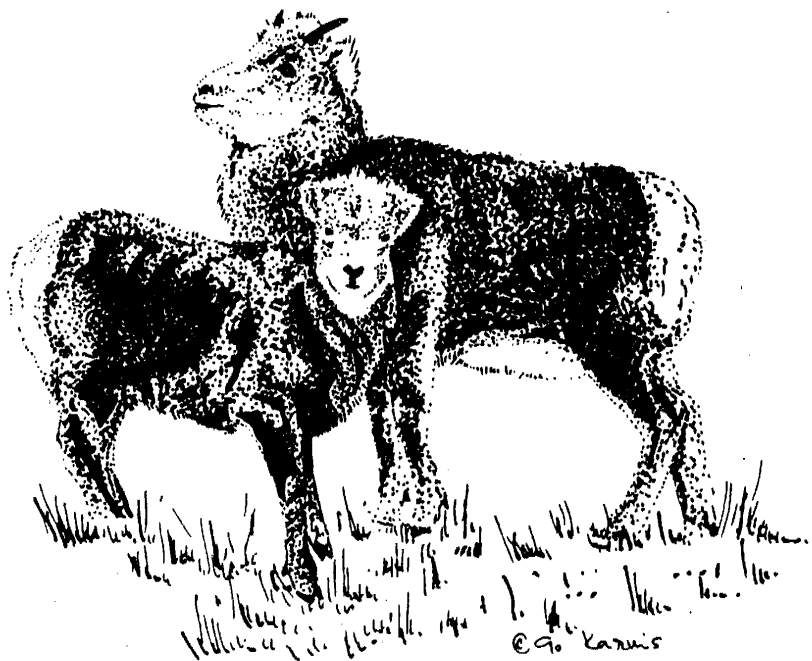


# SHEEP STUDIES AT FARO YUKON



*R.E. Schweinsburg*

July 1990

TRC-90-4

**Yukon**  
Renewable Resources

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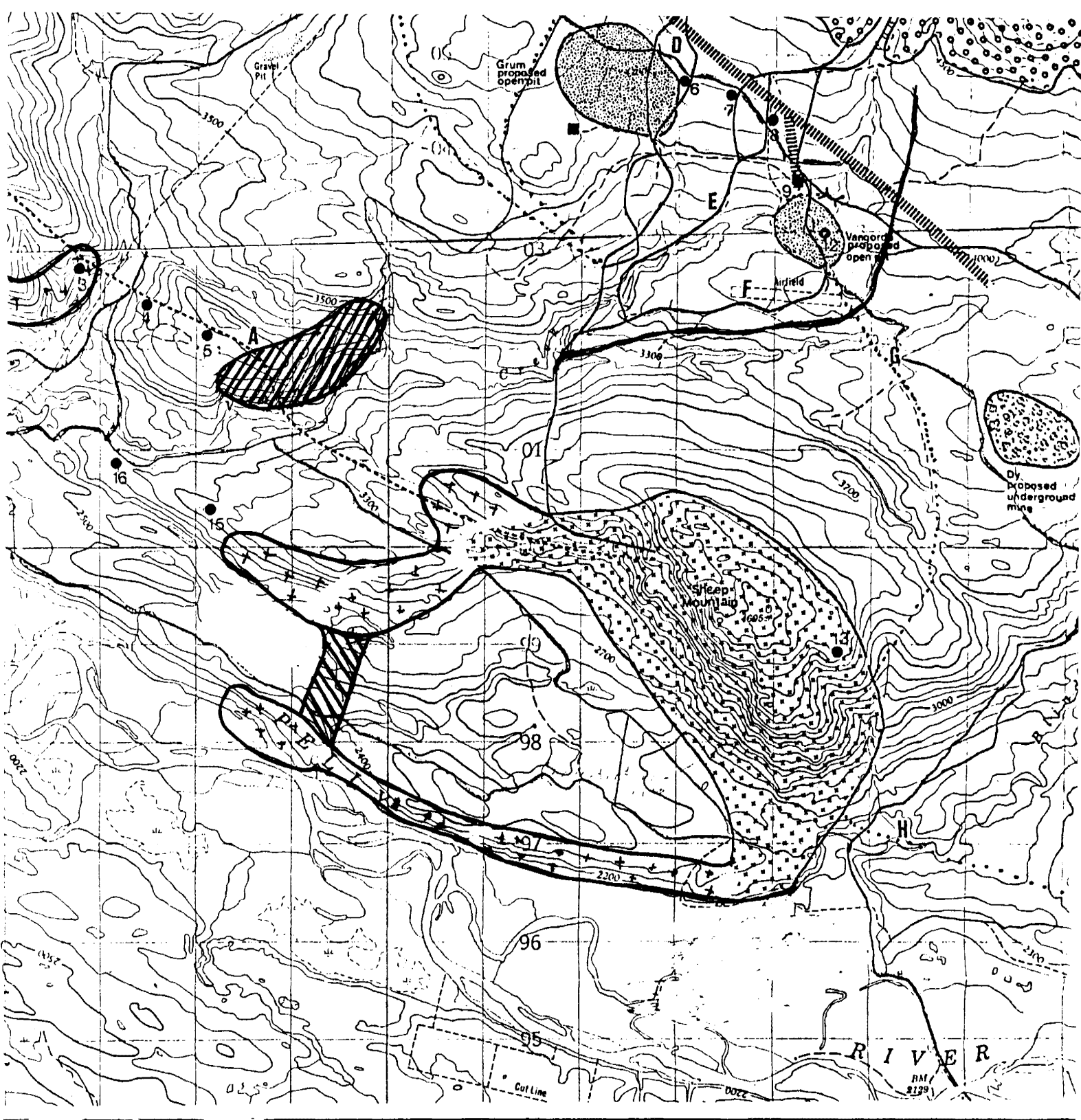
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## INTRODUCTION

Curragh Resources in Faro, Yukon is in the process of developing two new ore bodies, the Grum and Vangorda pits (Fig. 1) on Vangorda Plateau. Those ore bodies lie directly on traditional migration routes used by Fannin sheep (Ovis dalli stonei) when crossing the Plateau between their winter range on Sheep Mountain (Fig. 2) and their summer range on Mt. Mye (Fig. 1). The possibility exists that the habitat destruction and disturbance associated with those pits could block or seriously alter the migration routes to the extent that the sheep population declines or becomes extinct. Moreover, indirect but potentially as serious an impact could be generated by illegal hunting and disturbance of sheep on both winter and summer ranges by residents or visitors from the nearby town of Faro.

This sheep population is unique in that it is the only one of that variety whose range is so near a thriving town (Faro). This fact provides both potential problems and opportunities. Recognizing this prompted the Yukon Government's Department of Renewable Resources, in cooperation with Curragh Resources, to undertake studies to determine impacts on the sheep population and to mitigate those impacts if possible. The project has been viewed as a demonstration project to show that major developments can take place without harming wildlife if proper mitigation measures are implemented. In addition, the Yukon Government and the town of Faro are trying to develop the non-consumptive possibilities presented by those sheep living so near Faro and accessible by road.



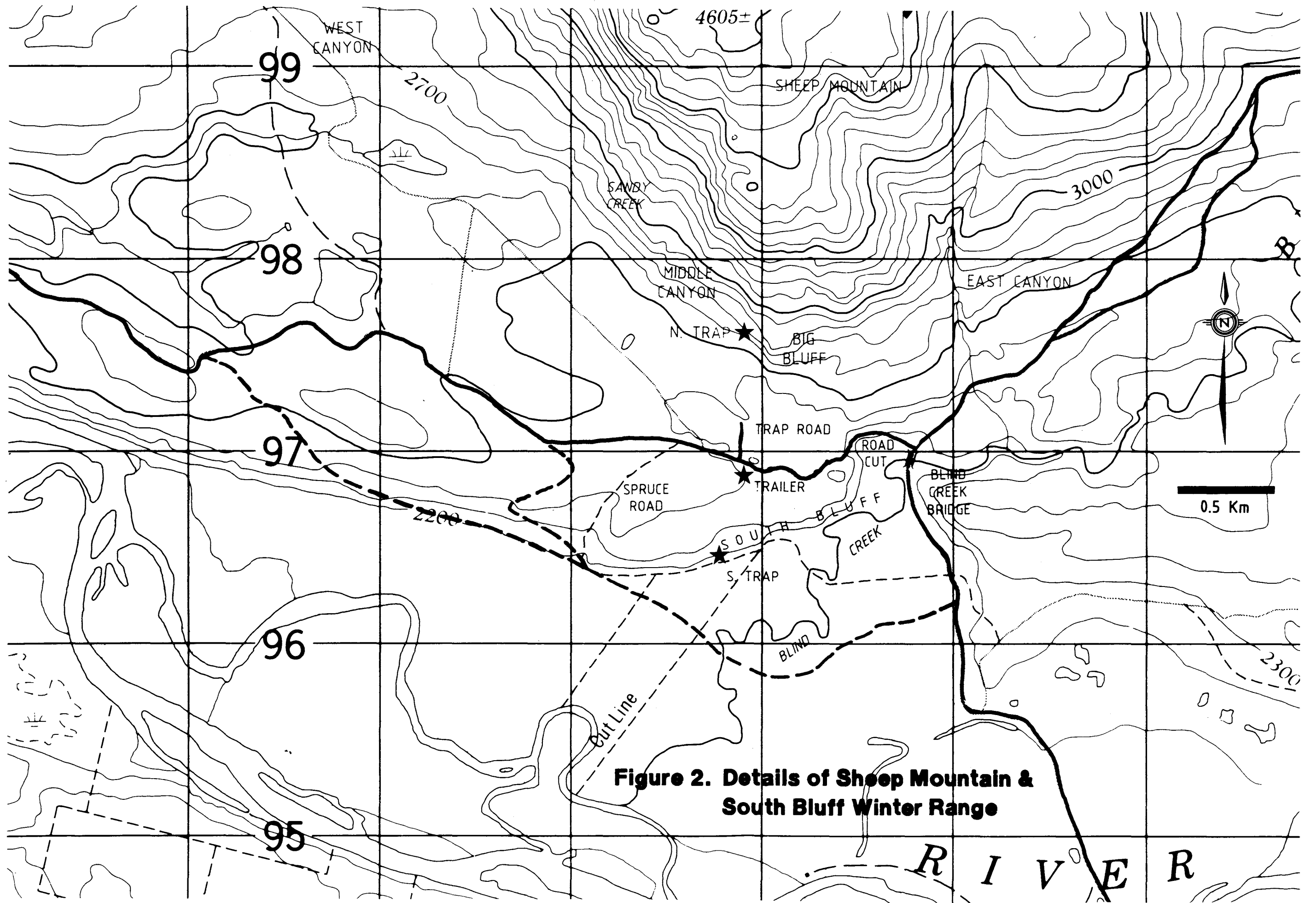
**Figure 1. Adapted from McLeod 1981.**

**EGEND**

SCALE 1:50,000

0 1 2 3 Kilometers

- Sheep Observations
- Verified Migration Routes
- Unverified Migration Routes
- Migration Route of Ram from Rose Mtn.
- Summer Range
- Winter Range
- Proposed Open Pits
- Proposed Underground Mine
- Overland Conveyor
- Dam and Vangorda Creek Diversion
- Grum Camp
- Roads
- Diversion Route
- Suspected Winter Range
- Suspected Move Corridor



**Figure 2. Details of Sheep Mountain & South Bluff Winter Range**

In an economy dominated by mining, diversification through other activities such as tourism, which could be provided by viewing opportunities of those sheep, would be welcome. Hence, that small band of sheep has become a focus for several diverse and sometimes conflicting interests.

For more information on the background and development of the Fannin sheep project at Faro see McLeod 1981, Curragh Resources Inc. 1987, Horesji 1988, Lortie 1988, Hoefs 1988, Schweinsburg 1989 and Schweinsburg 1990 and several survey summary results available from the Yukon Department of Renewable Resources.

