some alder
9	(11:00 AM)	5 August 1977	Within 1/2 mile Blue #10, sparse medium spruce
10		5 October 1977	With 1 large bull and 3 cows, medium medium spruce, not visually observed.
11		30 November 1977	Alone, open medium spruce


MOOSE 8022
Ø - tagging site
DEADMAN MOUNTAIN
DEADMAN LAKE
BIG LAKE
Deadman Creek
Delusion Creek
Butte Creek
Watana Creek
FOG LAKES
Fog Creek
Susitna River
Jay Creek
Mt. Watana
Kosina Creek
Tsisi Creek
CLARENCE LAKE
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Ø

Number	Collar Color	Collar Number	Date	Remarks
8022	Red	NA	28 October 1976	Artificial respiration for 10-15 min.

Observations

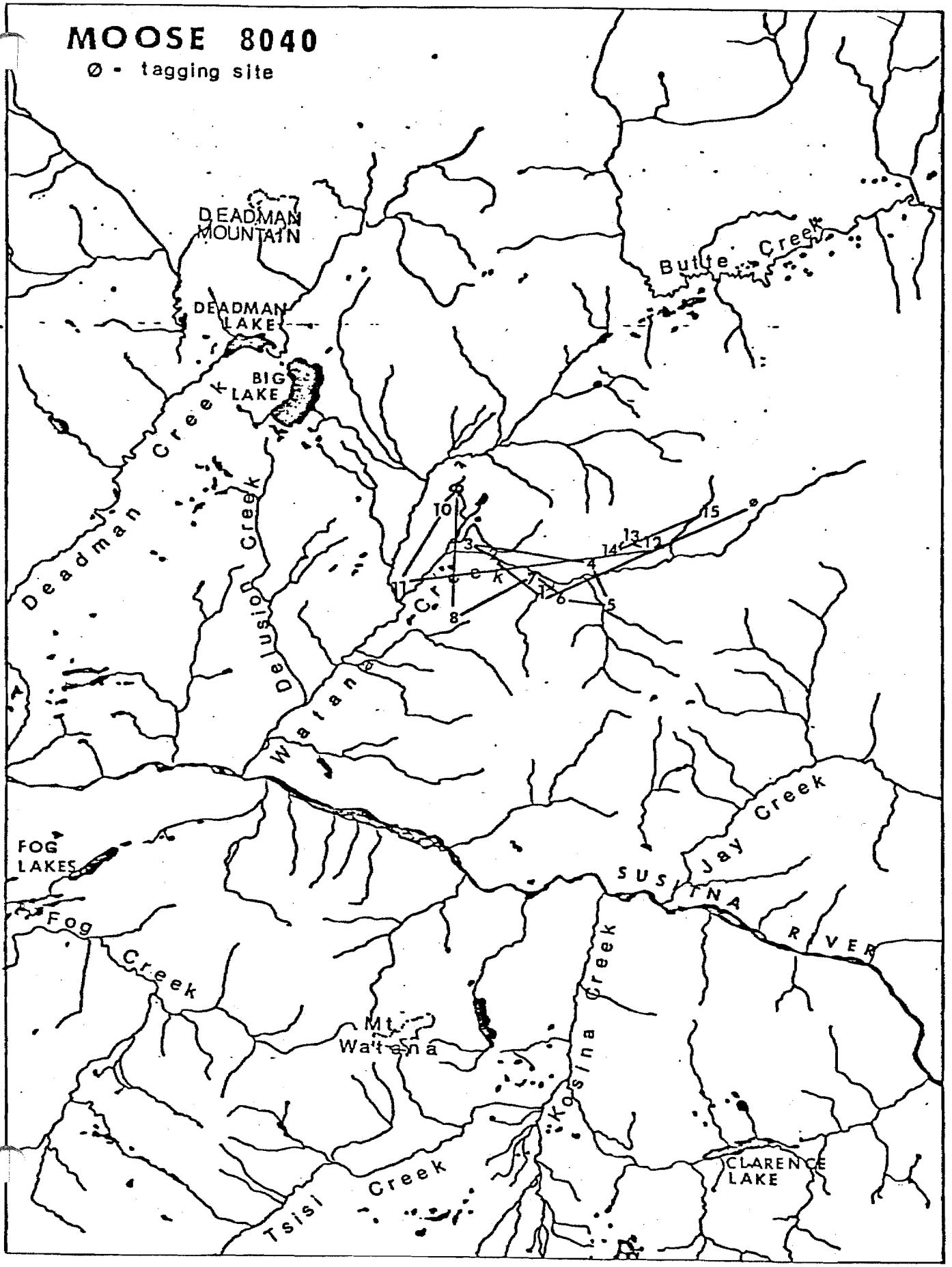
1	(1:30 PM)	22 November 1976	Unable to observe due to poor snow conditions and dense vegetation
2	(1:45 PM)	3 December 1976	With 1 cow
3	(11:00 AM)	24 December 1976	With 1 cow
4		19 January 1977	Alone
5	(11:00 AM)	4 February 1977	Not visually observed due to high winds
6		3 March 1977	Alone, standing, sparse medium spruce
7	(4:05 PM)	6 April 1977	With 2 moose
8	(9:00 AM)	22 April 1977	Alone, medium medium spruce
9		25 May 1977	Alone, riparian willow
Ø		1 June 1977	No visual observation, in steep wall canyon, near radio 8040
10		8 June 1977	Alone, medium medium spruce
11		16 June 1977	Alone
Ø		28 June 1977	Couldn't locate
12		5 July 1977	Not observed, alder
13	(11:00 AM)	5 August 1977	With 1 cow, tall alder
14		5 October 1977	With radio 8040, alder
15		30 November 1977	With 1 cow, willow


MOOSE 8588
Ø - tagging site
DEADMAN MOUNTAIN
DEADMAN LAKE
BIG LAKE
Deadman Creek
Delusion Creek
Watana Creek
Butte Creek
Jay Creek
SUSITNA RIVER
FOG LAKES
Fog Creek
Mt. Watana
Kosina Creek
CLARENCE LAKE
Tsisi Creek
1
2
3
4
5
6
7
8

Number	Collar Color	Collar Number	Date	Remarks
8588	Orange	16	19 March 1977	none

Observations

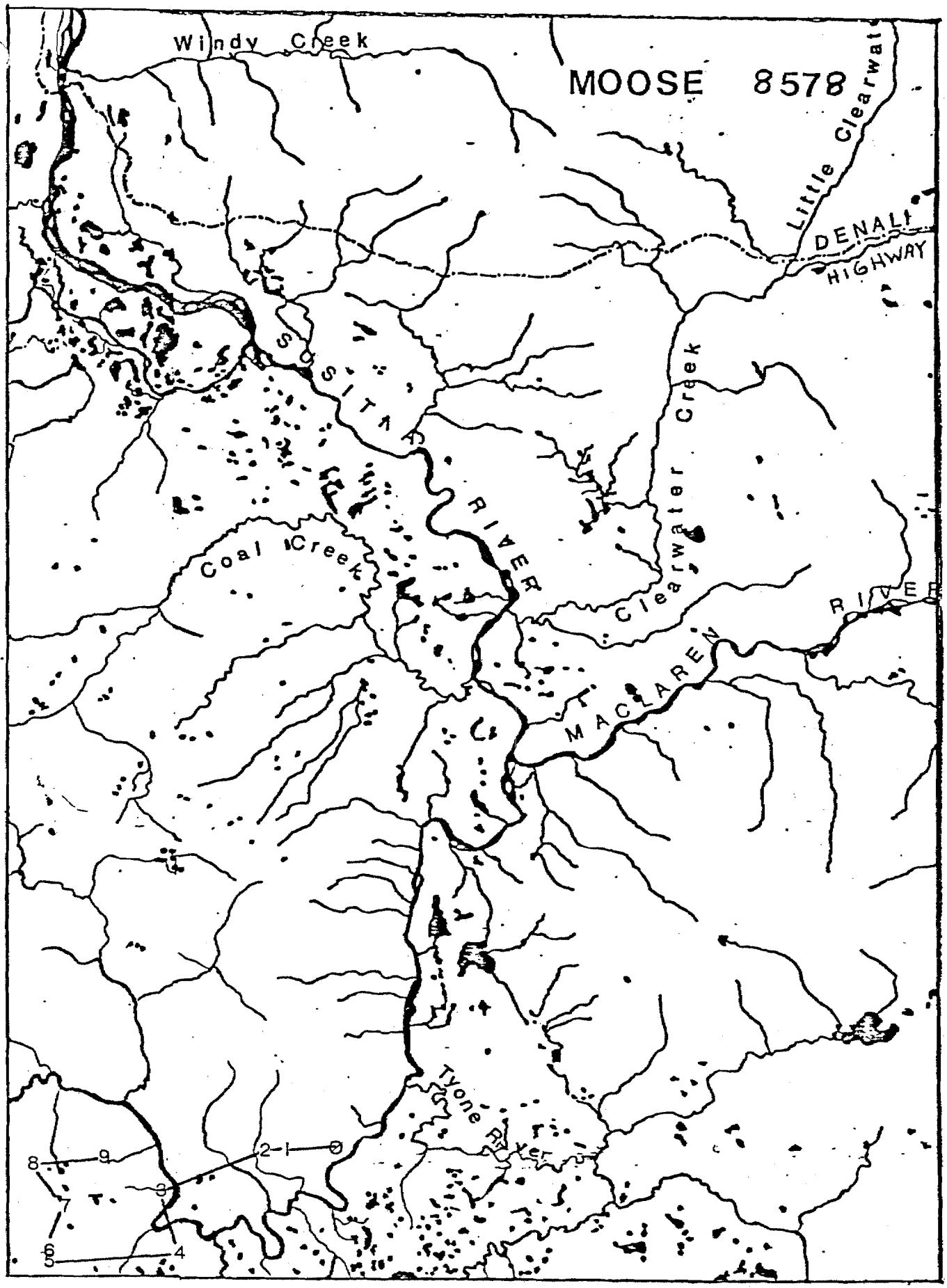
1 (4:05 PM)	6 April 1977	Close to radio 8022, medium medium spruce
2	22 April 1977	With 2 cows, sparse short spruce
3	27 May 1977	With 1 yearling and 1 cow, sparse short spruce
Ø	31 May 1977	Not visually observed
4	3 June 1977	Not visually observed on island, dense tall spruce
5	8 June 1977	Alone, spruce (KT)
6	16 June 1977	Alone, willow-alder
Ø	5 July 1977	Alone
7	21 August 1977	Alone, sparse tall spruce
Ø	5 October 1977	Could not locate
8	3 November 1977	With one bull and 3 cows
9	30 November 1977	With one yearling, willow


