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Pastoral Movements and the Subsistence Unit of the Rendille of Northern Kenya: with Special Reference to Camel Ecology

SHUN SATO

The University of Tokyo

Although there have been many social anthropological studies of East African herders, few have dealt to any extent with the ecological aspects of these cultures. The Rendille, pastoral nomads who subsist on the dairy products of camels, goats and sheep, are no exception to this.

This paper describes and analyses the livestock ecology, pastoral movements and changes in Rendille social groups. New concepts such as "the cooperative herding group", "homogeneous or heterogeneous fission-fusion of the social group" and "the subsistence unit" are presented. The importance of camels, technological adjustments to camel rearing for a stable food resource, the determinants of pastoral movement and its patterns, social adaptations to camel herding, and the peculiarities of camel pastoral society are discussed.

INTRODUCTION

The Rendille inhabit the arid lowlands of northern Kenya and are a nomadic pastoral people who subsist almost exclusively on the products of their herds of camels, goats and sheep. A few cattle and donkeys are kept as subsidiary livestock. They do not practise cultivation and are only marginally involved in the external economy, thus they may be regarded as "pure pastoralists" [BAXTER 1975].

Many social anthropologists have dealt with the various pastoral peoples of East Africa, focusing their studies primarily on sociopolitical systems, and they have had a great impact on the development of the field within the scope of their interests. They have attempted to analyse pastoral societies on the basis of the ecological characteristics of livestock herds, but their description of the livestock itself has been insufficient¹⁾.

Interesting works by Spencer [1973], Grum [1976] and Beaman [1977a, 1977b]

1) For example, the studies on the Nuer [EVANS-PRITCHARD 1940], the Somali [LEWIS 1961], the Masai [JACOBS 1965], the Karimojong [DYSON-HUDSON *et al.*, 1969, 1970; DYSON-HUDSON 1966], the Turkana [GULLIVER 1955], the Gabra [TORRY 1973], and the Samburu [SPENCER 1965].

on the Rendille are available, but these investigations have dealt mainly with inter-tribal relationships, the residential system and social institutions. Only Tanaka [1976, 1979], Tanaka *et al* [1976], Sato [1977, 1978a, 1978b, 1978c] and Fratkin [1977] have attempted to analyse this pastoral way of life and the maintenance of subsistence, based on the particular details of both the natural environment and the ecological characteristics of the livestock.

“Nomadism” (or pastoralism) may be divided roughly into two distinct sets of phenomena, livestock rearing and spatial mobility. This distinction also reveals the social and political causes of mobility [DYSON-HUDSON 1972]. The husbandry of livestock in pastoral nomadic societies is based on subsistence herding, which aims, within the limits of the available technology, to produce a regular daily food supply rather than a marketable surplus [DYSON-HUDSON and DYSON-HUDSON 1969].

In the first part of this paper the food-production system of the Rendille is described and analysed in terms of both the ecological and demographic characteristics of the animals herded and the technology employed, using data obtained by direct observation. In addition to the need to obtain pasturage and water, the pastoral form of mobility also arises as a consequence of socio-political factors. After presenting the concept of the “subsistence unit” as a socio-economically self-sufficient unit, I describe and analyse the temporal and spatial changes in the composition of social groups. Finally, the stability and flexibility of social groups and the socio-political institutions of the Rendille is considered from the viewpoint of social adaptation to that pastoral way of life.