#### PROJECT OBJECTIVES

This part of the study, carried out from mid-November 1989 to the end of May 1990 was a contribution of the larger project begun in 1987. The objectives for this part of the study were as follow:

- 1) to supervise the work on habitat improvement (Appendix A);
- 2) to try to determine how and when the sheep returned to the wintering area;
- 3) to mark as many sheep as possible and to attempt to put radios on those sheep thought to come from Rose Mountain;
- 4) to note the movements of marked sheep;
- 5) to determine productivity and mortality rates and mortality causes;
- 6) to determine if sheep used the habitat improvement areas;

- 7) to document habitat areas frequently used by sheep that could benefit from clearing;
- 8) to dismantle the traps used for trapping;
- 9) to document response of sheep to disturbance;
- 10) to assist the Conservation Officer with monitoring of illegal activities; and
- 11) to write a summary report that incorporates all of the data collected for the project to date.

## **METHODS**

Work on habitat improvement was carried out by a four man crew provided on a service contract with the Ross River Native Band. Hand clearing techniques were used throughout, with the salvageable timbers being stacked for eventual disposal as firewood. We received funding from the Community Development Fund to carry out this work.

Methods employed to capture sheep and to monitor the population were the same as those described in Schweinsburg (1989).

Field work began on November 15, 1989 and ended on May 31, 1990. During the first part of the season, observations were curtailed to some extent and trapping was not done in favour of supervision of the habitat improvement slashing crew (reported in Appendix A). Slashing terminated on December 20. By then it was too cold to trap. Trapping did not begin until March using alfalfa hay and salt for

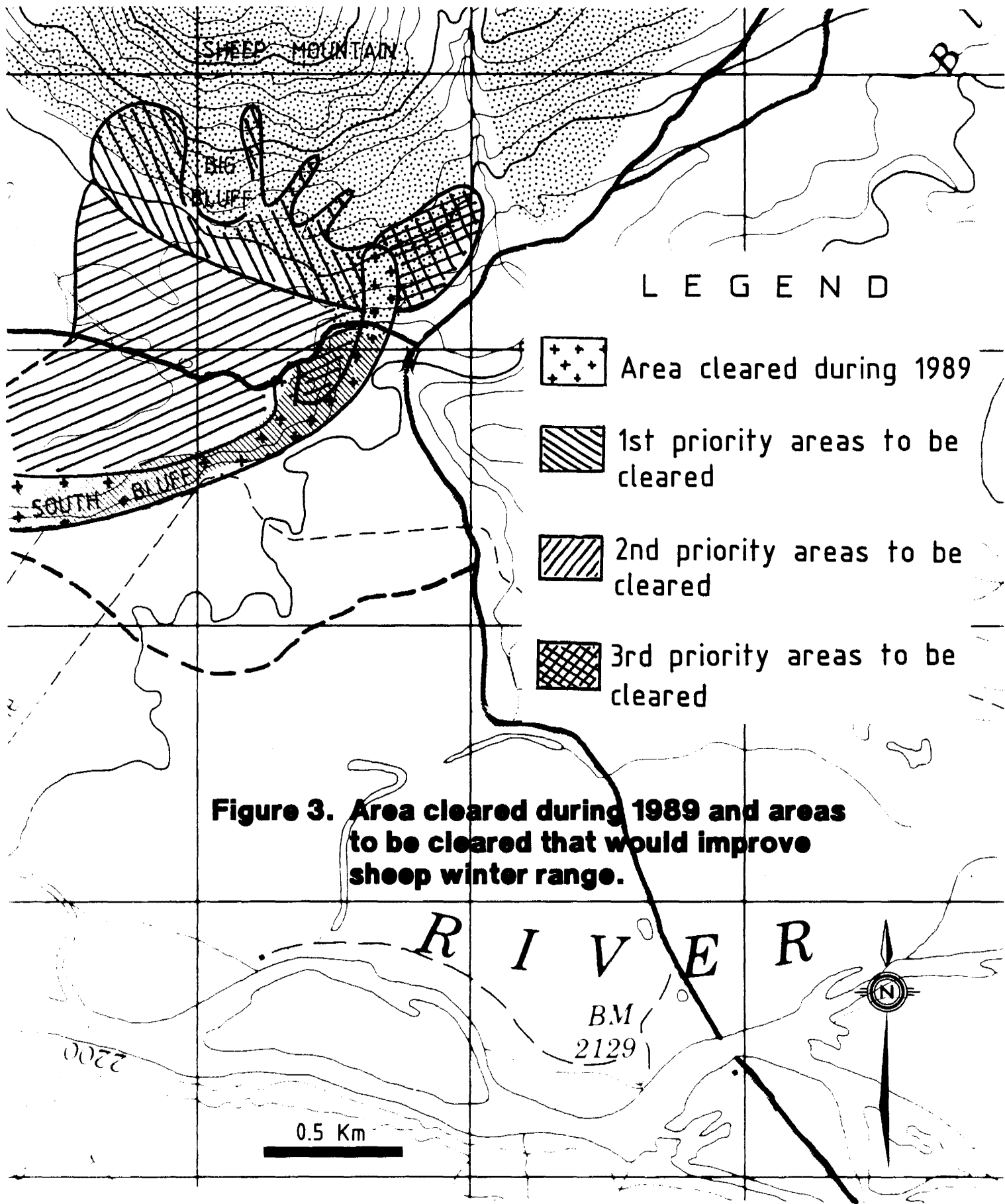
bait. Trapping was attempted through May to put radios on bands that did not contain any marked sheep, but the sheep did not visit the traps often after vegetation began regrowing on the slopes (mid-April). Only adult ewes were marked, either with color coded radio collars or yellow neck collars with black numbers.

## RESULTS AND DISCUSSION

### Habitat Improvement

The winter range area around Sheep Mountain burned in 1969; as a result the lower slopes and benches are covered with downed timber and brush, which impedes easy passage and grazing, thus diminishing its habitat type value for sheep. A strip varying between 15 and 30 metres wide and approximately 1.0 kilometres long was cleared of all downed timber and brush to see if that was a practical and useful way to improve the habitat for sheep (Fig. 3 and Appendix A).

Clearing started in November when the sheep were already on the winter range and the disturbance caused them to avoid the area being cleared and the South Bluff (Appendix A). They did not return to the area until the end of January when they again began to use the area and their movements from January on were comparable to 1988 (Schweinsburg 1989). "South Bluff" is an important area for sheep both for feeding and for the licks that occur along most of its length. It is clear when comparing sheep movements during 1988 and 1989, the difference in use would not have been noticed because the



**Figure 3. Area cleared during 1989 and areas to be cleared that would improve sheep winter range.**

sheep almost "passively" avoided the area and did not otherwise appear to be overly disturbed even during the few (three recorded) times they went down from the upper slopes of Sheep Mountain and encountered the slashing crew. This emphasizes the importance of maintaining the winter range (and possibly the summer range as well) as free of disturbance as possible. Possibly large areas will be avoided that could otherwise be used by sheep if this is not done.

One can only wonder what the range use patterns of the lower slopes and benches were before the Blind Creek Road was heavily used. Geist (1971) and Horesji (1988) present good discussions of elimination of sheep usage of areas because of disturbance and consequent loss of behavioral tradition.

Observations in our project area show that when the sheep returned to the cleared area, they seemed to prefer the open, newly cut area. Several times they were observed feeding up to the edge of the down timber that had not been cleared. When they were forced to hop over the blowdown they returned to the cleared area. It is a well known trait of sheep that they prefer open areas to those in which they cannot see approaching threats. Clearing more of the down timber and brush would improve sheep winter range, but the clearing must be done when the sheep are not present to avoid loss of habitat through the sheep avoiding disturbance.

On a prioritized basis, the areas that should be cleared first would be the brushy slopes and gullies around the base and sides of Big Bluff because they are most frequently used (Fig. 3). Much of this area is

not now available for grazing because of the obstacles of the down timber and brush. After that, the lower benches down to the top of South Bluff should be cleared. Hand clearing is expensive and the brush will grow back. Therefore, besides hand clearing, some method of clearing should be tried that effectively prevents aspen and willow regeneration by suckering or else the brush may grow back thicker than before. Perhaps small early spring fires or biodegradable herbicides could accomplish that. But even if the brush does grow back, the clearing of the down timber would improve the range. It should be mentioned that clearing the gullies and slopes of brush will possibly eliminate the use of those areas by blue grouse (Dendragapus obscurus). One of the biggest improvements that could be made is the reduction of human disturbance on the winter range, and I presume on the summer range (McLeod 1981, Horesji 1988, Lortie 1988). The proposed realignment of the Blind Creek Road should accomplish that, but only if the drafters of the Faro Community Sheep Viewing Project understand the amount, type and location of disturbance that the sheep will tolerate without abandoning portions of their winter range. Such information may not be available and therefore caution and monitoring of non-consumptive viewing interactions with sheep may be required.

One of the questions this study raises is why the sheep population has remained virtually stable for ten years despite apparently good reproduction and survival of young sheep (see the section on "Productivity and Mortality")? If the sheep population is below carrying capacity, then other factors must be causing lowered sheep numbers. To help understand the carrying capacity of the range, it

may be useful to build several enclosures to determine range use and overuse. These could be assessed every year and the information compared with population, sex and age counts.

#### Autumn Migration Patterns

Attempts were made to determine how and when sheep returned to the winter range by interviewing mine employees and Faro residents, but only generalized information was obtained that did not add anything to what was known. McLeod (1981) remains the best source of information about autumn migration and what little has been reported since then confirms her work.

Apparently the sheep return across the Vangorda Plateau during mid-September (McLeod 1981, Horesji 1988 and this study), but more specific timing data need to be gathered as well as information about any route changes or abandonment of routes that may occur as the Grum and Vangorda pits are developed. The corridor between the two pits seems more and more important as habitat destruction proceeds on the outer sides of the migration "funnel" and the diversion route (Horesji 1988) around the mine is apparently not used (Schweinsburg 1989 and this study). It may be in the future that the center route is the only one the sheep will use (McLeod's "E" route, Fig. 1) because of obstruction of the outer routes by disturbance and habitat destruction. Already the water treatment plant, settling pond and Vangorda power sub-station have intersected McLeod's route "D" and the Vangorda pit, her route "F" (Fig. 1). A water pumping station and pipeline from Vangorda pit to the water treatment plant, the

Vangorda haul road and oil transfer dump, and possibly a conveyor system threaten the main route "E" (Fig. 4).

### Spring Migration

In 1989, the first sign of sheep migrating to Mt. Mye was observed on May 10 (Schweinsburg 1989). This year the first sheep crossed on May 12 (Table 1) and was seen by a mine worker (Pardy pers. comm.). In both years all of the sheep had not migrated by the end of May when the studies terminated, particularly the rams which stay around Faro west of the road and north of the town dump, and a number of nursery sheep at Sheep Mountain. McLeod (1981) observed movements as early as April, but defined the most intensive movement of ewes beginning on May 12, 1981 and continuing until June 30.

The observation on May 16 (Table 1) was particularly interesting because it gave insights into sheep behavior when they are obstructed by mine activity. Despite knowing where the sheep crossing on Trail "E" was since 1981, Curragh saw fit to place a large pad of gravel right on the crossing to be used as an ore transfer dump for the Vangorda pit (Fig. 4). Here it is planned that high grade ore will be dumped and stock-piled before reloading for hauling to the mill. At about 13:00 there was a bulldozer and several haul trucks working on the haul road at the spot where it intersected Trail "E" adjacent to the ore transfer dump. As I started down Trail "E", I flushed a sheep off the downhill side of the haul road embankment. I hid and watched the sheep return and try to cross for over an hour as the trucks and bulldozer worked above her on the haul road. She was

Table 1. Observations of Sheep Crossing the Mine Area During May 1990.