MOOSE 8040
Ø - tagging site
DEADMAN MOUNTAIN
DEADMAN LAKE
BIG LAKE
Deadman Creek
Delusion Creek
Butte Creek
Watana Creek
Jay Creek
SUSITNA RIVER
FOG LAKES
Fog Creek
Mt. Watana
Kosina Creek
CLARENCE LAKE
Tsisi Creek
1
2
3
4
5
6
7
8
10
11
12
13
14
15

Number	Collar Color	Collar Number	Date	Remarks
8040	Green	NA	28 October 1976	Lone cow, old moose (10+), artificial respiration-5 minutes

Observations

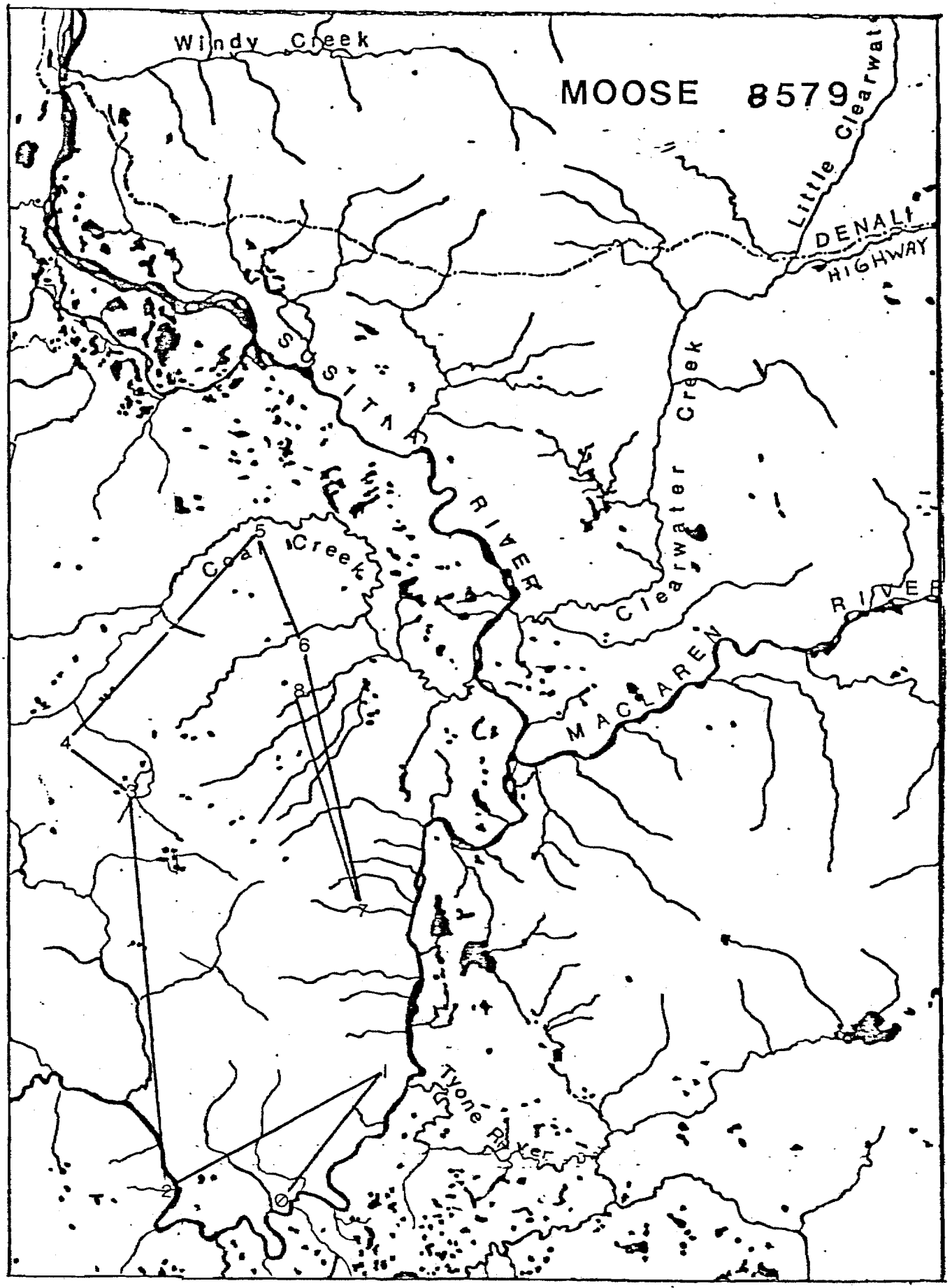
1	(11:50 AM)	22 November 1976	With 1 cow and 1 large bull
2		3 December 1976	With 1 yearling and 2 cows
3		27 December 1976	With 2 cows, 1 small bull and 2 large bulls
4	(9:30 AM)	17 January 1977	Alone
5	(10:30 AM)	3 March 1977	Alone
6	(6:16 PM)	6 April 1977	Alone
7	(9:20 AM)	22 April 1977	With 1 cow, riparian willow, condition 4
8		26 May 1977	Alone, sparse short spruce
Ø		31 May 1977	Not visually observed
Ø		1 June 1977	Alone
9		3 June 1977	Alone, willow
10		8 June 1977	With 2 new calves, alder
11		16 June 1977	Alone, alder
12		28 June 1977	Not observed, alder
13		5 July 1977	Not observed, tall alder
14	(11:00 AM)	5 August 1977	Not observed
15		5 October 1977	With 1 cow and 1 small bull, alder
16		30 November 1977	With 1 yearling, riparian willow


Windy Creek
MOOSE 8578
Little Clearwater
DENALI HIGHWAY
SUSITNA RIVER
Clearwater Creek
Coal Creek
MACLAREN RIVER
Tyone River
8
9
2
1
0
7
6
5
4

Number	Collar Color	Collar Number	Date	Remarks
8578	Orange	10	20 March 1977	Not pregnant, with 1 bull