1. AN OUTLINE OF THE RENDILLE

1) Segmentary Descent System and a Historical Overview

The Rendille land (*ili-Rendille*) covers an area of some 50,000 km² and extends from the eastern shore of L. Turkana, in the west, eastwards to the main north-south road linking Kenya and Ethiopia. The northern boundary is marked by the Chalbi Desert, and the southern by Baragoi, Wamba and Archer's Post (Figure 1). Most of this area lies at an elevation of 400–1200 m above sea level, with Mt. Marsabit (1707 m) in the northeast, Mt. Kulal (2604 m) and Mt. Nyiru (2753 m) in the west, and Mt. Ndoto (2637 m) and the Mathews Range (2376 m) in the south. There is a gradual decrease in elevation east of the western highlands, in the vicinity of Mt. Kulal, Mt. Nyiru and Mt. Ndoto. The lowlands continue through Somalia to the coast. Rendille land is located at the eastern edge of the Rift Valley, and a zone of black lava is prominent from the east shore of Lake Turkana to the foot of Mt. Marsabit.

Rendille society is organized on the principle of patrilineality, with descent groups arranged in a segmentary descent system composed of four categories; the moiety (*belesi*), the clan (*goup*), the sub-clan (*yaf*) and the lineage group (*keiya*). The smallest unit is the patrilineal extended family made up of several nuclear families. The largest segment of the descent system is divided into two moieties: the eastern