Date	Time	# and Description of Sheep	Direction	Location
May 12	15:00	Single ewe	N	By water treatment Plant - Trail D
May 15		Tracks - several sheep	N	Trail E - AEX crossing
May 16		Tracks - one sheep	N	Trail E - AEX crossing
May 16	14:00	#4, ewe and 2 yearlings	N	Trail E - Ore terminal Dump
May 17	18:35	#0, and 9 others	N	Trail E - Ore terminal Dump
May 17	12:42	3 yearlings or ewes?	N	Trail D - Water Treatment plant
May 22		2 rams?	N	Trail E - Haul Road
May 25		Tracks - 4 or 5 large rams	S	Trail E - Vangorda Cat trail
May 25	13:30	1 ram	S	Trail E - Haul Road
May 26	11:00	Young ram	N	Trail E - Ore terminal Dump
May 28		Tracks - several sheep	S	Trail E - AEX crossing
May 29	14:00	Tracks - one sheep	N	Trail E - AEX crossing

joined by three others, one of them marked #4. Finally the bulldozer went off down the road and the haul trucks went to make another load and it was quiet. By this time I had moved to the ore transfer dump. As soon as it became quiet, Sheep #4 poked her head over the embankment, looked around and walked out into the haul road, followed by another ewe and 2 yearlings. They did not appear alarmed as they walked on the haul road, stopped, looked around and continued on. When they got on the north side of the haul road another truck came from the Grum pit. They watched it come until it was within 10



metres and then ran off the road and up onto the ore terminal dump. They walked and trotted across that as another truck came from the Grum pit. At no time did they appear unduly alarmed and although they were delayed for about an hour, they were not permanently diverted and crossed when it was quiet. Fifteen minutes later they crossed the AEX crossing on Trail "E".

Another observation on May 17 indicated that it takes sheep about 7-8 hours to cross from West Canyon on Sheep Mountain to Mt. Mye. They were first seen (#0 and 8 others) at 11:00 on the farthest point in West Canyon (Fig. 2) heading toward Mt. Mye. Later in the afternoon at 18:35, number 0 and 9 others crossed at the ore terminal dump. From this point, it then took them from 30 to 45 minutes to reach Mt. Mye.

Last year a heavy snow forced sheep (including new born lambs) to return from Mt. Mye (Schweinsburg 1989). It snowed again this year on May 23, but not heavily enough to accumulate on the ground at the Grum pit, nor on the lower slopes of Mt. Mye. Some sheep (large rams judging from the size of their tracks) returned from Mt. Mye on May 25. I tracked them as far as possible down the Vangorda Cat Trail to where it ends in timber. They may have joined the 15 rams that were still above the town dump at the end of May and had not migrated yet. Last year rams stayed on winter range as late as June (Bowers pers. comm.) and they probably did the same this year.

At least 16 ewes or yearlings (including the yellow and black radio collared ewes) and 3 lambs had not migrated to summer range by May 31

and were still on Sheep Mountain.

As in 1989, the diversion route intended to divert the sheep around the Grum and Vangorda pits (Fig. 4) was not used by sheep (Schweinsburg 1989). It seems evident that sheep do not recognize any need to choose another route that far down Vangorda Creek where there is no disturbance. In the future, they may have to choose new routes if mine management continues to ignore sheep during planning of facilities, but that will happen only where they are blocked by intense activity. After two years of observation, I now believe the best way to ensure sheep passage is to maintain a disturbance free corridor between the Grum and Vangorda pits (Trail "E") rather than trying to divert them around the activity. The only way that can be accomplished is for regulatory agencies to have the authority to stop Curragh from placing facilities, such as the ore transfer dump, the water treatment plant and water pumping system right on the sheep migration routes, and require scheduling of activities (such as hauling ore over the haul road) that necessarily bisect the migration trails.

Examination of Table 1 discloses that most of the crossings of the disturbed area occurred after noon. During the spring migration, I speculate that most sheep begin their migration in the early morning somewhere on Sheep Mountain or lower Vangorda Creek and do not stop until they reach Mt. Mye. That could have them crossing the mined area during the afternoon. This is only speculation so far because I have been unable in two years of trying to intercept any sheep in Vangorda Creek.

That fact seems significant to me, however, because if they loitered along the bluffs where Vangorda and Shrimp Creeks meet, or elsewhere, I would have seen them. Tracks also indicate that sheep move straight through the migration route without stopping.

It is significant that despite increased activity for over a decade, the sheep have crossed the mined area at least twice a year using their traditional routes. Clearly some habituation and learning by the sheep must be occurring and their strong fidelity to their winter and summer ranges creates the incentive to tolerate a high level of disturbance and alteration of terrain on the migrations. From that, it seems clear that if Curragh would show the proper amount of commitment to maintaining an undisturbed corridor along Trail "E", there would be no concern regarding blocking the sheep migration.

#### Marking Sheep

<sup>13</sup>  
Thirteen sheep have been marked during the course of the project (Table 2). During the trapping efforts of this part of the study, (winter 1989-90), eleven sheep were captured by trapping, but only four were marked (Table 2). The rest were either recaptures, too young to mark or there was not enough help to handle them all and they were released. One sheep jumped out of the trap.

Many more sheep could have been captured had we: (1) started earlier in the year, (2) not been afraid of leaving the sheep in the trap for hours while help to handle them was obtained and (3) had dedicated personnel for trapping. As it was, we recaptured the leaders (or

those that were least wary) several times, whereas the warier sheep were not captured.

It was relatively easy to capture sheep with the door set on automatic, but one could not control which sheep and how many were caught. As in 1989, the main problem with trapping was getting the sheep and handlers to the trap at the same time. This could have been solved by leaving the trap to spring automatically more often

**Table 2. Details on the Sheep that Have Been Marked During this Project**

Date	Location	Radio Frequency	Collar Color	Age	Comments
March 16, 1989	Sheep Mt.	152.400	Yellow/green	12	Died on March 29*
March 29, 1989	Sheep Mt.	152.700	Yellow	6	*
March 29, 1989	Sheep Mt.	152.710	Red	5-6	*
March 29, 1989	Sheep Mt.	152.470	Black	8	*
August 1989	Mt. Mye	152.500	Green	4.5	+
August 1989	Mt. Mye	152.400	Green/Yellow	5.5	*
August 1989	Blind Lake Swim Lakes	153.610	Black/Yellow	5.5	+
August 1989	Blind Lake Swim Lakes	152.060	Double Red/ Yellow	6.5	+
August 1989	Blind Lake Swim Lakes	-	Yellow #1	2.5	+
March 24, 1990	Sheep Mt.	-	Yellow #2	12	==
March 24, 1990	Sheep Mt.	-	Yellow #3	8.5	==
March 27, 1990	Sheep Mt.	-	Yellow #0	9 (?)	==
April 3, 1990	Sheep Mt.	-	Yellow #4	8	==

\* Schweinsburg 1989  
 + Hoefs, M. 1989. Report on Sheep Live-capture of the Mt. Mye Population. Unpubl. Rep.  
 == This study

and checking it during the day, but I was reluctant to do this because of the possibility of injuring or overstressing the sheep. November, early December and late February and March are the best times to trap sheep. It is not too cold then and sheep come to the bait well.

The numbered collars were highly visible and could be individually identified from 1.5 km distance. The radio collars put on last year were loose on all of the sheep and considerable wearing of neck hair resulted.

South Trap was removed during May 1990, but North Trap was left for radio collar removal or any additional trapping.

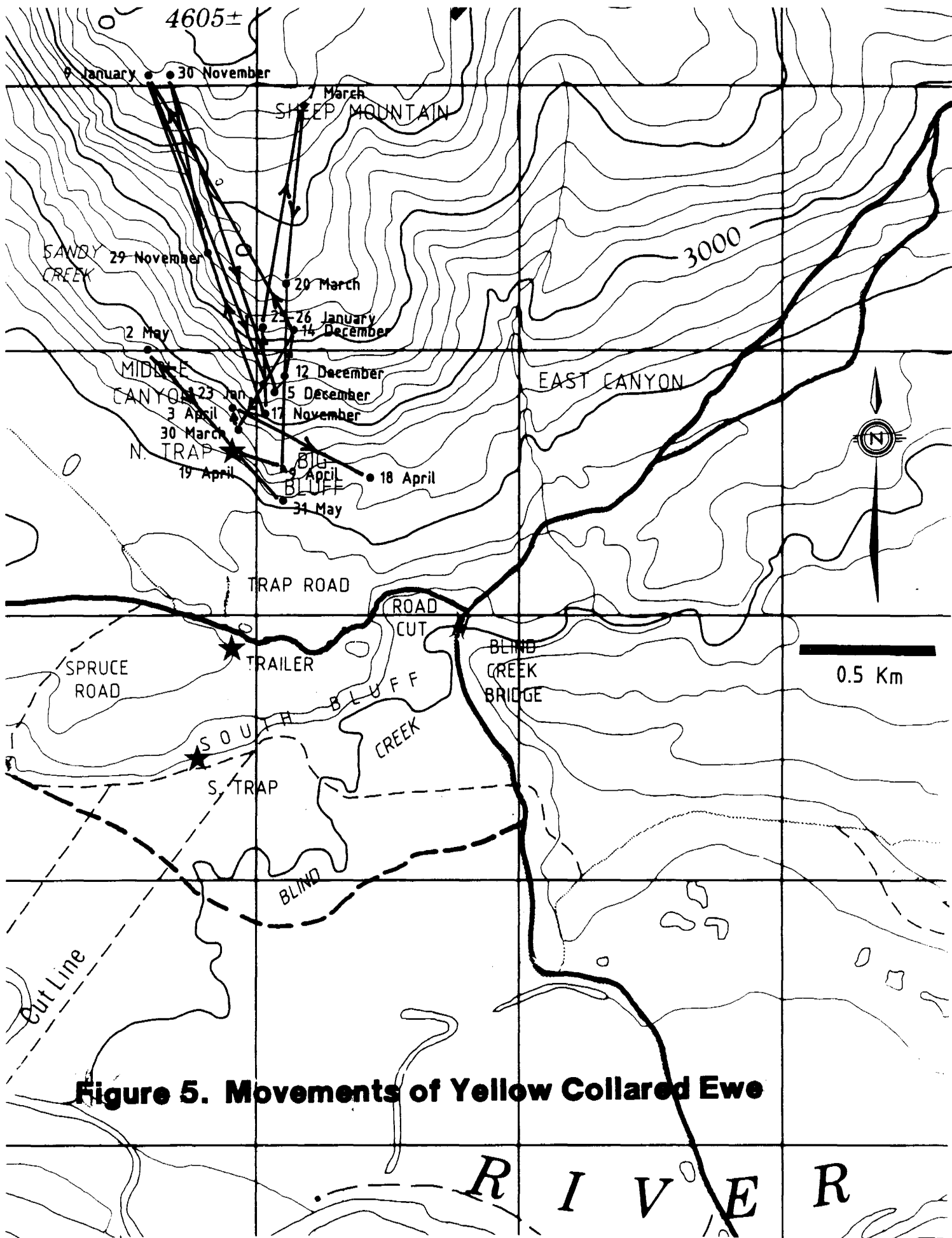
#### Movements of Marked Sheep (Ewes)

All of the sheep marked during the winter of 1988-89 on Sheep Mountain were relocated on Mt. Mye during the summer and those sheep plus those marked on Mt. Mye (Table 2) returned to Sheep Mountain and were seen during the winter of 1989-90. None of the sheep marked at Blind Lakes, Swim Lakes area were seen at Sheep Mountain., but they were relocated during a winter aerial survey on windswept slopes of the same area in which they were caught (Hoefs, pers. comm.). This shows a clear connection between the Sheep Mountain and Mt. Mye group of sheep, but not between those that summer to the east of Mt. Mye.