Observations

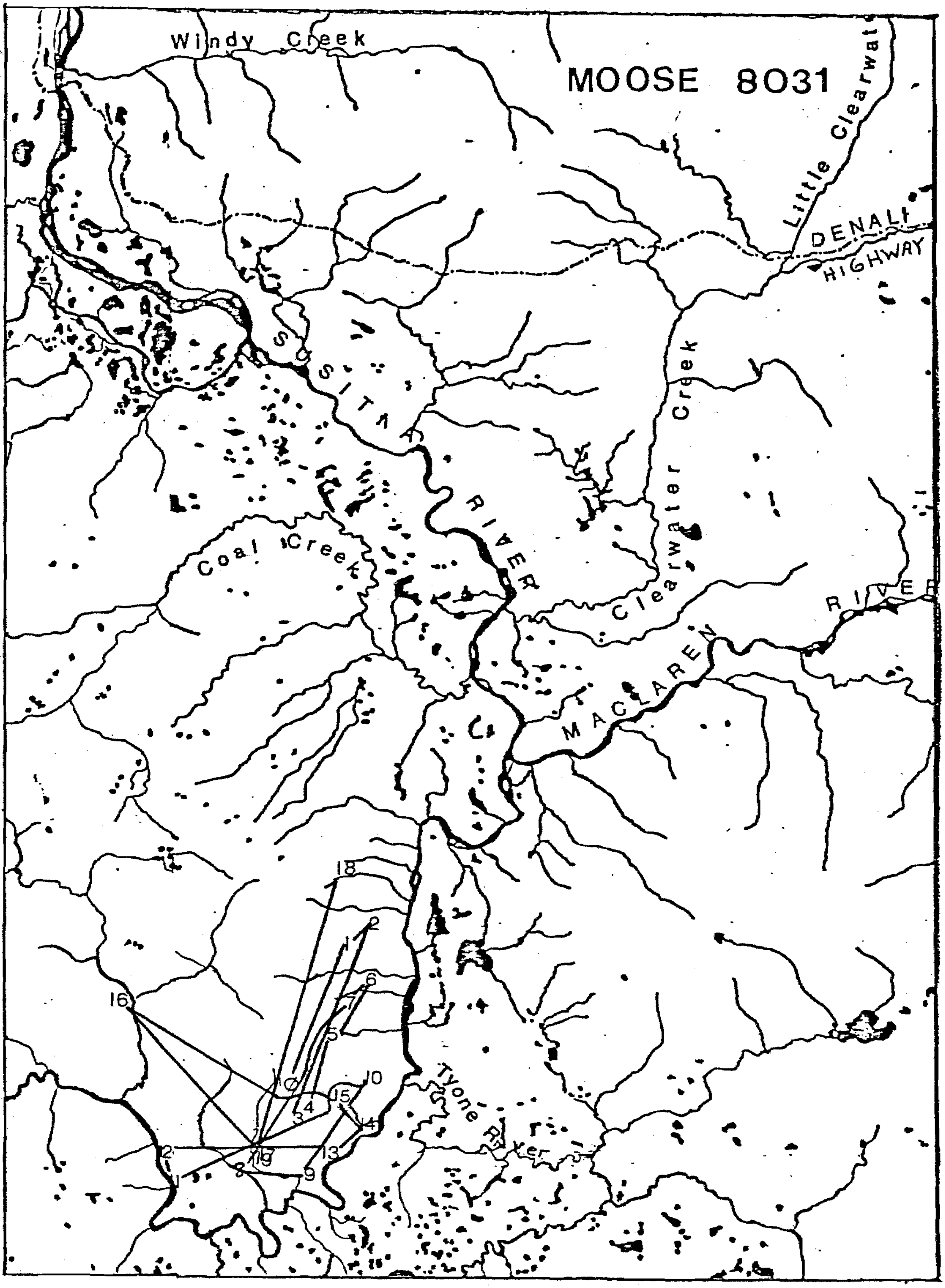
1		30 March 1977	Not visually observed (TB-AL)
2	(10:30 AM)	22 April 1977	Alone, upland small spruce bog
3		13 May 1977	No visual observation due to two other cows in area, steep river banks and heavy spruce (TB-AL)
	(11:00 AM)	30 May 1977	No calf, with 1 bull and 2 cows (TS-KB)
4	(2:00 PM)	3 June 1977	With 10 cows and 1 bull, open spruce, no calf (TB-KB)
5	(2:30 PM)	6 June 1977	Up high in scrub sparse spruce, with 1 cow and yearling
		10 June 1977	No calf, with a cow with calf an 1 lone cow, yearling male grizzly present (SE-KB)
		17 June 1977	With 1 adult, no calf
	(10:30 AM)	27 June 1977	Alone (TB-AL)
		30 June 1977	With 1 cow and bull, cow with calf 1/8 mile away (KB-TB)
	(10:00 AM)	6 July 1977	Alone, upland tundra, no calf, feeding (WB-KB)
6	(10:15 AM)	23 July 1977	Bedded down with 3 adults and 1 small bull, mixed brush upland tundra with short scattered spruce (WB-KB)
7		22 August 1977	Alone within 1/4 mile is cow with yearling, in sparse medium spruce with lots of dwarf birch almost alpine (WB-KB)
	(8:55 AM)	30 August 1977	With cow and calf in sparse short spruce, feeding (WB-KB)
8	(5:00 PM)	5 October 1977	Alone, standing in scrub spruce, willow (WB-KB)
9	(1:40 PM)	22 November 1977	Alone, standing in upland short sparse spruce (WB-KB)


MOOSE 8579
Windy Creek
Little Clearwater
DENALI HIGHWAY
SUSITNA RIVER
Clearwater Creek
Coal Creek
MACLAREN RIVER
Tyone River
1
2
3
4
5
6
7
8

Number	Collar Color	Collar Number	Date	Remarks
8579	Orange	14	20 March 1977	Pregnant, 15 minutes artificial respiration (broke couple of ribs), with 1 calf

Observations

1	22 March 1977	With cow, upland willow surrounding medium spruce, condition 4 (WB-KB)
2	13 May 1977	Definite location didn't see due to steep riverbanks and heavy spruce (TB-AL)
3 (11:30 AM)	3 July 1977	Alone, feeding in upland tundra (WB-KB)
4 (10:15 AM)	25 July 1977	Alone, no calf, riparian willow habitat in upland tundra, bedded down
5 (5:30 PM)	18 August 1977	With a cow with calf in tall spruce sparse and dwarf birch (WB-KB)
6 (2:00 PM)	5 October 1977	With 10 cows, 1 small bull in upland short spruce (WB-KB)
7	3 November 1977	With #61 which has calf (SE)
8 (2:00 PM)	22 November 1977	Alone, running, in tall riparian spruce (WB-KB)


MOOSE 8031
Windy Creek
Little Clearwat
DENALI
HIGHWAY
SUSITNA
RIVER
Coal Creek
Clearwater Creek
Clearwater
MACLAREN
RIVER
Tyone River
18
2
1
6
7
5
16
10
15
4
3
14
12
17
19
13
9
8
11

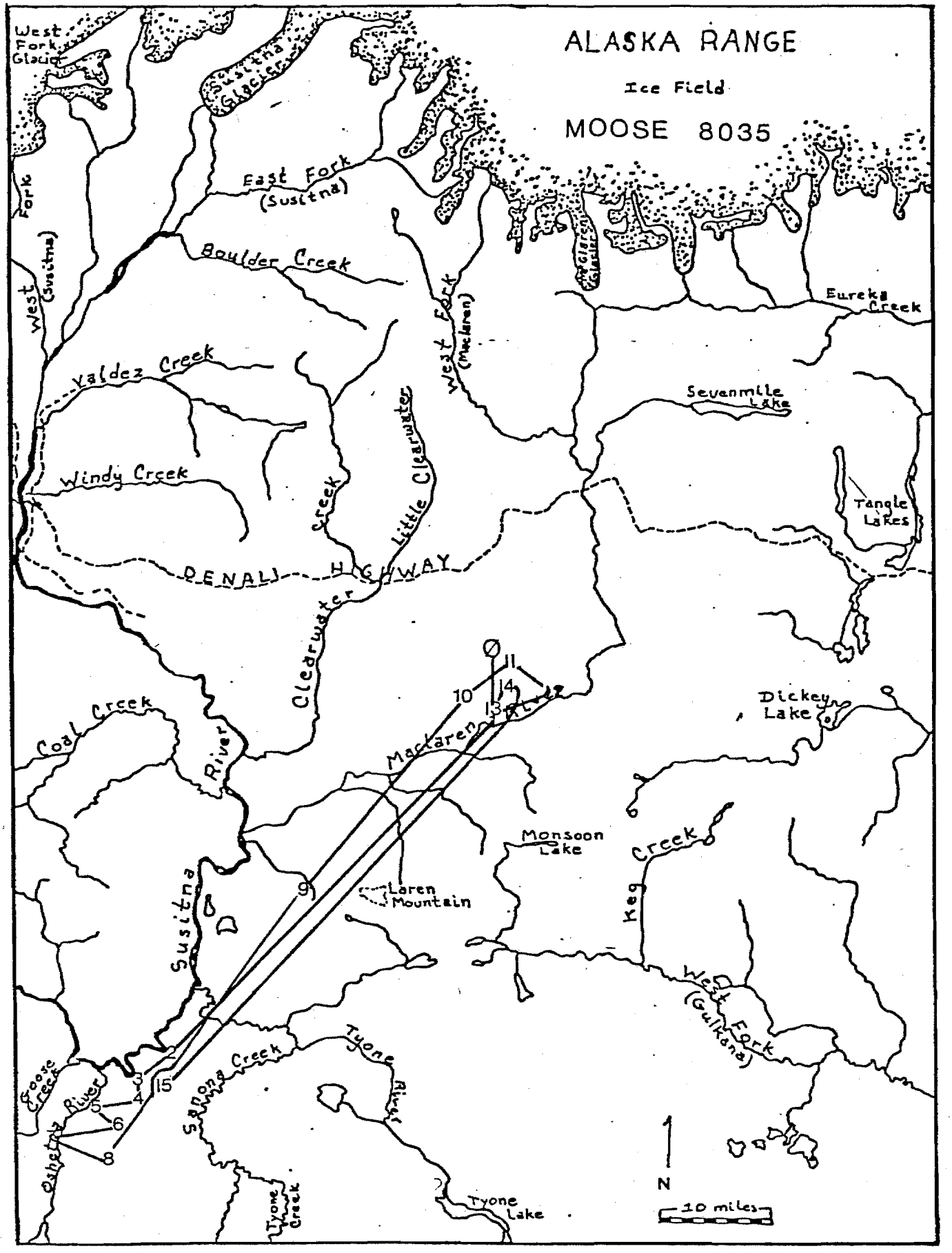
Number	Collar Color	Collar Number	Date	Remarks
8031 Visual	Green Blue	NA 3	22 October 1976	none