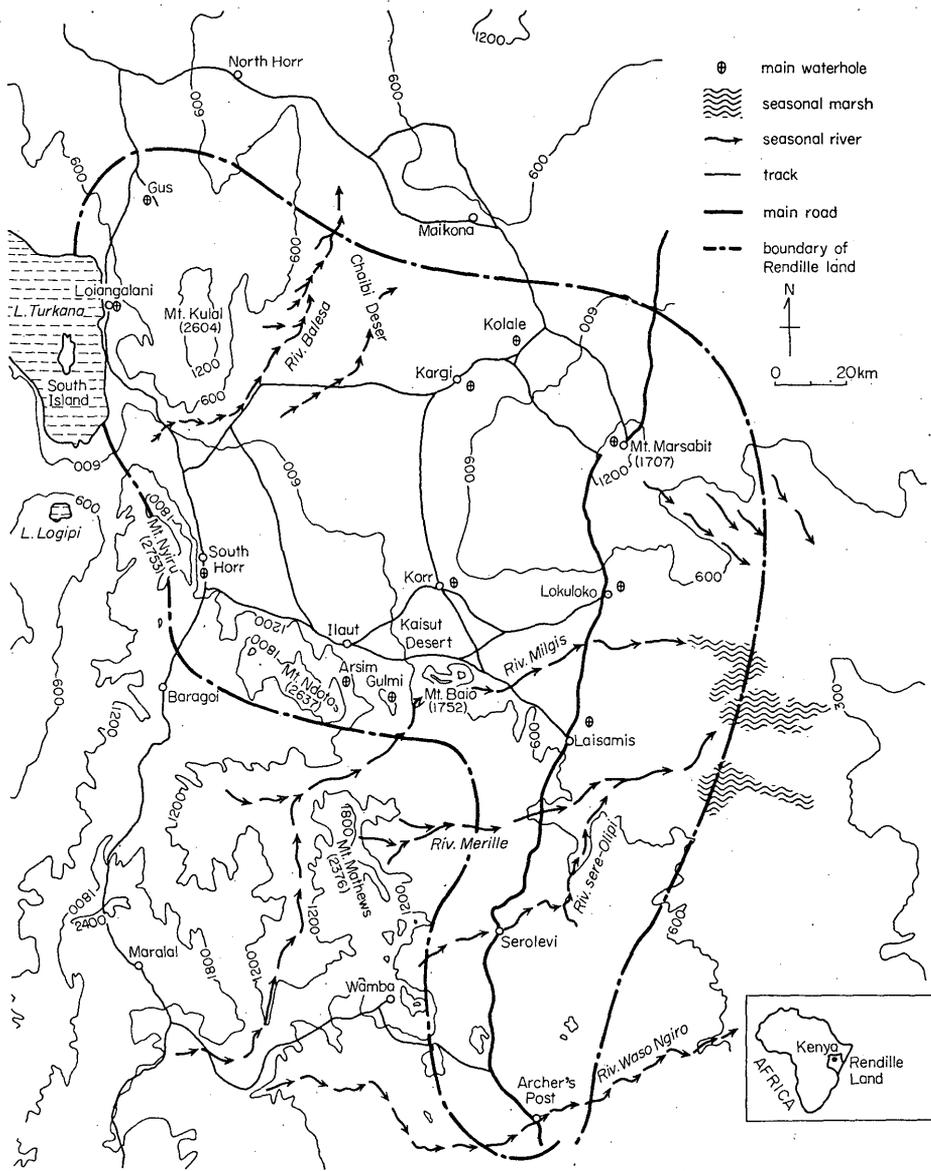


Figure 1. Rendille land

moiety (*belesi-beri*) and the western moiety (*belesi-bahai*), which are composed of four and five patrilineal clans, respectively. In turn, these clans are segmented into two to seven sub-clans, each of which is further segmented into five to 30 lineage groups. Although the Rendille trace their descent to a fictitious common ancestor within the particular descent group, individuals can recognize their real common ancestors for only two to three generations. Some clans may have their own pastures or waterholes, which are not reserved for exclusive use, and other clans have access to them. The most prominent social function of the clan is as the unit of exogamy.

Much remains unclear concerning Rendille history and origins, but linguistically they are thought to belong to the Somali group of eastern Cushitic [FLEMING 1976; WHITELEY 1974; HEINE 1976]. East of the northern part of Rendille land are the following tribes: the Dasanech (*Geleba*, [15,000], Sobania 1973) of the Oromo group; the Gabra (*Gabra*, 20,000) of the Galla group; the Borana (*Boranto*, 55,000) of the Galla group; and the Somali (*Darafa*, 250,000) of the Somali group, all of which are classified as eastern Cushitic. The Sakuye (*Sakuye*, 1,700) and the Buliji (*Buliji*) are interspersed among these tribes. South of the western part of Rendille land are found the Turkana (*Semeidero*, 203,000) of the Teso group; and the Samburu (*Kor*, 55,000), the Ndorobo (*Dorobo*, 21,000) and the Elmoro (100) of the Masai group, all of which are classified as Para-Nilotic²⁾. Apart from the Ndorobo who are hunter-gatherers and possess few animals, the Buliji and Sakuye who are agriculturists inhabiting the Mt. Marasbit region and the Kenya-Ethiopia border zone, respectively, and the Elmoro who are fishermen in Lake Turkana, the neighbors of the Rendille are all nomadic pastoralists. The Dasanech, Borana, Samburu and Turkana subsist mainly on cattle and smallstock³⁾, whereas the Gabra and Somali subsist mainly on camels and smallstock.

An estimated 19,000 Rendille inhabit an area of about 50,000 km² at a density of 0.38 persons/km². The Rendille and the Gabra are similar both in the size and density of their populations⁴⁾. Small tribes like the Rendille and Gabra, compared with others in the region, exert only a slight socio-cultural influence on neighboring peoples. Just as the Gabra maintain friendly relations with the Borana, so the Rendille consider the Somali as their brothers and are also politically allied with the Samburu [SPENCER 1973]. On the other hand, by tradition the Rendille are hostile toward the Turkana, Dasanech, Gabra and Borana. These inter-tribal relations are neither permanent nor rigid, and are easily altered on a temporary basis by livestock raiding or by the mutual need to use the same pastures [TANAKA 1976]. When unfavorable local environmental conditions force people to venture deeply into neighboring areas in search of pasturage, skirmishes may occur between the

2) Tribal population is derived from Whiteley [1974], Torry [1976] and Dyson *et al* [1937].

3) In this paper, the word "smallstock" is used as a general term for goats and sheep.