The connection, if any, between the group that winters on Sheep Mountain and those that summer to the west on Rose and Whiskey

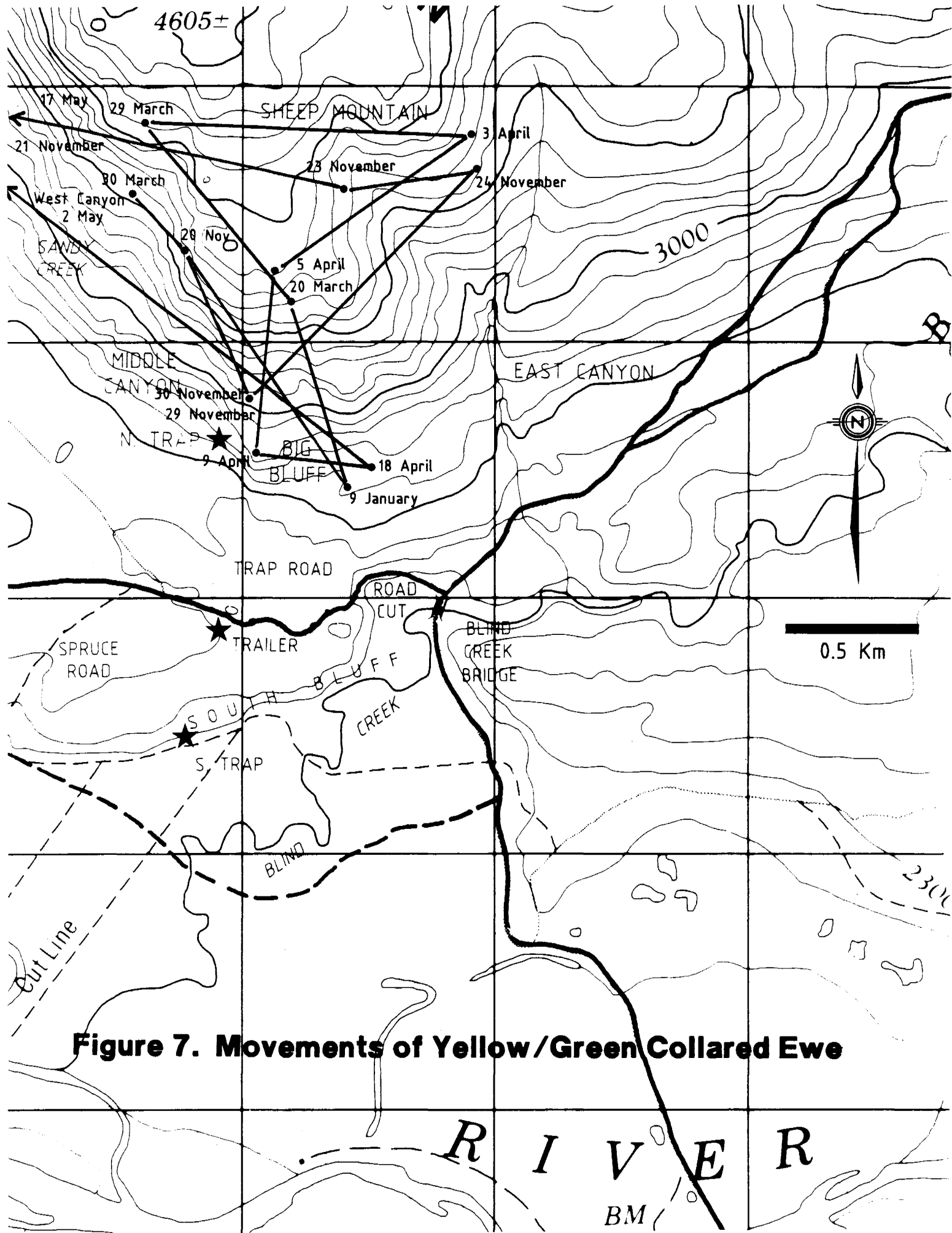
Mountains has yet to be demonstrated. During the spring of 1989 it appeared that a group of ewes came from the west to Sheep Mountain and then returned to the west during spring migration (Schweinsburg 1989). That was not repeated during 1990 and only one ewe and yearling was seen west of Faro this year. All efforts to trap sheep from the west on winter range have been futile because sheep were not taking bait during late spring when they apparently move to and appear on Sheep Mountain (Schweinsburg 1989). This year, the influx was not noticed as it was the previous year (which may or may not have been an aberrant movement).

The home range of the collared sheep overlapped to a considerable amount (Figs. 5-13). Inspection of those figures indicate that the area around Big Bluff was the most important to sheep. Two factors may have influenced this pattern. The first was the presence of bait at both north and south Traps. The second was the observability of sheep in certain areas. There were days when certain marked sheep could not be located no matter how hard one searched for them. This indicates that there are large areas of the range that are not clearly visible from the road, a fact confirmed by traversing the upper reaches of Sheep Mountain. The ewe marked with a green collar was not seen after March 6, but when I checked her signal on April 24, it was normal and coming from the west end of Sheep Mountain. I spent hours over many days glassing for her, but could not see her although there were several sheep in that area throughout the winter and spring. Sheep undoubtedly use the top part of Sheep Mountain more than can be verified by glassing from below (Lortie 1988 and this study).