Observations

1		2 November 1976	With several bulls and cows within 1/4 mile, also #2 with calf (TB)
2	(11:15 AM)	19 November 1976	Unobserved due to vegetations and poor snow (WB)
3	(10:15 AM)	16 December 1976	With a yearling cow
4	(Noon)	24 December 1976	With a calf
5	(3:30 PM)	19 January 1977	With a calf, within 1/4 mile 2-3 year old bull with 1 antler and cow with calf
6	(1:00 PM)	3 February 1977	Did not attempt to observe (TS)
7	(Noon)	4 February 1977	Visually observed accompanied by calf
8	(3:00 PM)	22 February 1977	With calf, with cow with twins (TS)
9	(Noon)	5 March 1977	With calf
10	(3:30 PM)	30 March 1977	Didn't visually observe (TB-AL)
11	(8:15 AM)	25 April 1977	With calf and another cow, tall spruce-willow
12	(3:15 PM)	13 May 1977	Didn't see due to steep river banks but definately there, singnal not heard until almost overhead (TB-AL)
	(2:00 PM)	20 May 1977	With calf, also 2 cows with calves, 1 cow, medium spruce upland, 2500'
13	(11:00 AM)	30 May 1977	With yearling and 1 cow, no calf, feeding, less than 40' spruce and muskeg (TS-KB)
14		3 June 1977	With yearling and 1 cow
	(1:30 PM)	6 June 1977	With a yearling in scrub spruce 200' above river (WB-KB)
		10 June 1977	With yearling, sparse medium spruce (SE-KB)

8031 continued

		17 June 1977	With yearling (SE-KB)
15		24 June 1977	Couldn't see due to wind (TB-AL)
16	(11:45 AM)	3 July 1977	Bedded down with yearling (bull) at least 17 other moose there (WB-KB)
17	(10:35 AM)	23 July 1977	With bull yearling in dense medium spruce, 2700', standing together
	(5:30 PM)	18 August 1977	Bedded down with her yearling bull with 1 large bull in dense medium spruce (WB-KB)
	(9:15 AM)	30 August 1977	Unable to observe, probably bedded down in thick medium spruce
18	(1:15 PM)	5 October 1977	With 4 cows, 1 cow with calf, 1 yearling in dense medium spruce upland (WB-KB)
19	(1:30 PM)	22 November 1977	With 4 cows, 1 calf, 2 large bulls, 1 yearling bull, standing, feeding, dense medium tall spruce, essentially same location as 17


ALASKA RANGE
Ice Field
MOOSE 8035
West Fork Glacier
Susitna Glacier
East Fork (Susitna)
West Fork (Susitna)
Boulder Creek
Valdez Creek
Windy Creek
Little Clearwater Creek
West Fork (Maclaren)
Eureka Creek
Sevenmile Lake
Tangle Lakes
DENALI HIGHWAY
Clearwater
Coal Creek
Susitna River
Maclaren River
Dickey Lake
Monsoon Lake
Keg Creek
Loren Mountain
West Fork (Gulkana)
Goose Creek
Oshetna River
Sanona Creek
Tyone River
Tyone Creek
Tyone Lake
N
10 miles

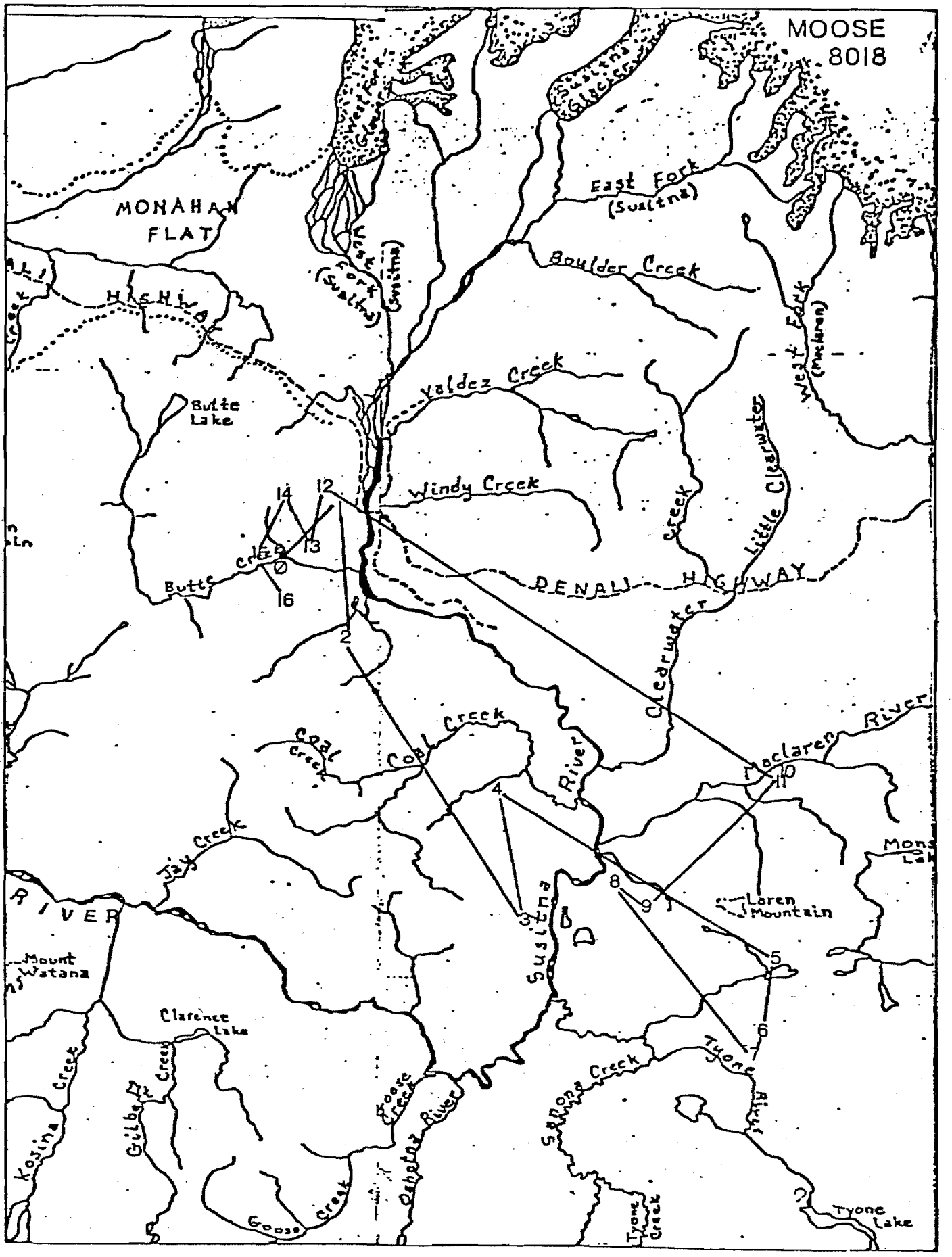
Number	Collar Color	Collar Number	Date	Remarks
8035	Blue	NA	27 October 1977	3-4 minutes artificial respiration, with one #11. probably 3 other cows. 1 large bull, 1 small bull

Observations

1		2 November 1976	With 1 cow
Ø		19 November 1976	Not visually observed, with radio 8030 and cow
2	(10:15 AM)	16 December 1976	Did not visually observe due to fog
3	(Noon)	24 December 1976	With 1 cow, within 1/4 mile 1 cow with calf and 5 cows
4	(3:45 PM)	19 January 1977	With 2 yearlings (1 is bull), over 1/4 mile a total of 11 moose which included 2 medium bulls with 1 antler and 2 calves
5	(1:00 PM)	3 February 1977	No attempt to observe
6	(1:00 PM)	4 February 1977	With 2 yearlings (1 bull), other moose in area but no count
7	(3:30 PM)	22 February 1977	With 2 moose
8		5 March 1977	With 1 yearling
Ø		30 March 1977	No visual observation
9		22 April 1977	Condition 5-6, riparian willow
10	(2:30 PM)	25 May 1977	Alone, medium medium spruce, feeding
	(2:00 PM)	1 June 1977	Alone, bedded down, sparse medium spruce
	(Noon)	6 June 1977	Alone, dense ripariam tall spruce
	(8:30 AM)	10 June 1977	With cow, standing in riparian spruce
		17 June 1977	With 1 cow
11		25 June 1977	Alone
		6 July 1977	With 1 cow in upland tundra, resting

8035 continued

(Noon)	12 July 1977	With 1 cow, upland riparian
12 (1:15 PM)	23 July 1977	Bedded down, sparse medium spruce
13 (4:45 PM)	18 August 1977	Bedded with a cow and yearling bull, sparse short spruce
14 (4:30 PM)	5 October 1977	With 1 large bull, 13 cows, small moose 1 calf, scrub willow with medium medium spruce
15 (2:00 PM)	22 November 1977	Feeding, alone, medium short spruce