4) Population densities of several pastoral societies are available:

Samburu	1.09 persons/km ²	[SPENCER 1965],
Turkana	1.29 //	[GULLIVER 1955],
Gabra	0.15 //	[TORY 1976].

various tribes concerned, despite hitherto friendly relations. On the other hand, favorable environmental conditions may force members of several different tribes to herd their animals side-by-side along the inter-tribal boundaries in an atmosphere of an apparent, temporary truce. Sometimes, when an individual seeks to expand his herds at the expense of another, or when needing food during travel, he may steal livestock from another tribe. Inevitably, this develops into a quarrel.

Apart from livestock, there is another socio-cultural similarity between the Rendille and their neighbors. The age-system of the Rendille, discussed in detail below, is structurally similar to that of the Samburu. The Rendille age-system is composed of the same categories (age-grade, age-set and generation-set) as the latter and also they perform their initiations in the same 14 year interval as do the Samburu.

Inter-tribal marriage occurs more frequently between the Rendille and the Samburu than between the Rendille and other tribes (Borana, Gabra, Somali and Sakuye). As a reflection of this complexity, the lineage groups include those which are said to derive from the Somali, Gabra, Borana, Sakuye and Samburu. With such diverse origins, the Rendille lineage groups are included in 15 clans, but among these only nine are included in the moiety system. These nine clans may be called the "Rendille proper" [SPENCER 1973]. Of those six clans excluded from the moiety system, one is a mixed group of Rendille and Borana, and the remaining five are mixed Rendille-Samburu groups. Those clans which have come strongly under the socio-cultural influence of the Samburu are called "Ariaal Rendille".

The Rendille have a dual-residential system: they reside in either settlement or herding camps, although the numbers of both members and residential places fluctuate in response to seasonal changes in the socio-ecological environments. The structure of each type is flexible (*vide infra*).

Table 1. Age-sex composition of *Tupcha* settlements

Age	Males			Females		
	<i>Tupcha</i>	others*	total	<i>Tupcha</i>	others*	total
71 - 80	1	0	1	1	0	1
61 - 70	8	3	11	9	3	12
51 - 60	16	0	16	23	4	27
41 - 50	9	3	12	10	2	12
31 - 40	28	7	35	31	7	38
21 - 30	37	0	37	58	3	61
11 - 20	44	5	49	34	4	38
0 - 10	34	7	41	28	4	32
total	177	25	202	194	27	221
Total			423			
Sex ratio (M/F)			0.91			

* "others" means such people belonging to clans other than the *Tupcha*.

This paper is based on field research among the *Tupcha* clan, composed of two sub-clans (*Deele* and *Orbora*) and belonging to the eastern moiety⁵⁾. During the course of this investigation, from April, 1975 to November, 1976, settlement was dispersed in two to four sites, inhabited by 423 persons. The age-sex composition on the settlements and the sex ratio, calculated at 0.91, are shown in Table 1.

2) The Age-System as a Means of Population Control

The Rendille age-system is composed of age-grades, age-sets (*kholo*), and generation-sets (*malada*), but females, except for the *sapadi* described below, belong to neither age-set nor generation-set, but only to a specific age-grade [SATO 1979]. Male age-grades are distinguished as follows: boyhood (*iele*), warriorhood (youth; *her*) and elderhood (manhood; *mahabarre*). Age-grades for females are girlhood (*albe*), daughterhood (*albe-herre*) and womanhood (*obore*)⁶⁾.

Males are considered to be "boys" from the time of birth until circumcision (*handi*), and "warriors" from the time of circumcision to marriage. Thereafter, until their death, they are "elders". Every 14 years a new age-set is formed through tribal circumcision ceremonies. There are no age-set for "boyhood", but "warriorhood" has one, and "elderhood" has three or four generally recognizable age-sets. Generation-sets, unlike the age-sets, are formed for each clan; each age-set within the same clan is divided into two generation-sets.

Females belong to "girlhood" from birth until their teeth are extracted at about 12-13 years of age; to "daughterhood" from then until marriage; and to "womanhood" from marriage until death.