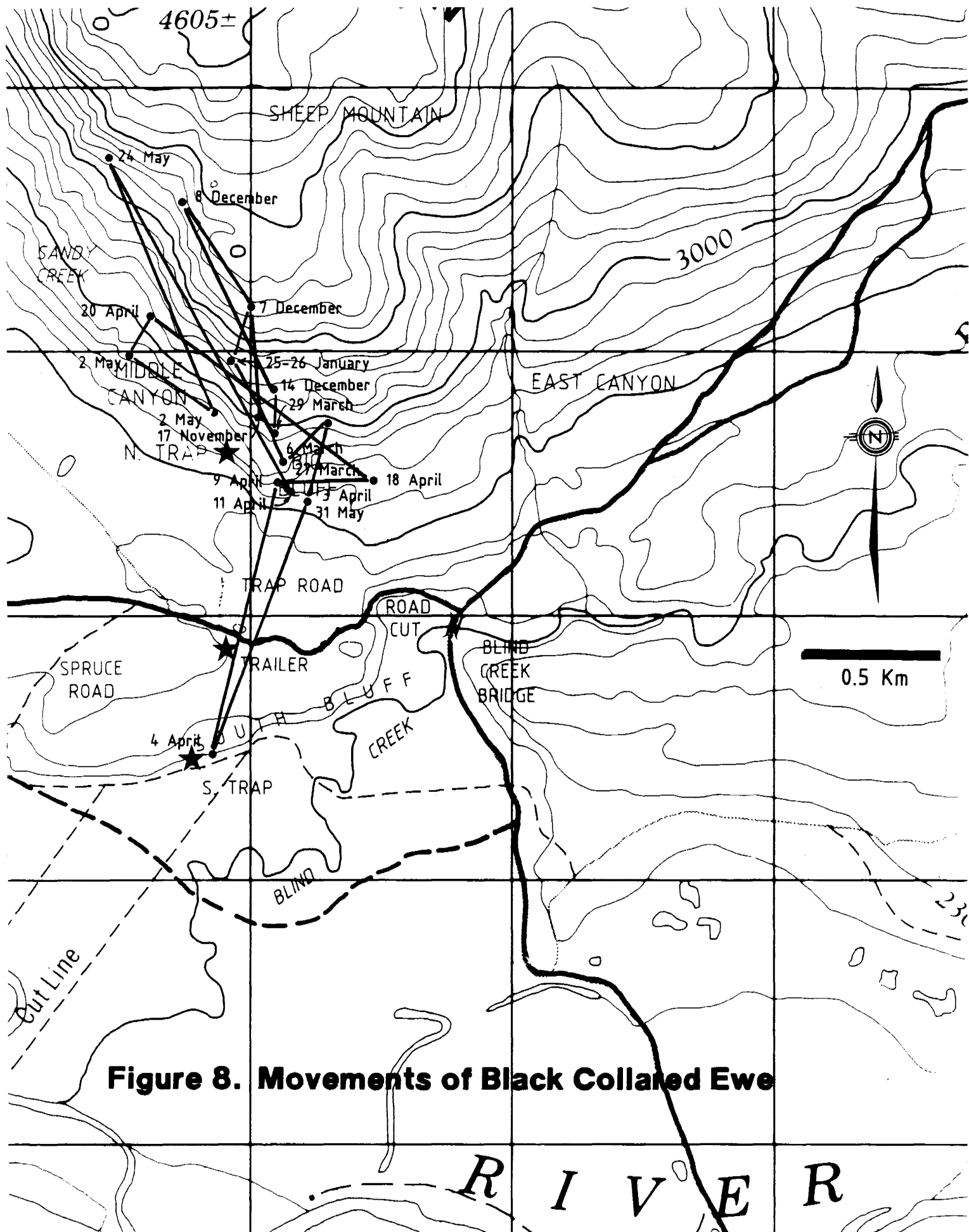


**Figure 5. Movements of Yellow Collared Ewe**

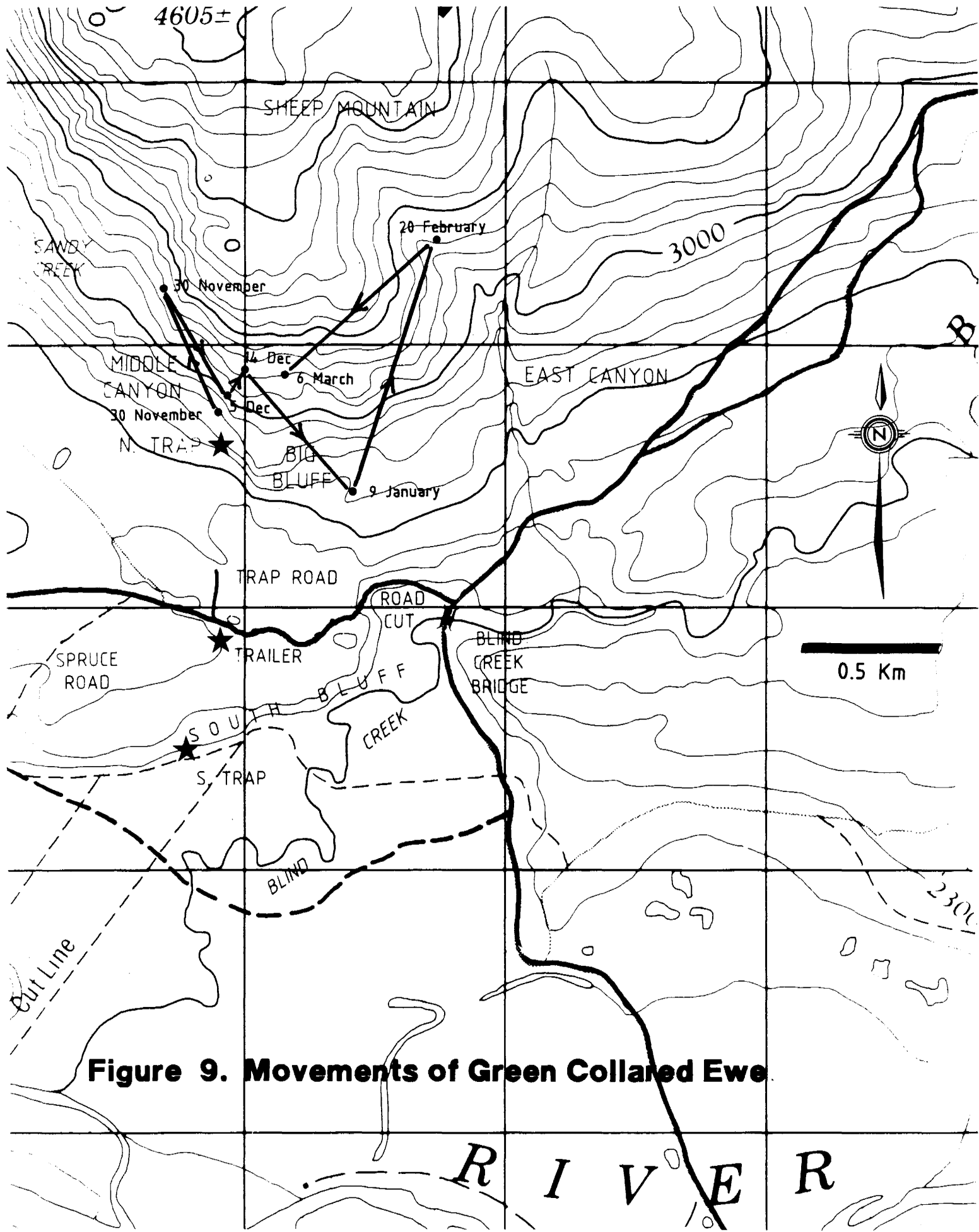




**Figure 7. Movements of Yellow/Green Collared Ewe**



**Figure 8. Movements of Black Collared Ewe**



**Figure 9. Movements of Green Collared Ewe.**

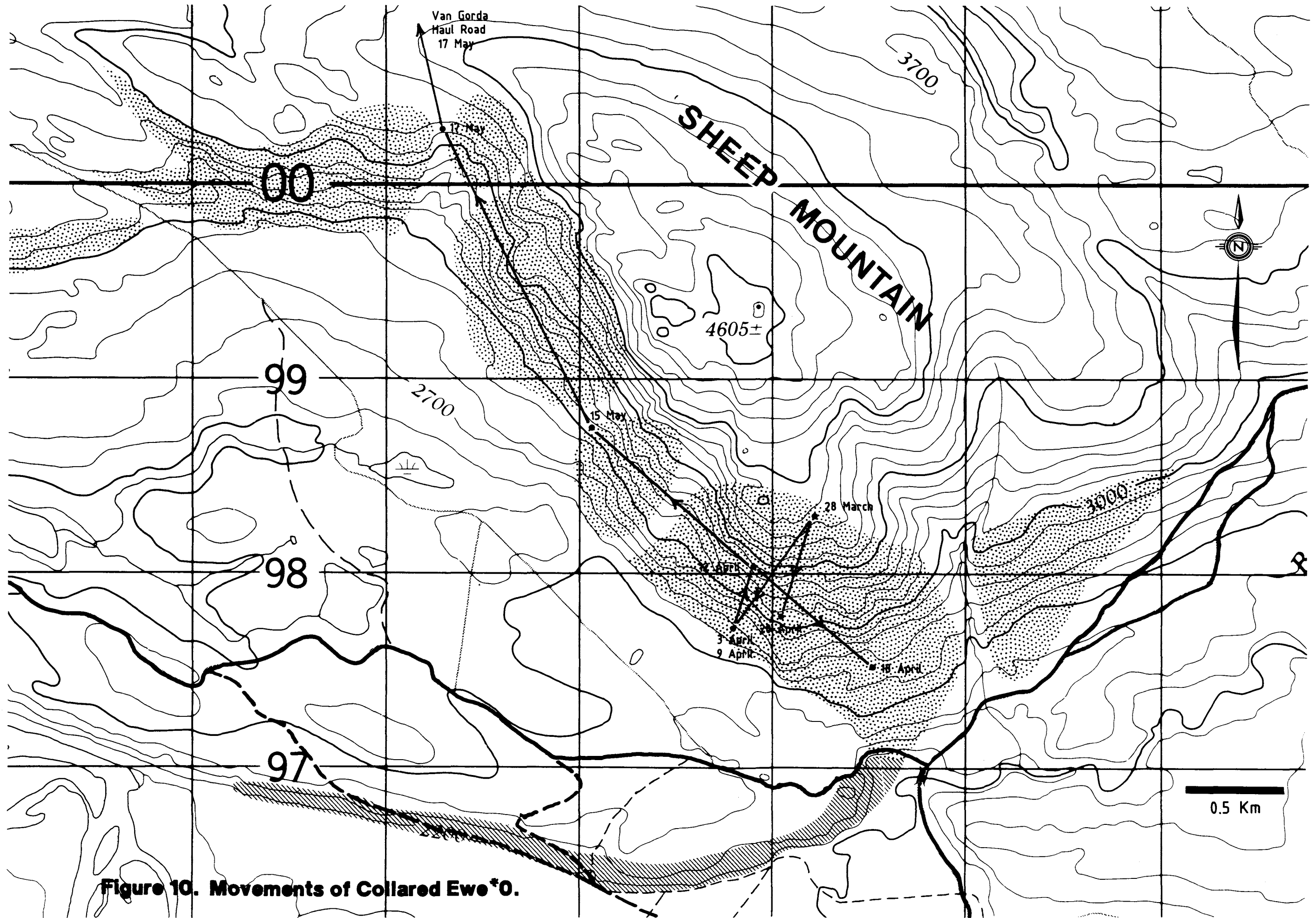
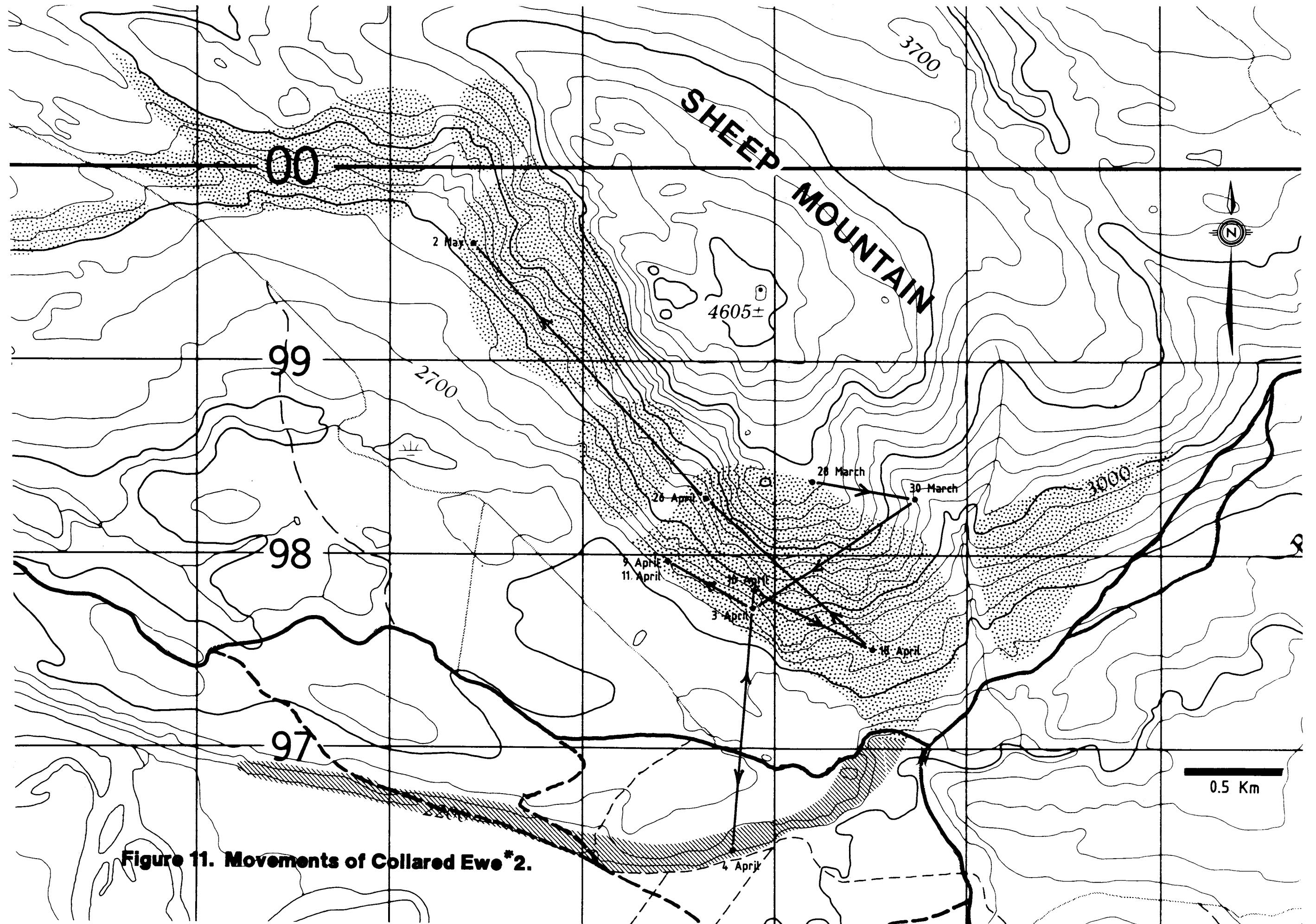
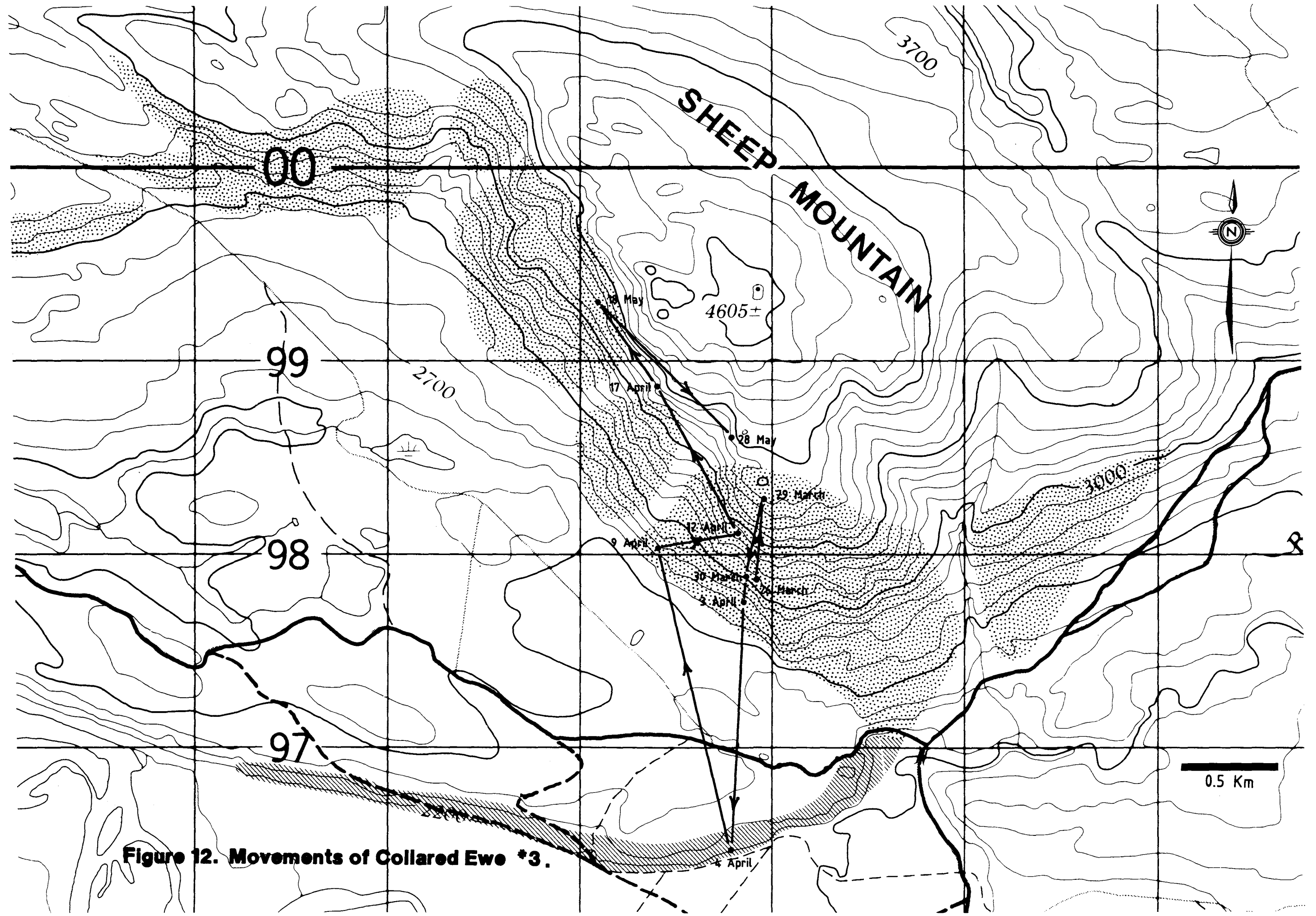