MOOSE
8018
MONAHAN
FLAT
East Fork
(Susitna)
Boulder Creek
West Fork
(Susitna)
Valdez Creek
Butte
Lake
Windy Creek
West Fork
(Maclaren)
Little Clearwater
Creek
DENALI HIGHWAY
Butte Creek
Clearwater
Coal Creek
Coal
Creek
Susitna
River
Maclaren River
Jay Creek
Mon
La
Loren
Mountain
Susitna
Mount
Watana
Clarence
Lake
Kosina Creek
Gilbert Creek
Moose Creek
Oshetna River
Goose Creek
Tyone River
Tyone Creek
Tyone Lake
1
2
3
4
5
6
7
8
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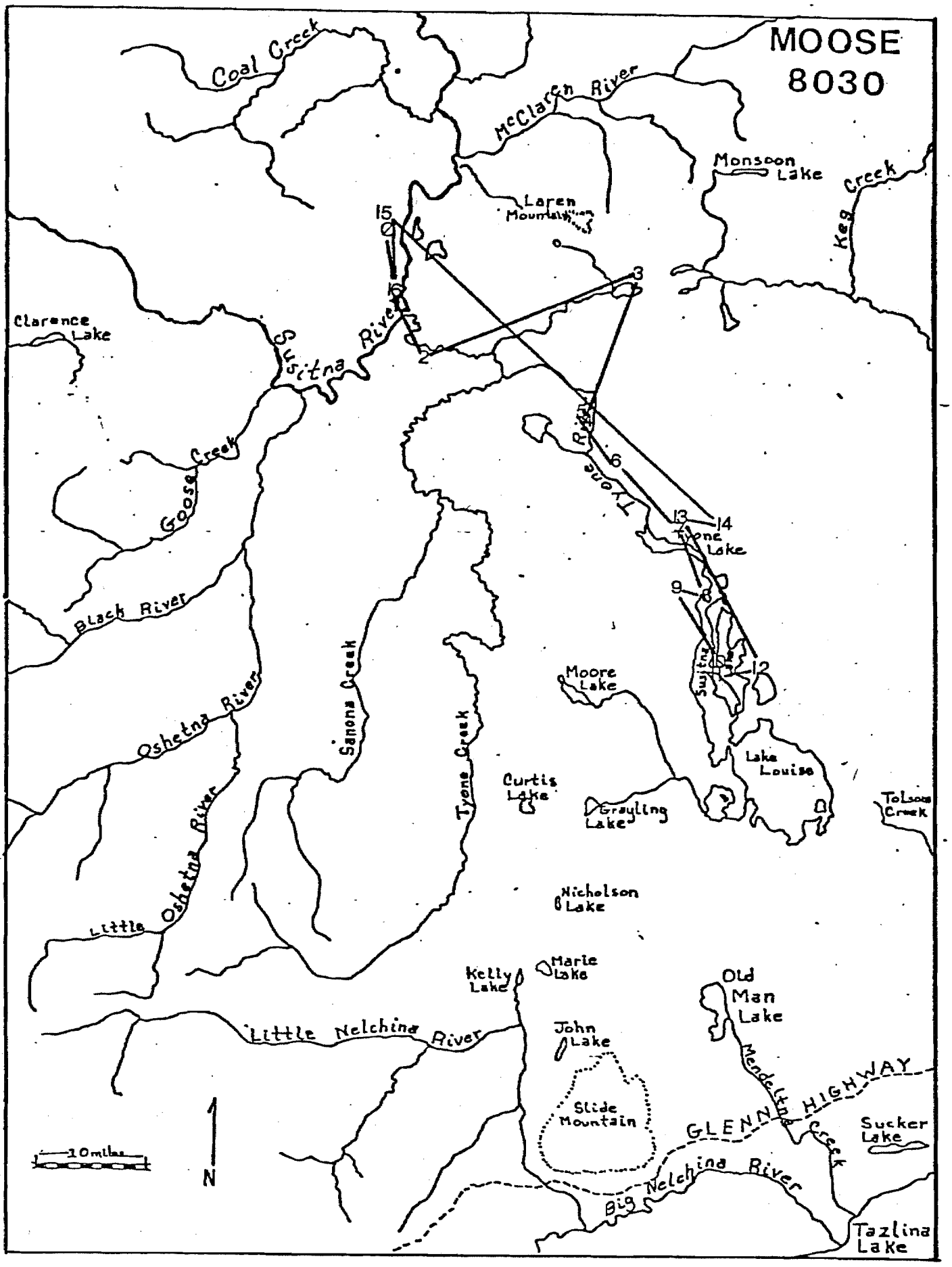
12
13
14
16

Number	Collar Color	Collar Number	Date	Remarks
8018	Green	NA	27 October 1976	Probably with a calf, with one cow
Observations				
1	(12:10 PM)		22 November 1976	With calf, 3 cows and 3 calves (1 set twins)
2	(1:50 PM)		3 December 1976	With medium bull, within 1/4 mile 5 cows, and 3 cows with 2 calves
3	(11:15 PM)		24 December 1976	With 1 cow
4	(1:20 PM)		19 January 1977	Alone
5	(1:00 PM)		7 February 1977	Alone
6	(1:00 PM)		5 March 1977	With calf
7	(11:02 AM)		30 March 1977	With calf
8			25 April 1977	With calf, medium medium small spruce
9	(7:45 PM)		10 May 1977	With 3 cows, sparse medium spruce
Ø			27 May 1977	
10	(Noon)		30 May 1977	With 1 new calf, feeding, near a cow with twins
Ø	(4:30 PM)		6 June 1977	With calf, resting, river floodplain with medium medium spruce
11	(8:00 AM)		10 June 1977	With calf, lying down in sparse tall spruce
12	(10:30 AM)		12 July 1977	Unable to observe, in thick upland tundra, within 1/2 mile cow with calf
13	(12:30 PM)		23 July 1977	No visual, dense willow and alder must be bedded down
14	(9:00 AM)		22 August 1977	Unable to observe due to dense alder-willow within 1/4 mile cow with calf
15	(2:15 PM)		5 October 1977	Alone, standing, riparian willow
16	(10:30 AM)		22 November 1977	With 2 cows, 3 calves, bedded riparian willow


MOOSE
8030
Coal Creek
McClaren River
Monsoon Lake
Keg Creek
Laren Mountain
Clarence Lake
Susitna River
Goose Creek
Black River
Oshetna River
Little Oshetna River
Sanona Creek
Tyone Creek
Tyone River
Tyone Lake
Moore Lake
Susitna
Lake Louise
Curtis Lake
Grayling Lake
Toloose Creek
Nicholson Lake
Little Nelchina River
Kelly Lake
Marie Lake
John Lake
Old Man Lake
Mendeltna Creek
GLENN HIGHWAY
Slide Mountain
Sucker Lake
Big Nelchina River
Tazlina Lake
10 miles
N
1
2
3
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6
8
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12
13
14
15

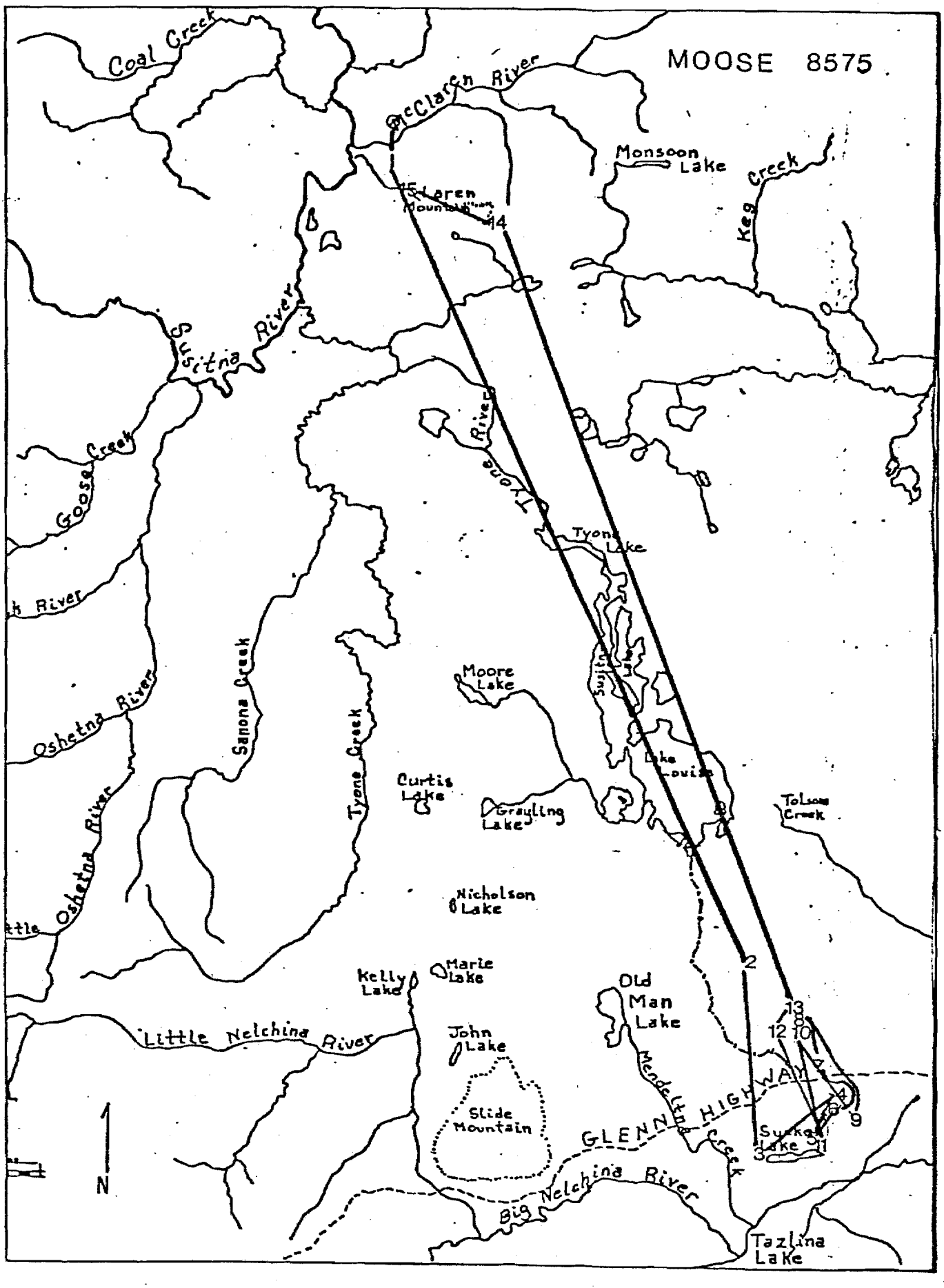
Number	Collar Color	Collar Number	Date	Remarks
8030	Black	NA	22 October 1976	With 5-6 cows