Boys should be initiated into age-sets according to their birth order, within the circle of full-brothers, thus a younger brother cannot be admitted to an age-set before his elder brother has been initiated. Further, the eldest son should be circumcised into the third age-set after that to which his father belongs. This third age-set above a given one is called the "*ohonnie*" (the father's age-set) of the third one below it. In this way, every third age-set is joined by what Spencer [1973] has called an

5) This paper is based primarily on data from the first research period, April, 1975–November, 1976. Supplementary data were obtained during the second research period, September–October, 1977. Dietary research on the smallstock was conducted in the third research period, December, 1978–March, 1979

During the first three months of my stay in the Rendille land, I was helped in my research by the Rendille interpreter who could speak Swahili and English. As I acquired a fluent command of Rendille through daily contact, I collected data with Rendille and Swahili languages. In this paper, Rendille words are inscribed in italics, except for common foreign idioms.

6) The age-grade of womanhood is subdivided according to the growth of the women's sons. From her wedding until the birth of the first child, a woman is called "new wife" (*albehnianiarre*); after the delivery she is *obore*; and when her son reaches warriorhood, she is called "mother of warrior" (*abal-ti-herre*). Young children are generally called *niahot*. The general term for boys who are going to be circumcised is *midiru*, and that for girls coincident with them in age is *albe-galitame*.

“age-set line”. All Rendille age-sets are arranged into one of three age-set lines, one of which in particular is known as *teeria*. Daughters whose fathers belong to a component age-set of *teeria* are called “*sapadi*”. Most Rendille daughters marry when warriors in the second age-set after their fathers’ age-set marry, but *sapadi* must wait until those of the third age-set after that of their fathers marry. In other words, *sapadi* cannot marry before their eldest brothers. Thus they marry one age-set (14 years) later than daughters whose fathers belong to other age-set lines. Moreover, whereas all other daughters are circumcised on the day of their wedding, the eldest sisters of *sapadi* within a lineage group are circumcised somewhat earlier.

During my period of fieldwork, all warriors married (from 1975 to 1978). Based on a population census taken in 1976, there were 58 warriors in the *Tupcha* settlements, 51 from the *Tupcha* clan and 7 from other clans (Table 2). Their average age was estimated at 31.8 years, which probably represents the average marriage age for warriors. Since they were circumcised in 1965, it can be concluded that the average age for circumcision is 20.6 years. At that time there were 92 marriageable daughters, including six who had been married previously. The average age of the daughters was 25.1 years, which may coincide with the average marriage age for daughters. Some *sapadi* were included in this calculation, so the average was higher than those for other age-sets.

In the *Tupcha* settlements, there were formerly 24 elders who belonged to the father’s age-set of the present warriors ([3] *elibalis*, Table 2), but of these, only 8 (35%) were alive at the time of field survey. Their sons numbered 64 persons, composed

Table 2. Family composition of the *Tupcha*’s settlements by age-system

	Elders (age-set)	Wives	Warriors (6. <i>defgudo</i>)	Daughters	Boys	Girls	total	
<i>Tupcha</i>	1. <i>iribangudo</i>	—	2	2	—	—	4	
	2. <i>defgudo</i>	—	7	7(1)	1	2	18(1)	
	3. <i>elibalis</i>	8	25(1)	38(3)	52(1)	20(3)	8	151(8)
	4. <i>libale</i>	16	22(4)	—	28(3)	44(3)	26	136(10)
	5. <i>iribandiff</i>	9	10	—	—	22	11(2)	52(2)
	6. <i>defgudo</i>	—	—	—	—	—	—	—
	total	33	66(5)	47(4)	81(4)	88(6)	46(2)	361(21)
others	1. <i>iribangudo</i>	—	—	—	—	—	—	
	2. <i>defgudo</i>	—	5	1	1	—	7	
	3. <i>elibalis</i>	3	6	1	—	—	1	11
	4. <i>libale</i>	1	1	—	—	—	—	2
	5. <i>iribandiff</i>	3(2)	5	—	—	5	4(1)	17(3)
	6. <i>defgudo</i>	5	5	—	—	2	—	12
	total	12(2)	22	2	1	7	5(1)	49(3)
Total	45(2)	88(5)	49(4)	82(4)	95(6)	51(3)	410(24)	

(): residents living outside of *Tupcha*’s settlements.