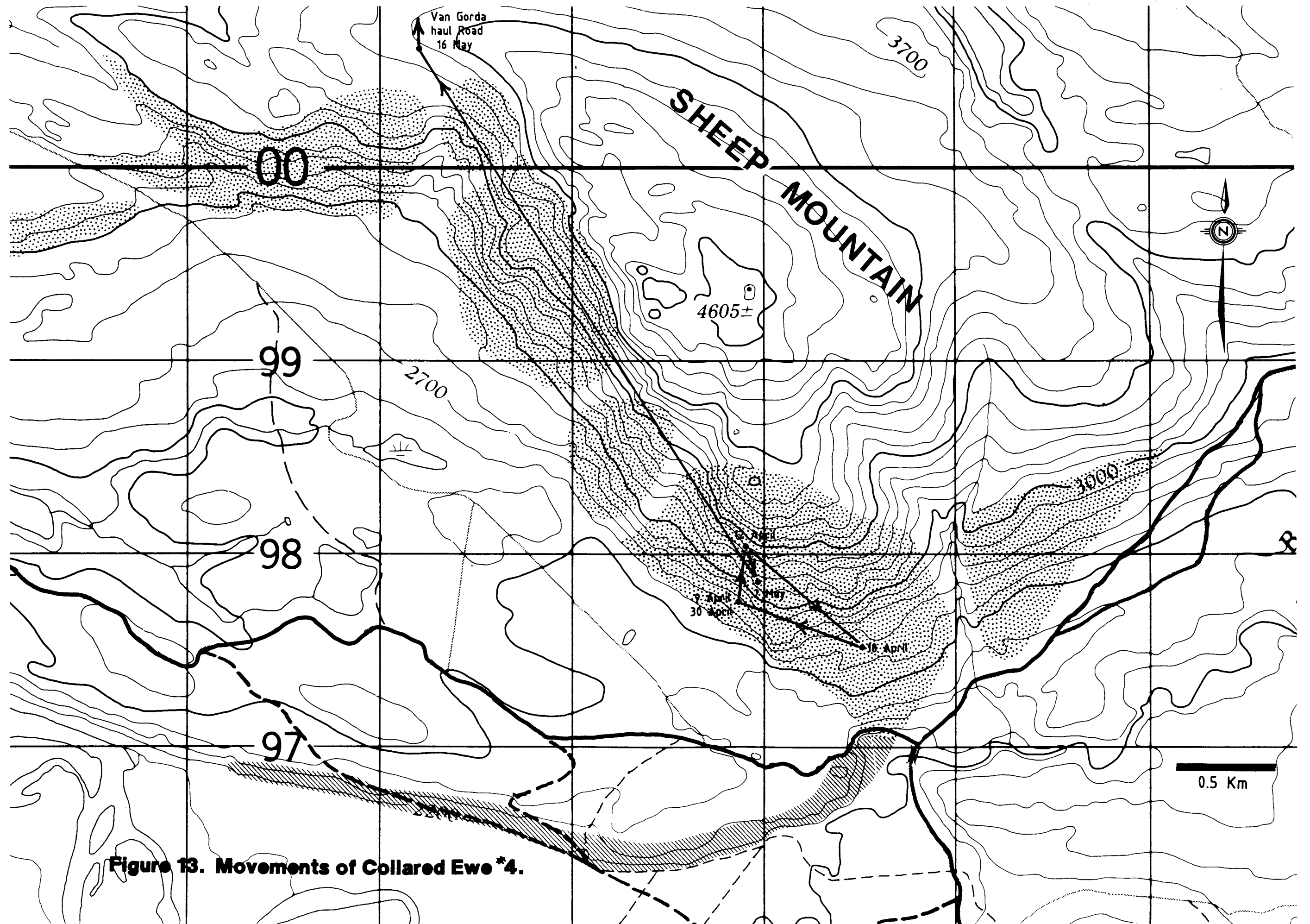
Figure 10. Movements of Collared Ewe\*0.



**Figure 11. Movements of Collared Ewe #2.**



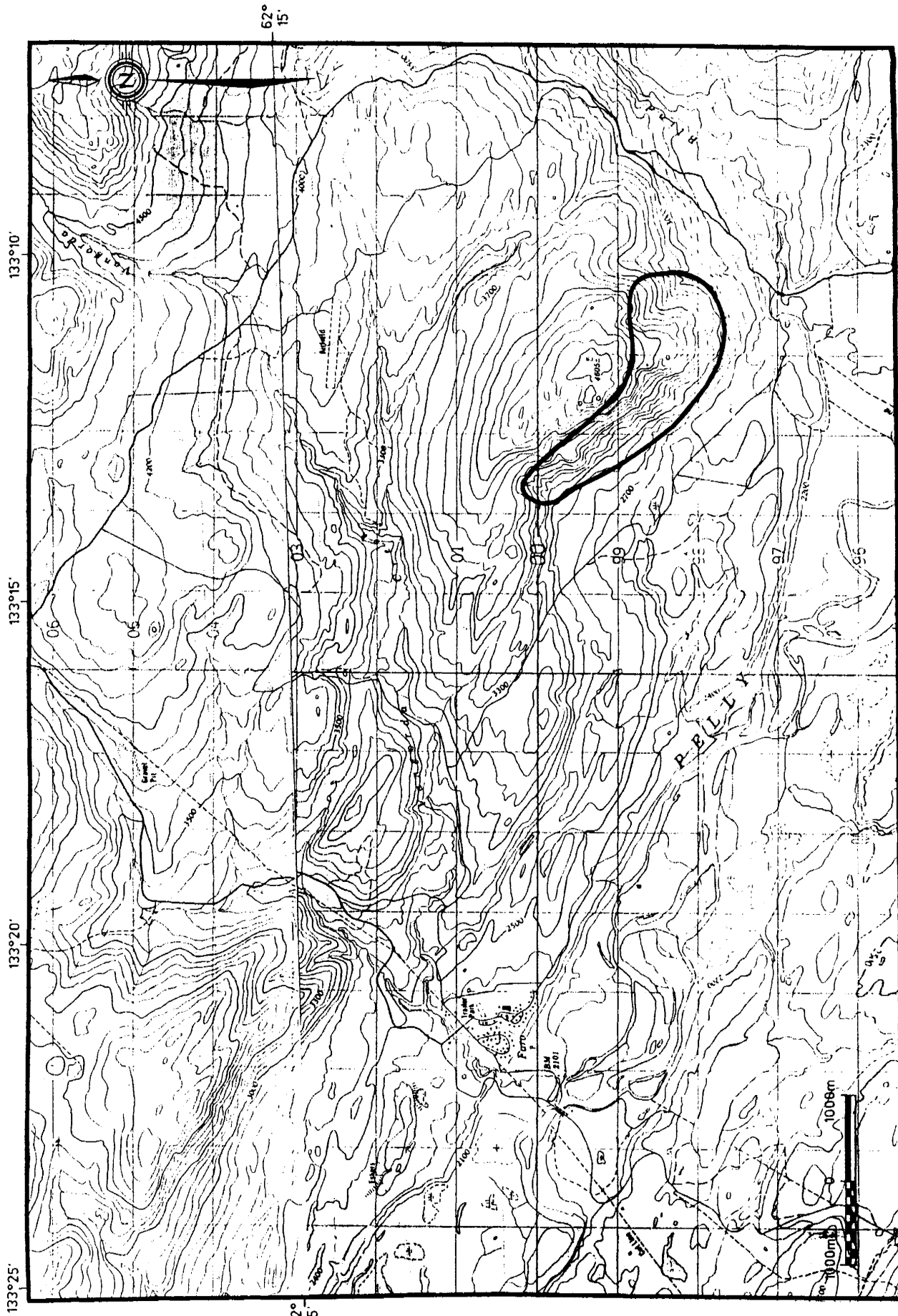
**Figure 12. Movements of Collared Ewe #3.**



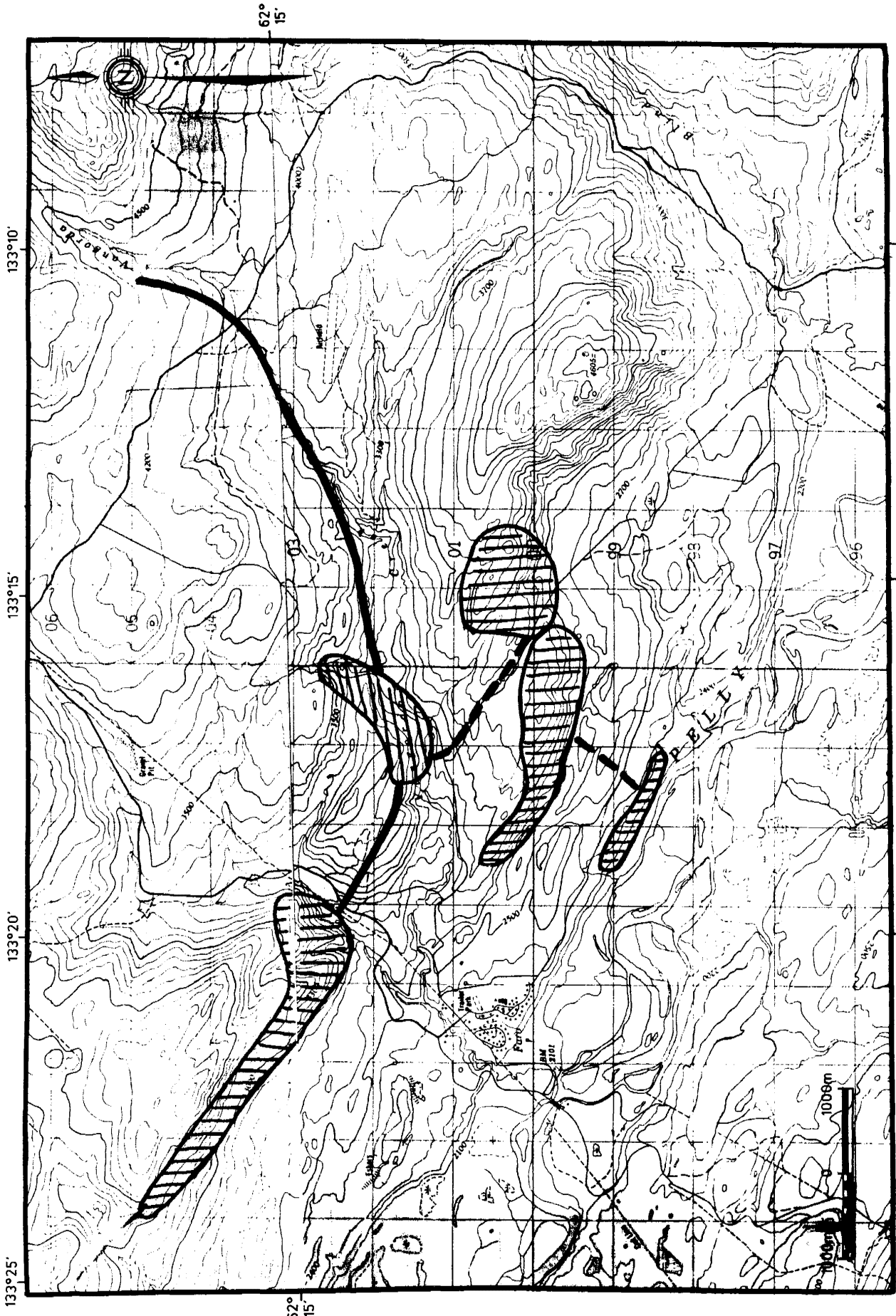
**Figure 13. Movements of Collared Ewe \*4.**