Observations

1		2 November 1976	
2		19 November 1976	With 1 cow, and close to radio 8035
3	(9:07 AM)	16 December 1976	With cow and calf
4		19 January 1977	Alone, however, large concentration moose in area
5		3 February 1977	No attempt to observe
6	(Noon)	5 March 1977	Alone
7	(10:22 AM)	30 March 1977	
8	(12:30 PM)	22 April 1977	With 2 cows, medium medium spruce
9	(5:00 PM)	10 May 1977	No attempt to observe
Ø	(9:52 AM)	13 May 1977	Walking, dense tall spruce
10	(10:00 AM)	30 May 1977	With one new calf on island, feeding, sparse medium spruce
Ø	(11:45 AM)	6 June 1977	With calf, feeding, sparse tall spruce
Ø	(Noon)	10 June 1977	With calf on island, resting, sparse tall spruce
11	(1:15 PM)	15 June 1977	Alone, moved to next island, feeding on shore in water
Ø		17 June 1977	Alone
Ø		25 June 1977	Unable to observe due to dense vegetation
Ø		30 June 1977	With calf on island, medium medium spruce
Ø	(10:15 AM)	7 July 1977	With calf
Ø	(10:00 AM)	12 July 1977	With calf, bedded, medium medium spruce
12	(10:00 AM)	23 July 1977	With calf, running dense medium spruce

8030 continued

13	25 August 1977	With calf and 1 cow, sparse medium spruce
14	30 August 1977	With calf, bedded, dense medium spruce
15 (1:00 PM)	5 October 1977	With calf, 1 cow with calf, and 1 small bull, medium short spruce
16 (1:15 PM)	22 November 1977	With calf, standing in dense short spruce


MOOSE 8575
Coal Creek
McClaren River
Monsoon Lake
Keg Creek
Loren Mountain
14
Susitna River
Goose Creek
Tyone River
Tyone Lake
Oshetna River
Sanona Creek
Moore Lake
Tyone Creek
Curtis Lake
Grayling Lake
Lake Louise
Tolsona Creek
Nicholson Lake
Kelly Lake
Marie Lake
Old Man Lake
John Lake
Little Nelchina River
Slide Mountain
Meadow Creek
GLENN HIGHWAY
Sunken Lake
Big Nelchina River
Tazlina Lake
N

Number	Collar Color	Collar Number	Date	Remarks
8575	Orange	3	21 March 1977	Pregnant, with group of 3 moose

Observations

1	(2:40 PM)	30 March 1977	Alone
2	(7:45 AM)	22 April 1977	Alone, bedded
Ø		10 May 1977	Did not attempt to observe
3	(9:10 AM)	11 May 1977	Within 1/2 mile of 3 cows, dense tall spruce
4	(8:30 AM)	25 May 1977	Alone, appeared pregnant, medium medium spruce
5	(2:45 PM)	26 May 1977	With cow that has new calf, resting, medium medium spruce
6		30 May 1977	Alone, feeding, sparse tall spruce
7		10 June 1977	Alone, traveling, willow
Ø		17 June 1977	Alone
8	(8:00 PM)	22 June 1977	Alone, feeding, sparse tall spruce
9	(1:00 PM)	28 June 1977	Alone, bedded, dense medium spruce
10	(9:00 PM)	6 July 1977	Alone, bedded, dense medium spruce
11	(1:00 PM)	12 July 1977	Alone, bedded, riparian willow
12	(7:30 AM)	2 August 1977	Alone, bedded, medium medium spruce
13	(9:45 AM)	17 August 1977	Alone, bedded, sparse medium spruce
Ø	(2:00 PM)	18 August 1977	With 2 cows, bedded, medium medium spruce
Ø	(9:45 AM)	13 September 1977	Alone, bedded, dense medium spruce
Ø		30 September 1977	No visual, cow was traveling
14	(5:00 PM)	5 October 1977	Alone, in dense medium spruce, within 1 mile 1 cow with twins and 1 cow with calf
15	(1:00 PM)	22 November 1977	With 1 cow, bedded, dense tall spruce

APPENDIX II

Wildlife Studies

Introduction

The proposed Susitna Hydropower Project will have impacts on several wildlife species which either reside in the project area, use the area for migration or other seasonal purposes or use habitat downstream which will be altered by the stabilization of water flow. The following individual proposals comprise an integrated program to provide information needed to predict the impacts of the Project on wildlife and to provide a basis for making decisions which might minimize those impacts.

This program will not answer all questions. It is designed to provide an acceptable basis of knowledge in a limited time period using presently available techniques. Emphasis has been placed on species which are likely to be most adversely affected by the project and are of greatest interest to man.

The design, timing, manpower requirements and funding levels of the individual projects have been coordinated for efficiency. No single project can be conducted by itself without considerable change in design and increase in cost. For example the moose study is the core of the entire package. The wolf, wolverine, bear and caribou studies are dependent on the moose study for manpower equipment and logistic support. The moose, habitat mapping and vegetation studies are also dependent on each other as each will influence the design of the others and their results must be compatible for final data analysis. If one project does not produce results at the proper time other projects will be delayed, reducing the quality of information and increasing the overall cost of the program.

Title: Habitat mapping and vegetation studies required for analysis of the effects of the Susitna Hydropower Project on wildlife.

Objectives: To prepare a vegetative type map of areas within and adjacent to proposed impoundments, along transmission corridors and along the downstream floodplain.

To identify key moose browse species and determine the condition and trends of selected moose habitats.

To determine the effects of altered water flow on key plant species and map areas where substantial vegetation changes will occur.

Background: Most impacts of the Susitna Hydropower Project on wildlife will occur through loss or alteration of habitat. Where habitat is totally lost to a population through inundation or blocking of migrations it is necessary to know the importance of that particular habitat to the population and the availability of alternative habitats. Where habitat will be merely altered, it is also necessary to know what elements within that habitat are important to the population and what changes will occur in those elements. Direct studies of wildlife species can

delineate a population and tell us where various components of the population are at different times and to a certain extent why they are there. However, wildlife studies must be accompanied by habitat studies if we are to determine the full significance of habitat alteration to the population.

This project is not an actual proposal. Several of the studies outlined here could be expanded to meet the needs of other disciplines. Therefore, this is a statement of information needed to evaluate the effects of the Susitna Project on wildlife. Actual study proposals should be developed to provide this information on the schedule outlined.

Procedures: A habitat type map of the proposed impoundment areas, all drainages flowing into the impoundments, access and transmission corridors and the downstream floodplain should be prepared during the first two years of the study. This map should be of sufficient detail to permit delineation of specific habitats favored by moose and must be accompanied by sufficient ground truth data to identify the distribution and abundance of moose browse species. In order to accomplish this it is essenital that the principal investigators of moose studies work directly with the habitat mappers.

Studies of the effects of water table and influence of water level fluctuations on vegetation, particularly moose browse species, along the floodplain of the Susitna River should be initiated immediately. A map of areas where changes in flow caused by the dams will alter the vegetation, either through changes in soil moisture or by allowing plant succession to occur, should be prepared. Emphasis should be placed on areas of high moose use such as the lower Susitna River.

Detailed studies of vegetation in important moose wintering areas should be conducted to identify plant species used by moose and quantify their presence, use and trends. Study areas would be identified from data collected under the moose studies.

Schedule:

FY 78	Habitat mapping, effects of water level studies
FY 79	Habitat mapping, effects of water level studies
FY 80	Map areas of expected plant composition changes. vegetation studies on moose winter range
FY 81	Moose winter range studies
FY 82	Moose winter range studies

Title: Impact of the Susitna Hydropower Project on Moose Populations

Objectives: To identify moose subpopulations using habitat subject to direct and indirect impact of the Susitna Hydropower Project.

To determine the seasonal distribution, movement patterns, size and trends of those subpopulations.

To determine the timing and degree of dependency of those subpopulations on habitat to be impacted by the Susitna Hydropower Project.