(October, 1976)



Photograph 1. Girls returning from collecting plant fiber

of 41 warriors ([6] *defgudo*) and 23 boys, who were all candidates for the following two age-sets. From this it can be concluded that in one generation, from the marriage of the fathers to that of their sons, the number of male members increase 1.71–2.67 times and that Rendille males increase at a rate of 1.7–2.6% per year⁷⁾.

Thus the Rendille age-system functions to favor late marriage. Moreover, unmarried females are strictly prohibited from becoming pregnant, and should it occur, the Rendille try to have illegitimate children artificially aborted or killed at the birth. This social norm together with the age-system accounts for the slow growth of the Rendille population.

3) Dietary Patterns

The Rendille take their meals twice daily, early in the morning before taking their livestock to pasture, and again after the animals have been safely penned in their enclosures for the night. Milk, blood and meat obtained from their livestock

7) This result is derived from the following calculations: On the assumption that all 23 boys will die before their marriage (about 14 years later). Rendille males increase 1.71 ([no. of sons]/[no. of fathers]) times during 31.8 years from the marriage of fathers to that of their sons. This figure is the minimum of increase. On the other hand, on the assumption that all 23 boys including 17 boys who will marry 14 years later and 6 boys who will marry 28 years later, will exist until their marriage, Rendille males increase 2.67 times during 38.1 years, which is an average years for son's marriage. This figure is the maximum of increase.

In terms of annual rate of increase, Rendille males increase 1.7% per year at a minimum of rate, whereas 2.6% per year at a maximum of rate. These figures are derived from the following equations:

$$\lambda = \text{annual rate of increase, } N_t = \text{total population } t\text{-years later, } N_t/N_0 = \lambda^t$$



Photograph 2. Camel blood is removed by cutting the jugular vein with an arrowhead

and maize flour, acquired by trade, form the dietary staples of the Rendille. Luxury items include honey, tea, snuff, chewing tobacco, *mera* (*Catha edulis*), the resin of wild plants, fruits, twigs and young roots. Their major spices are sugar, salt, ginger and pepper.

Since they are prohibited from taking cooking utensils to the camel camps, camel herders must live exclusively on camel products; milk, blood and meat. At least once every morning they drink a mixture of milk and blood (*banjo*), after which they leave for the day's herding.

The Rendille do, however, take cooking utensils to the smallstock camps, where water is comparatively easy to obtain, so that in addition to milk, blood and meat of their smallstock, they prepare maize flour for their meals. In the settlements, all the staple foodstuffs are normally available, but during the dry season, when the livestock have been moved out of the area of the settlements, people are forced to subsist solely on the maize flour purchased with the proceeds of the sale of smallstock. During the rainy season, when the livestock are grouped near the settlements, livestock products, which are preferred to maize flour, are available. Thus Rendille dietary patterns vary according to both season and location of residence. The Rendille also collect honey and wild edible plants to assuage their hunger and thirst when on route to the pastures. But such foodstuffs constitute only an insignificant portion of the total diet in terms of volume.

2. NATURAL ENVIRONMENTS AND SPATIAL MOBILITY

1) Climate and Water Resources

According to the meteorological records of the Kenyan Government, in 1970 the total annual rainfall at Marsabit and Maralal amounted to less than 255 mm in the northern areas of Rendille land, and 255–510 mm in the southern mountainous regions. However, during the periods 1959–1961 and 1968–1975 there was almost no precipitation in the lowlands.