As in 1989, sheep used the range differently as the season progressed (Schweinsburg 1989). Rutting activity was observed from West Canyon to Big Bluff, but the focal area seems to be between Sandy Creek and East Canyon (Fig. 14). The rams then dispersed to the west where they wintered and the ewes to the upper parts of Sheep Mountain (Figs. 15-16). During the coldest part of the winter the upper part of Sheep Mountain is most important for nursery sheep. During this time they restrict their movements and are not easily seen. The snow melts from the top of the mountain to the bottom and the sheep move down as the slopes are being exposed. They can be seen feeding during late winter at the edges of snow banks where old growth has been exposed and new growth first appears. It appears that sage (Artemesia frigida) is a favored food at this time and is one of the first plants to show new growth. During late April and May they are feeding around the base of Sheep Mountain on new growth and aspen leaves. They become highly mobile at this time and rams reappear and use Sheep Mountain as far as East Canyon and South Bluff. During lambing, ewes retreat to the rockier areas higher up above Big Bluff, Middle Canyon and Sandy Creek (Fig. 17). Some lambing apparently also takes place on Mt. Mye (Schweinsburg 1989).

There were several noticeable differences in range use patterns between 1989 (Schweinsburg 1989) and 1990 (Fig. 16). The first was the avoidance of South Bluff described in the section on "Habitat Improvement" and Appendix A. The second was the avoidance during 1990 of West Canyon. I speculate that because this area is lower and less steep it accumulates snow faster than other areas and 1990 was a year of heavy snowfall. But even in the spring rams did not seem to

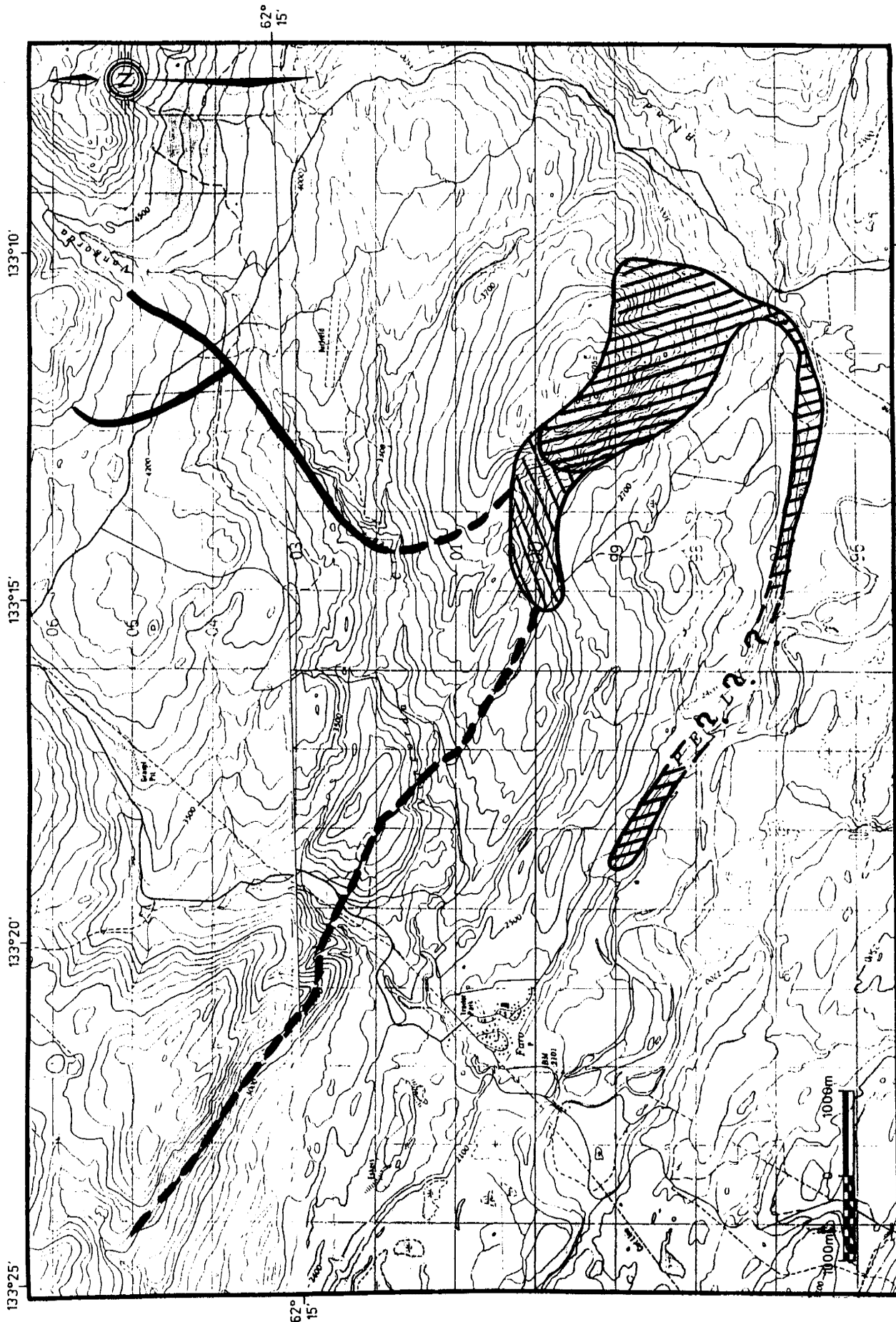


**Figure 14. Main Known Rutting Area.**







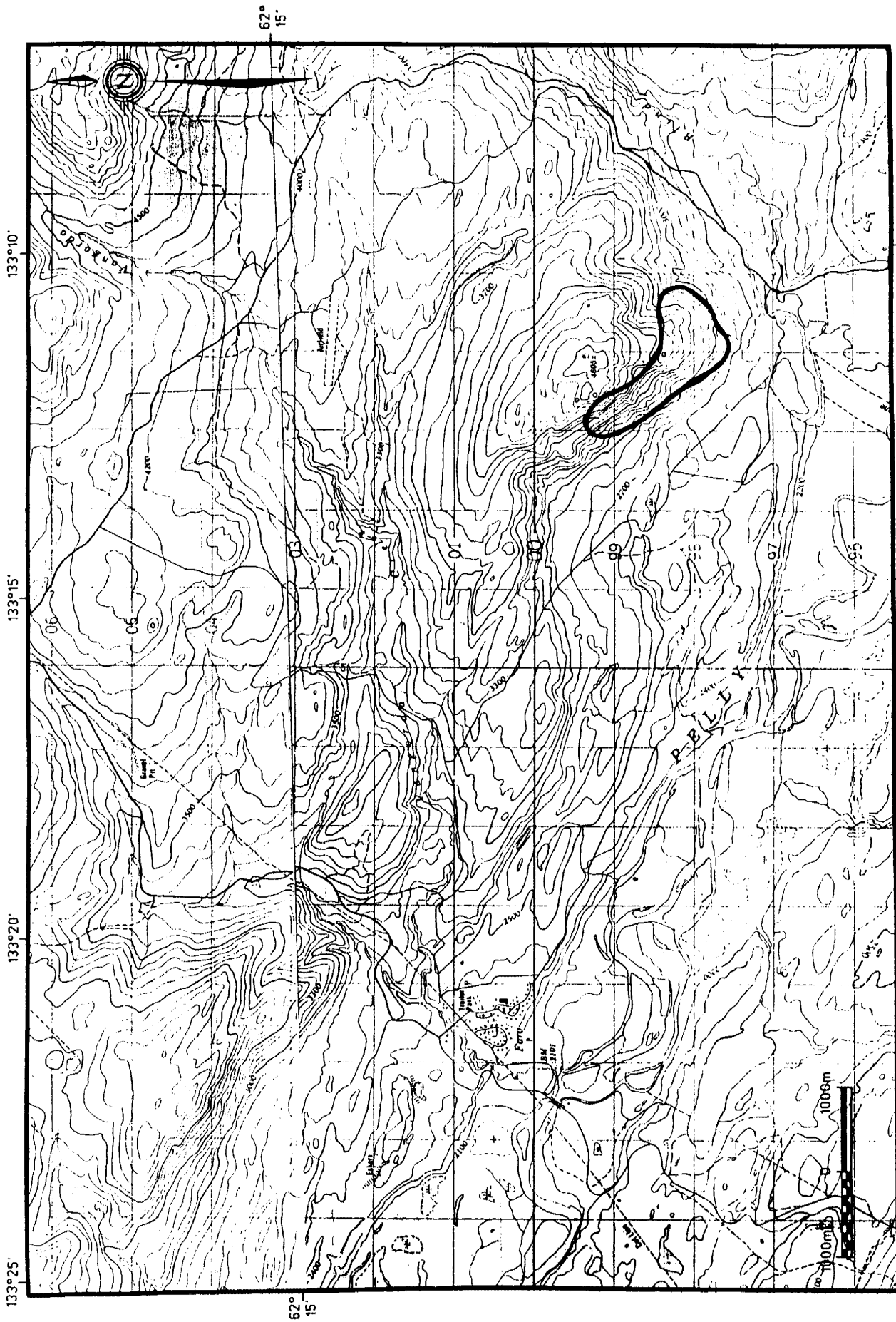
**Figure 15. Known & Suspected Wintering Areas for Rams.**

-  Known Wintering Area
-  Suspected Wintering Area
-  Migration Routes
-  Suspected Movement or Migration Route



**Figure 16. Winter Range for Nursery Sheep.**

-  1988-1989 Wintering Area
-  1989-1990 Wintering Area
-  Migration Route
-  Suspected Movement or Migration Route



**Figure 17. Main Known Lambing Area.**

use the area as heavily as they did the year before.

Another wintering area was discovered this year along the Pelly River Bluffs approximately 2.5 kilometres east of Faro (Fig. 15). It was discovered when a resident reported a dead ram (see section on "Productivity and Mortality"). At least six other sheep were there (ewes) but it was impossible to get to them because of the snow depth and broken river ice, so a good count and classification was not possible. Possibly there is a crossing, between West Canyon or Ochre Bluff and this area, around kilometre 5 on the Blind Creek Road where the three sheep were reported on the road during 1989 (Schweinsburg, 1989), or they could reach this area by the South Bluff trail.

Except for the ewe marked with the green radio collar, all of the marked sheep were seen together at one time or another, but not enough sheep were marked to determine band dynamics and integrity.

#### Movements of Rams

Lortie (1988) reported the sudden appearance of 12 "mystery" rams on Sheep Mountain during April 1988. He thought these rams were separate from a group of 13 that wintered near Faro. In 1989, I again observed the "mystery" ram band, this time consisting of 11 rams (Schweinsburg, 1989), that joined during April 1989 the 12 that had wintered near Faro. This pattern of the "mystery" band appearing in April and joining the resident band was not as evident during 1989-90. One of the "mystery" rams was missing its right horn. That ram and at least 14 others wintered near Faro during the winter of

1989-90, but they were strange rams only one of which I recognized from the previous year. However again on April 25 I counted two groups of rams, one with 10 in it above the dump and the other with 12 (and the ram with the missing right horn) on the Vangorda Creek slope just southeast of the microwave tower. During that count, the two largest rams, one with a broomed right horn, "Blackie", and a grey, "Greyback", were absent but were seen two days later (Wittfoth, pers. comm.). That makes the total number of rams in the area 24.