Background: Several subpopulations of moose occupy habitats that may be inundated or substantially altered by the proposed Susitna Hydropower Project. Limited studies conducted in 1977 identified one subpopulation which occupied the upper ends of tributaries north of the proposed impoundment areas during spring, summer and fall, then migrated to the Susitna River bottomlands during winter. Similar populations almost certainly occupy drainages to the south of the impoundments. There is also strong evidence that riparian habitat along the mainstem, which may be significantly altered by the stabilization of water flow, also serves as winter range for several subpopulations of moose. These habitats may be critical to these populations in severe winters. Other subpopulations may be nonmigratory and use areas to be affected all year. Some migratory populations may not rely on the river bottoms for seasonal range but may migrate through them on their way between seasonal ranges.

The degree of impact will vary depending on the subpopulations size, status and degree of dependence on altered habitat and the nature of the habitat alteration. Many factors must be considered including: the sex and age composition of members of the subpopulation using the habitat (often pregnant cows or cows with calves are more dependent on lowland areas than bulls), the overall range of the subpopulation (some members of a nearby subpopulation migrate up to 60 miles indicating that reductions in moose densities could occur over a vast area), the availability of alternative ranges particularly during severe winters (habitat alterations which may be relatively insignificant in normal or mild winters may be devastating when heavy snowfall makes alternative ranges unavailable), etc.

An adequate assessment of the potential impacts of the Susitna Project on moose requires a thorough understanding of moose populations using the area. This information must then be related to a knowledge of the habitat and the elements within that habitat that are necessary for moose. This study is designed to provide the necessary information on moose. It is essential that certain habitat studies be conducted concurrently. A habitat map of sufficient detail to delineate types selected by moose, covering the impoundment area, surrounding drainages, transmission corridors and the floodplain of the Susitna River to its mouth, should be prepared at an early stage of the studies. Detailed browse studies should be conducted at sites selected on the basis of use by moose to identify important browse species, measure the degree of use and identify other elements of the habitats that are important to moose. The role of

the water table and spring flooding in maintaining moose habitat below Devils Canyon should be determined and maps delineating areas where the alteration of the flow will result in vegetation changes should be prepared.

This moose study and the habitat studies outlined above should be closely coordinated as each will influence the final design of the other and all are necessary to relate habitat changes to moose.

Procedures: During 1977, 12 moose were radio collared and 14 others were collared with visually identifiable collars. These moose were tracked from March to December 1977. Under this study, tracking of those moose will be continued, to further delineate the ranges of that subpopulation.

Additional moose will be radio collared in drainages along the south side of the proposed impoundment area and in riparian habitats along the mainstem below Devils Canyon.

Each radio collared moose will be relocated regularly. For each relocation the exact location, habitat type, activity of the moose and association with other animals will be recorded.

A random stratified census and seasonal sex and age composition counts will be conducted on subpopulations most likely to be affected by the Susitna Hydropower Project. Concentrations of moose will be mapped throughout the area whenever the opportunity arises.

These data will be used to identify subpopulations using areas to be impacted, to determine the seasonal ranges and migration routes of each subpopulation and to estimate the size and composition of those subpopulations most likely to be impacted. Locations of moose will be overlayed on habitat maps to determine the degree of use of certain habitat types as well as specific habitats. This information will be analyzed by subpopulation, season, sex and age class and reproductive status. Areas likely to be altered by the project that are critical to a subpopulation will be identified and recommended for more detailed vegetation studies.

Schedule:

FY 78	Radio collar moose, tracking flights, composition counts
FY 79	Tracking flights, composition counts, random stratified count. Review habitat map and map of downstream areas to be impacted and identify data gaps. Identify areas for detailed vegetation studies.
FY 80	Replace radios and radio collar new moose to fill identified data gaps, tracking flights, composition counts.
FY 81	Tracking flights, composition counts, random stratified counts.
FY 82	Tracking flights, composition count, start final analysis of data.
FY 83	Tracking flights, complete analysis of impact of Susitna Hydropower Project on moose, write final report.

Cost:

FY 78	$220,000
FY 79	$210,000
FY 80	$180,000
FY 81	$210,000
FY 82	$175,000
FY 83	$ 85,000

Title: Mitigation measures for lost moose habitat.

Objectives: To identify and evaluate measures for enhancing moose habitat.

To locate areas where moose habitat enhancement would effectively mitigate loss or deterioration of moose habitat resulting from the Susitna Hydropower Project.

Background: Important and perhaps critical moose habitat will be totally lost or reduced in quality by the Susitna Hydropower Project. The proposed moose and habitat studies should quantify this loss and its resulting impact on moose populations.

Moose tend to favor subclimax ranges. In recent years several agencies have recognized a potential for enhancing habitat for moose by setting back plant succession through artificial means. The Alaska Department of Fish and Game, U.S. Fish and Wildlife Service and U.S. Forest Service have all experimented with such techniques as mechanical crushing, prescribed burning and fertilizing. At present these techniques have not been fully evaluated.

Such techniques are probably effective only in certain types of habitats. In some cases it might be possible to fully mitigate the impact on a particular subpopulation of moose. For example, if an effective technique can be found to maintain willow habitats on river bars without periodic flooding, impacts on subpopulations dependent on downstream habitat might be kept to a minimum.

In other cases where critical habitat will be completely destroyed it might be possible to make alternative habitat available to the affected subpopulation of moose. However, there will likely be some subpopulations for which mitigation measures will not be possible. In these cases the loss to human users could be offset by enhancing the range of populations of moose away from the Project area.

In order to assess these possibilities it is necessary to evaluate the various techniques and to delineate habitat where these techniques would have a positive effect on moose.

This project is designed to provide information to assess the feasibility of mitigation and to initiate long term studies which would direct actual mitigation efforts. Evaluation of these long term studies will take many years. The need to complete the long term studies will depend on the results of the feasibility study.

Procedures: A complete review of potential moose habitat manipulation techniques will be made. Areas which have been experimentally manipulated in the past will be visited and the quantity and quality of potential moose browse produced will be assessed. Information gaps will be identified and if necessary further experimental manipulation will be recommended.

Data from the habitat mapping, vegetation and moose studies will be used to identify areas where habitat manipulation might offset adverse impacts on each of the subpopulations of moose that are identified.

Schedule:

FY 79	Preliminary review of techniques and identification of areas of past experimentation.
FY 80	Evaluation of success of previous manipulation efforts. Identification of data gaps. Recommendations on future experimentation.
FY 81	Continue evaluation of manipulated areas. Initiate manipulation experiments to fill data gaps.
FY 82	Evaluate techniques. Identify potential areas for mitigation.
FY 83	Evaluate techniques. Identify potential areas for mitigation.

Cost:

FY 79	$ 5,000
FY 80	$ 20,000
FY 81	$275,000 (actual cost will depend on results of FY 79 and 80 studies)
FY 82	$ 20,000
FY 83	$ 20,000

Title: Impact of the Susitna Hydropower Project on caribou populations.

Objectives: To identify subpopulations of caribou in the Nelchina Basin.

To determine the seasonal ranges and migration routes of these subpopulations with emphasis on traditional migration routes across proposed impoundment areas and potential alternative routes.

To determine the availability of suitable alternative seasonal ranges to caribou subpopulations that might be isolated from traditional ranges by the proposed impoundments.

Background: The Nelchina basin has been the most important sport hunting area for caribou in Alaska. Although caribou numbers were reduced from a recorded high of 72,000 to a low of 10,000 the population is presently increasing and is now estimated to exceed 14,000 cariobu. Proposed management plans state that the population will be allowed to increase until it numbers 20,000 caribou.

Caribou traditionally have used a variety of ranges on both sides of the Susitna River and varying numbers have crossed the Susitna at least twice a year. Major crossing locations have been recorded in areas which would be affected by the proposed hydropower project. Because caribou frequently migrate long distances and may periodically overgraze one range and shift to another, it is necessary to examine the status of caribou and identify alternative ranges over a large area.

Range studies conducted by the Alaska Department of Fish and Game have shown that the most desirable winter ranges remaining in the Nelchina basin are located in the Clearwater Mountains, Chunilna Hills, Susitna Uplands and Monahan Flats. Most of these ranges are north of the Susitna River while historical and recent calving and summer ranges exist south of the river. The preferred lichens south of the river have generally declined and have not shown substantial recovery even with lowered caribou populations. Meanwhile, the Nelchina population has used this area to a greater extent than the other portions of its range. A portion of the winter range exists east of the Richardson Highway in the Wrangell Mountains but movement into this range may be affected by the recent construction of the oil pipeline from Prudhoe Bay to Valdez. All of these factors make it likely that the ability to cross the Susitna will remain critical to the well being of the Nelchina caribou herd.

To determine the extent that the impoundments will affect this movement is difficult. Other migration routes may be used in addition to those already shown in the literature or sufficient range may be available to the east to support the proposed population level. It is also possible that a separate but smaller population exists north of the Susitna which may increase to fill the available range in that area even if the existing Nelchina population were confined to the area south of the proposed impoundments.

Procedures: Caribou on both sides of the Susitna River will be radiocollared during the breeding season. Monitoring flights will be made at a relatively low intensity (approximately monthly) throughout most of the year to determine if more than one population exists in the area and to determine seasonal ranges of each population identified. More intensive monitoring flights will be made during the periods of precalving and postcalving movements and winter shift to determine present migration routes and the timing of migration. It will be necessary to repeat this procedure for several years to determine variation among years.

Traditional migration routes will be determined by mapping trails and will be compared with present routes.