The Rendille recognize four main seasons, two rainy and two dry. The main spring rains (*guu*) are heavy and begin around April. In “good” years *guu* is the season of plenty. Fresh pasturage abounds and milk is plentiful because most of the young animals, especially camels, are born after the spring rains. In June or July the long dry season (*nabaha-ki-deldeele*) commences, and lasts until October or November. The vegetation and pastures dry up more or less rapidly according to the abundance of the main spring rains. In this season the livestock are watered. In good years, however, this long dry season is interrupted by a light rain (*arat*) which falls in September. The coming of the autumn rainy season is heralded by long, light rains (*iel*) which begin around October and last for a few days. This autumn rain also renews pastures, and in this period another, but briefer, season of animal birth occurs. The last of the autumn rains (*sorar*) heralds the end of the autumn rainy season. After the *sorar* the short dry season (*nabaha-ki-gaban*) starts in December or January and lasts until March. In good years, however, a light rain (*furmat*) falls around February and signals the end of the short dry season. This dry season usually coincides with the period when lactation ceases.

Generally speaking, in northern Kenya the rainy season is biannual and more rain falls between April and May than between October and November, and in the mountainous regions more than in the lowlands. But the most important feature of the precipitation is its wide variation in both time and space. Rainfall patterns are both unstable and unpredictable.

In the lowlands, the highest average daily shade temperature recorded is 39°C and the lowest 22°C. The annual range is small. The Merille, Milgis, Sere-Olipi and Waso Ngiri Rivers rise in the southern mountains, and Mt. Kulal is the source of the Balesa; but when these great rivers flow into the lowlands they diverge and disappear into many underground streams. Surface flow occurs for a month or so after the rains. However, water can be obtained by digging 3–4 m in the dry river beds. Places where water can be obtained in this manner, are classified into *wor*, *tura*, *horr* and *sulsul*. *Wor* is a general term for wells sunk into river beds, whereas *tura* is used for those on the plain. Large-scale ponds of subterranean water are called *sulsul*, and oases are known as *horr*.

Scattered throughout the lava regions as well as in the mountains is subterranean water which springs from geological faults. This is known as *mohor*. Running water immediately following a rainfall is called *yoku*. There are also pools of different sizes in which water accumulates after a period of rainfall. A small pool

which cannot store water for more than a week is called *har*, and a large pool which can store water for more than a month, and which has a radius of 50–100 m, is known as *gadapp*. There are other rocky pools in the lava regions. The smaller pools of this kind are called *wijir* and the larger ones, *ntortor*.

Subterranean water sources provide a better and long-lasting supply of water for the Rendille and their livestock than does surface water, since the latter evaporates rapidly owing to the high temperature and low humidity of the region. Sudden, irregular droughts also occur, so even these water sources cannot be relied on. At present the only permanent water sources available to the Rendille are the pumped wells, drilled and maintained by the Catholic Mission and the Government.

There are eleven large-scale waterholes that can be used to water camels⁸⁾. Among them, the waters of South Horr, Gulmi and Arsim are both low in saline content and cold, and so are rarely used to water livestock. Instead, because of its higher salinity, the spring at Kolale in the Chalbi Desert is favored as a waterhole for camels.

During the rainy season, browse, herbs and grasses absorb considerable quantities of water and these supply enough moisture for the animals which consume them⁹⁾. At this time, therefore, the livestock are not watered. During the spring rainy season of 1976, watering of livestock was not observed for three months from 28th, March to 14th, June.

During the dry seasons, a short dry season from December 1975 to March 1976, and a long dry season from June to October 1976, the camels were watered every 11 days on an average, with a range of 5–14 days. During this time they moved at an average speed of 3.52 km/hr between the pastures and the waterholes, which are located 50–70 km apart. A round-trip could be completed in 5–7 days.