It seems that during April the rams come together from the various small patches of winter range and start moving around. They become very visible at this time and seem to appear from nowhere. Lortie felt that the rams that suddenly appeared on the winter range wintered somewhere around Rose Mountain. I also suspect that some may winter somewhere near Faro in the Vangorda Creek drainage or possibly the Pelly River Bluff where the dead ram was discovered (see section on Mortality). During April and May rams may be seen anywhere from East Canyon to South Bluff and even Faro itself. They stay around Faro into June although some may go back and forth to Mt. Mye. They appear to be the last sheep to leave the area in June.

I am not sure how they leave the area. Some evidently go north up Vangorda Creek to Mt. Mye and others west to Whiskey and Rose Mountains. Rams are seen on the surveys of Mt. Mye during the summer.

During the fall, rams have been reported returning to the wintering area from both the west and the north, but none of the reports I

checked out could definitely be described as migration movements. For instance rams that suddenly appear to the west of Faro above the dump could easily have come from the north down Vangorda Creek, crossed the road unseen and then appeared as if they came from the west although they really came from Mt. Mye to the north. Although the rams appear to loosely associate in two main bands, considerable uncertainty remains about ram band dynamics and movements.

During the rut, rams are very active although focussed on Sheep Mountain proper where most of the ewes are. At least 14 rams were on the rutting ground in 1989. After the rut, they disperse to the west and winter from West Canyon to above the dump whereas most of the ewes seem to stay on Sheep Mountain.

During January of the last two years a small group of rams have been reported at the mine in the upper reaches of Vangorda Creek. The snow is deep then and I can only speculate that they are dispersing to small areas of winter range before the cold of January and February sets in. Figure 15 shows the known and suspected wintering areas and migration routes for rams.

Rams cross the road to the west of Faro and evidently continue onward to Whiskey and Rose Mountains. It is also known that some migrate to the north to Mt. Mye, but no rams have been marked so individual movements are not as clear as are those of the ewes.

Productivity and Mortality

The sheep population wintering on Sheep Mountain has apparently not increased since 1981 despite very good reproduction (Table 3) and low winter lamb mortality (confirmed by inspection of Table 3 and comparison of autumn and spring counts the last two years).

Table 3. Population and productivity counts of sheep on both winter and summer ranges throughout the study from 1980 to 1990.

Date	# of Ewes**	# of Lambs** or Yearlings	# of Rams**	Location	Source
Aug. 9, 1980	43	17	-	Sheep Mtn.	McLeod 1981
July 20, 1988	35	18	24	Mt. Mye	Hoefs 1988
April 1988	36	(22)	13	Sheep Mtn.	Lortie 1988
April 1989	28	(21)	23	Sheep Mtn.	Schweinsburg 1989
Aug. 16, 1989	53	15	19	Mt. Mye	Hoefs 1989
October 6, 1989	34	(14)	5	Sheep Mtn.	Hoefs 1989
April 1990	40***	(18)	24	Sheep Mtn.	This study
<b>Average</b>	<b>38.4</b>	<b>17.8</b>			

\*  
\*\* Not all are adult ewes  
\*\*\* Lambs or yearlings depending upon time of year of count  
Higher count, but at least two marked sheep were missing

The reason for this is unknown although it seems reasonable that it must be one or a combination of the following factors:

1. movement out of the area by a number of sheep each year or
2. cumulative mortality factors of unknown dimension.

Hunting by natives (Lortie 1988) and illegal kills (Lindsay pers. comm.) on the winter range have contributed to mortality each year except 1989-90 when a conservation officer was stationed at Faro. His presence resulted in only one dead sheep being found in 1989-90 (a mature ram that died of natural causes) as opposed to five the year previously (Schweinsburg). Rumours abound in Faro about the illegal killing of sheep on both the winter and summer range although they are largely unconfirmed. It has been impossible to get a good count for past years of the number of sheep that were killed illegally and by native hunters.

Wolves also undoubtedly account for some sheep every year and numerous sightings of wolves hunting sheep were seen during the last two years and many other sightings were reported. Barichello et al. (1989) reports that wolves take about  $3.8 \text{ sheep}/100\text{km}^2$  in the southern Yukon.

It could be coincidence that the numbers recorded recently are similar to those recorded by McLeod ten years ago or it could be some density dependent factor working to keep the number of sheep in this area constant. However, one would think that if the range was overgrazed or the sheep otherwise stressed by some density dependent factor then reproduction and lamb winter survival would be much lower than it is (Table 3). As well, Geist 1971 indicates that stone sheep display high fidelity to winter ranges and all of the marked ewes have turned up where expected which seems to rule out any significant movements out of the area caused by range depletion or behavioural interaction or population stress.

A percentage of sheep every year is lost to natural causes. That appears to run around 11-12% in mature rams (Geist 1971) and 8-10% in ewes. The 12 year old ram found during February this year is the only one so far during the study whose death was definitely attributable to natural causes. He evidently starved although his rumen was full. This may be an indication of low protein forage. This ram was also involved in a very strenuous rut, at least one combat he was engaged in lasted several hours and he probably went into the cold period with depleted reserves. He also had "lumpy jaw".

It is possible that the legal and illegal kill, wolf kill and death by natural causes have added up to the yearly ewe deaths necessary to keep the population from growing. If the number of animals illegally killed is curtailed by the Conservation Officer at Faro and if that is the major mortality factor (as suspected) then the population should increase in the next few years. If not, then other reasons will have to be sought to explain why the population has not grown for the past decade.

#### Response of Sheep to Disturbance

The avoidance of areas disturbed by brush clearing has already been described under the section of "Habitat Improvement" and Appendix A. Disturbance during migration is described under "Spring Migration". From these observations and general impressions that I gathered from two years on this study, I formulate the following hypothesis.

First, sheep will tolerate considerable disturbance on their migrations, but not on their winter (and possibly summer) range. One could liken the situation to a commuter who will tolerate considerable stress getting to work, but wants peace and quiet once he returns home. If he does not get it he moves his home. I get the impression that sheep are uneasy and alert and ready for danger on the migration route. Therefore when disturbance occurs it is expected and relatively easily escaped by running away from or around it. Once the danger is passed they are rewarded by moving to a secure disturbance-free area at either end of the migration path.

On the other hand, disturbance on the winter range is not a one time event that is expected and easily dealt with. The best option when their living room is invaded is to move it and avoid the disturbance. If this happens over a number of years the tradition of using the area, which is passed from old to young sheep, may die out.

Sheep live in a noisy environment with roaring wind and falling rocks and water, therefore noise by itself does not seem to bother them. When it is combined with motion, however, they do become alarmed. Noisy motion that is predictable such as a vehicle following a road does not seem to alarm them as much as does an all terrain vehicle that moves in unpredictable patterns. They seem to stand and watch vehicles to see what they are going to do. If they follow predictable routes, they are not alarmed. That is not so if the vehicle suddenly turns toward them and follows them as they run. One Faro resident told me how he followed (actually chased) sheep along South Bluff in an ATV. That will not have to happen too often for

the sheep to abandon South Bluff.

Sheep do not appear to like people <sup>to</sup> get above them. They seem to understand the advantage of height and like to stay above any threat. As the Faro Sheep Viewing Project comes of age, great care must be taken to habituate sheep to the presence of people, particularly along South Bluff where people can easily get above them, before unregulated access is allowed. I fear if this is not done, then South Bluff will be eliminated as an area used by sheep.

Viewers must also be educated to the possibility of herding sheep away from important areas because sheep tend to move away from humans on foot even though they appeared not to be overly alarmed by non-threatening human presence.

I did not observe any encounters between sheep and domestic animals during the two years of observations. Wolves and even foxes caused flight to rocky areas, always uphill. Certainly the presence of dogs on the winter range would disturb sheep, especially along South Bluff where they could get above them.

All-terrain vehicles are used by hunters on the summer range. Besides the possibility of poaching, the use of such vehicles at an unknown frequency, could cause sheep to abandon parts of their summer range.

## CONCLUSIONS AND RECOMMENDATIONS

### Habitat Improvement

It appears that clearing the downed timber and brush would improve sheep habitat, but it must be done in a way that does not disturb sheep. Therefore:

1. more habitat should be cleared;
2. methods besides hand clearing should be experimented with to prevent regrowth of brush;
3. whatever method is tried, it must be done when the sheep are absent to avoid loss of use of parts of the range; and
4. exclosures should be installed and assessed yearly to determine baseline range conditions to compare with population counts.

### Migration Patterns

Specific autumn migration timing and routing across the mine area remains one of the biggest unknowns of this project. More is known of spring migration, but it should be monitored as the mine is developed to ensure that sheep are able to pass. Therefore:

5. monitoring of migration during autumn to determine specific timing and routing should be done;
6. monitoring during spring should also be done to ensure that sheep are able to pass the mined area. We should specifically watch to see if they are trying to find alternate routes.

### Marking Sheep

It seems that enough sheep are marked to understand movement patterns between Mt. Mye and Sheep Mountain. The relationship of sheep to the east of Mt. Mye seems clear (although there is only one year's data), but not to the west. ✓

Therefore:

7. the remaining radios should be put on sheep (ewes) on the summer range to the west of the winter range, especially Rose and Whiskey Mountains.
8. all of the radios should be located again during the summer of 1990 and the autumn of 1990 after sheep have returned to winter range; and
9. the radios that have been on for two years should be removed during the spring and summer of 1991 and replaced with numbered collars.

### Coordination with Mine Management

It seems clear that mine management is not taking sheep movements into account when planning placement of their facilities, nor is protecting the sheep migration considered a high priority. Some personnel were highly cooperative while others consider helping out a very low priority. Therefore:

10. Government must take a stronger stand on educating all upper mine management on the need to protect the sheep migration routes;
11. Government must take a stronger stand on keeping upper mine management informed of the findings of the sheep study;
12. If necessary, Government must take more of a "watchdog" stance with the mine;
13. mine personnel should be required as part of their job (particularly shifters) to accurately record all sheep observation on the mine.
14. the ore transfer dump on Trail "E" should be abandoned; and
15. no placement of any facility of the corridor of Trail "E" should be allowed.

#### Productivity and Mortality

Despite good lamb production and winter survival, the population appears not to have increased for the last decade. The presence of the Conservation Officer stationed at Faro seems to have cut down illegal killing of sheep on the winter range. If that was the main factor preventing population increase, then we can expect to see the population grow in the next few years. If not then we should look elsewhere for the reasons for population stability. Perhaps nowhere else in the Yukon can the factors regulating coloured sheep populations be so easily studied. Therefore:

16. autumn and spring counts of ewes and lambs should be continued; to determine if possible what has been keeping the population from growing and to determine the next set of limiting factors if indeed the present cause is illegal and native hunting.
17. the Yukon Government should consider using this area as one to study mortality and productivity factors of coloured sheep.

It is important that the non-consumptive use of sheep does not introduce another disturbance factor that will cause them to abandon their range. The area of South Bluff appears to be particularly vulnerable to disturbance because of its ready accessibility to people and because humans can easily get above sheep and harass them unintentionally. Therefore:

18. the planners of the Faro Sheep Viewing Project should be made aware of this possibility and the Yukon Government should have enough input into the project to ensure that sheep are properly habituated before unlimited access is allowed;
19. the planners should closely examine the experience at Sheep Mountain, Kluane Park when developing their own project.
20. control should be enforced of all vehicular activity on the winter range, particularly ATV's.

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