Potential alternative ranges will be identified and evaluated using the modified Hult Surlander method of range analysis. These ranges will be compared with Nelchina ranges that have been studied for a number of years.

Schedule:

FY 79	Radio collar caribou, monitor movements. Conduct range analysis.
FY 80	Replace inoperative radios, monitor movements.
FY 81	Replace inoperative radios, monitor movements.
FY 82	Replace inoperative radios, monitor movements.
FY 83	Monitor movements. Repeat range analysis to determine trends.

Cost:

FY 79	$120,000
FY 80	$ 95,000
FY 81	$ 95,000
FY 82	$ 95,000
FY 83	$102,000

Title: Effects of the Susitna Hydropower Project on wolves.

Objectives: To determine the number of wolf packs and the number of wolves in each pack that inhabit areas to be directly affected by the Susitna Hydropower Project.

To determine the proportions of each pack's territory that lies within areas of impact.

To determine the location of dens, rendezvous sites, hunting areas and the other essential activity areas of each pack in relation to proposed impoundments and construction activities.

To determine the dependence of each pack on prey populations that may be adversely affected by the Project.

Background: Wolves are of considerable national concern as evidenced by recent newspaper and magazine articles. They are known to inhabit the entire project area and information on population size and movements is needed to determine project impacts.

Studies in other areas of southcentral Alaska have demonstrated that some wolves have home ranges as large as 2,000 square miles while many packs have territories ranging from 200 to 600 square miles. It is known that the immediate project area may contain five or more wolf packs. It appears that some of these packs use the Susitna River as a territory boundary, and inundation and associated development could have a dramatic influence on them. These packs depend heavily on moose populations that use the impoundment areas. In addition other studies have shown that any human disturbance relatively close to a wolf den may cause abandonment of the traditional site and perhaps reproductive failure.

Procedures: Two to four wolves will be radio collared in each pack whose territory is believed to include potential impoundment areas and construction sites. The numbers of wolves in each pack will be determined, each pack's territory will be delineated and the degree and nature of use of potential impact areas will be determined through repeated relocations and observation of activities. Specifically, all den sites, rendezvous sites and favored hunting areas will be mapped. These data will be used to determine the degree of dependence of wolves on various areas that will be impacted by the Project.

Dependency on various prey species will be determined by scat analysis and observation of hunting behavior and kills. This information will be used in conjunction with data from the accompanying studies of prey species, particularly the moose study, to estimate indirect impacts on wolves caused by a reduction in prey availability.

Field activities and manpower for this study will be integrated with the moose study. Wolves frequently will be tagged and relocated at the same time as moose. Full funding of the moose study is required for the successful implementation of this study.

Schedule:

FY 78	Radiocollar wolves, monitoring flights.
FY 79	Replace lost radios, monitoring flights.
FY 80	Replace lost radios, monitoring flights.
FY 81	Radiocollar new wolves to fill data gaps. Monitoring flights.
FY 82	Monitoring flights.
FY 83	Monitoring flights.

Cost:

FY 78	$55,000
FY 79	$36,000
FY 80	$29,000
FY 81	$40,000
FY 82	$25,000
FY 83	$13,000

Title: Effects of the Susitna Hydropower Project on black and brown/grizzly bears.

Objectives: To estimate the numbers of black and brown/grizzly bears using the area to be impacted by the Susitna Hydropower Project.

To determine the dependency of these bears on areas to be impacted, with emphasis on identification of denning areas and seasonal feeding areas.

Background: Very little is known of either brown or black bear populations in the Susitna Basin except that brown bear densities appear to have been very high for several years. We do not know how many bears inhabit the area or how dependent they are on the impoundment areas. Studies should be conducted to estimate bear numbers in and surrounding project area, determine whether the same bears are resident or whether a larger number have a seasonal dependency on the area, and determine the location and extent of denning activities.

A major problem with any large construction project is the attraction of bears to camps and construction sites. This usually results in threats to human safety, delays in construction and destruction of bears. If areas of bear concentration can be identified and avoided during construction, these problems can be substantially reduced.

Procedures: Bears will be radiocollared in the project area. Movements in and around the area will be monitored. Den sites and concentration areas will be mapped.

Bear numbers will be estimated through marked/unmarked ratios observed during spring and fall composition counts and by recording all bears seen during tracking flights.

Field activities for this study will be closely integrated with those for the moose and wolf studies. Full funding of the moose study is required for the successful implementation of this study.

Schedule:

FY 79	Radiocollar bears, monitoring flights composition counts.
FY 80	Monitoring flights, composition counts.
FY 81	Monitoring flights, composition counts.
FY 82	Monitoring flights.

Cost:

FY 79	$95,000
FY 80	$57,000
FY 81	$50,000
FY 82	$35,000

Title: Effects of the Susitna Hydropower Project on wolverine.

Objectives: To determine the population status of wolverines using areas to be impacted by the Susitna Hydropower Project.

To determine movement patterns and identify habitats of seasonal importance to wolverines.

Background: Less is known about the wolverine than any other big game species in Alaska. Threatened with extinction throughout most of its range in the Scandinavian countries, parts of Russia, the continental United States and Eastern Canada, it is still considered relatively abundant in Alaska. Studies in Idaho and Sweden indicate that wolverines have exceptionally large home ranges. Records of males moving 15 miles in a 24 hour period are not uncommon.

The Talkeetna mountains on either side of the Susitna River between Gold Creek and the MacLaren River presently support a healthy population of wolverines. Although their density is not known at this time, it is probably as high or higher there than in any other portion of their range in Southcentral Alaska. Because the welfare of this species in Alaska is of both national and international concern, some intensive efforts to determine the status, distribution, and movement patterns of wolverine in the project area are warranted.

Procedures: A limited number of wolverines will be radiocollared and tracked in conjunction with other telemetry studies in the area. Home ranges, movement patterns, and seasonal habitat use will be determined by systematic relocation of radiocollared animals.

A systematic aerial survey of wolverines and their tracks will be made in conjunction with wolf studies to determine the distribution and numbers of wolverines using the area.

These data will be used to estimate the number of wolverines using the impoundment areas, determine the degree of dependency of certain wolverines on those areas and identify specific areas of importance to wolverines.

Schedule:

FY 79	Radiocollar, monitoring flights, census.
FY 80	Radiocollar, monitoring flights, census.
FY 81	Monitoring flights.

Cost:

FY 79	$30,000
FY 80	$25,000
FY 81	$10,000

Title: Distribution and status of Dall sheep adjacent to the Susitna Hydropower Project area.

Objectives: To determine the numbers of Dall sheep inhabiting mountains adjacent to proposed dam sites.

To delineate the seasonal ranges of the sheep population.

Background: A relatively isolated sheep population inhabits mountains adjacent to the proposed dam sites. While there will probably be little direct impact on this population by the proposed project, there is a possibility of adverse impacts from human disturbance as a result of dam construction activities and increased access.

Procedures: Aerial surveys will be conducted to determine the size of the sheep population and to delineate seasonal ranges.

Schedule:

FY 79	Aerial surveys.
FY 80	Aerial surveys.
FY 81	Aerial surveys.

Cost:

FY 79	$3,000
FY 80	$3,000
FY 81	$1,000

Title: Distribution and abundance of furbearers and small game in the proposed Susitna Hydropower Project impoundment areas.

Objectives: To determine the distribution and relative abundance of furbearers and small game in the proposed impoundment areas and determine the degree of use of those species by humans.

To determine the dependence of furbearers and waterfowl on downstream habitats which will be altered by changes in water flow.

Background: Little is known about the distribution and abundance of either furbearers or small game. In order to assess the potential impact of the project on small game it will be necessary to conduct a basic biological reconnaissance. It is known from data collected incidentally to other projects that the Susitna River Basin provides habitat for large numbers of fox, wolverine, and river otter. All three of these species are highly sought by trappers.

Stabilization of water flow could substantially alter aquatic furbearers and waterfowl habitat downstream.

Procedures: Limited aerial surveys will be conducted to determine the presence, distribution and relative abundance of fox, otters, beavers, ptarmigan, waterfowl and raptors. On the ground observations will be made in conjunction with the nongame project.

Trappers and residents of the area will be interviewed.

Surveys of aquatic furbearers and waterfowl will be conducted in downstream areas of probable habitat alteration that will be identified by studies on the effects of water flow on habitat.

Schedule:

FY 79	Surveys in impoundment areas, interviews.
FY 80	Surveys in impoundment areas, interviews.
FY 82	Surveys downstream.
FY 83	Surveys downstream.

Cost:

FY 79	$35,000
FY 80	$35,000
FY 82	$25,000
FY 83	$25,000

Title: Distribution and abundance of nongame species of wildlife in the area to be impacted by the Susitna Hydropower Project.

Objectives: To determine the occurrance, distribution and relative abundance of small mammals and passerine birds in the proposed impoundment areas.

Background: Little is known about the occurrence, distribution or abundance of small mammals and both resident and migratory passerine birds in the Project impact area. A limited reconnaisance should be conducted.

Procedures: A literature search will be conducted. Surveys from the ground will be made and limited trapping will be done. Portions of this study will be coordinated with small game and furbearer studies.

Schedule:

FY 79	Literature search, initiate surveys.
FY 80	Complete surveys.

Cost:

FY 79	$7,000
FY 80	$8,000