Mountain spring water, in addition to well and surface water, is used for smallstock. According to the observations made on 12 smallstock herds from January to February, 1976, the animals were watered every 4.5 days on an average, with a range of 2–7 days. The Rendille assert that during the dry season camels cannot subsist without water for more than seven weeks, smallstock for a week, and cattle for four days.

Whenever possible, daily watering of livestock is recommended to stimulate growth [WILLIAMSON *et al* 1965; GAUTHIER-PILTERS 1974]. But the Rendille believe that overwatered livestock are physically weakened. Smallstock are not watered for a full month after birth, and infant camels may not receive water up to eight months following birth. Mother camels are not watered for a month after delivery. It is thought that the Rendille follow this practice in order to acclimate their livestock to marginal conditions under which water may become extremely difficult to obtain.

When water is available in the vicinity of the settlements the women carry water

8) Gus, Kolale, Kargi, South Horr, Lake Turkana, Arsim, Gulmi, Lokuloko, Laisamis, Archer's Post, Korri (see Figure 1)

9) In the rainy season, plants contain 40–80% water, and during this time camels may be watered as infrequently as once every six months [GAUTHIER-PILTERS 1974].

Table 3. Amount of water drawn by the Rendille

Date (Feb., 1976)	Workers		Types of water-cask		total (person)	Types of pack animals		Water-supply per day (l./day)	total (head)
	elders	women daughters	water container ¹ no.	milk container ² no.		camels	donkeys		
6th	1	3	34	30	7	10	2	12	12
7th	—	4	24	24	4	8	—	8	8
8th	—	2	10	6	3	2	2	4	4
9th	—	5	40	36	6	12	2	14	14
10th	—	—	32	30	5	10	1	11	11
11th	1	—	11	9	3	3	1	4	4
12th	—	6	35	33	7	11	1	12	12
13th	—	—	28	24	6	8	2	10	10
14th	—	2	12	12	4	4	—	4	4
15th	—	3	25	21	5	7	2	9	9
16th	1	4	37	33	7	11	2	13	13
18th	—	2	15	15	3	5	—	5	5
21th	—	1	9	9	2	3	—	3	3
22th	—	3	25	21	5	7	2	9	9
23th	—	4	24	24	7	8	—	8	8
24th	—	—	12	12	3	4	—	4	4
25th	—	2	9	9	2	3	—	3	3
26th	—	3	34	30	8	10	2	12	12
27th	—	2	24	24	5	8	—	8	8
28th	—	4	26	18	7	6	4	10	10
Total 20 (days)	3	50	466	420	99	140	23	163	163
(%)	(3)	(51)	(47)	(101)	(101)	(86)	(14)	(100)	(100)
Average per day			23.3	466	21.0	43	509		

No. of consumer of water=156 (persons),

Average consumption of water = $\frac{\text{amount of water-supply}}{\text{no. of consumers}} = \frac{509}{156} = 3.3$ (l./person per day)

1.; capacity 20(l), 2.; capacity 2.06 (l)

containers (*han-ki-biche*) on their backs to draw water. Young children also carry empty cans or milk containers (*jijo* and *solol*) and fill them with water. However, if the waterholes are distant, the containers are loaded on either pack-camels or donkeys, and a day-long excursion takes place to fetch water. Each hut keeps one or two 20-liter water containers at hand. Drawing water is considered to be principally women's work and is carried out cooperatively among relatives, families and friends within the same settlements. When a woman is ill or pregnant and there is no child who can do the work, the husband will go to draw the family water. If the waterholes are distant and a sufficient supply is difficult to obtain, water becomes very precious and is never shared. At such times, it frequently becomes the cause of disputes.

During the period of my intensive investigation of water consumption, the Rendille lived in a settlement 15 km from the nearest waterhole, a pumped well. To transport the water they employed their camels and donkeys. During the research period, they relocated to a place even farther from a waterhole (Table 3).

Water is drawn once every 3–4 days for human consumption by each family. For the settlement as a whole, an average of 23.3 water containers and 21 milk containers were used to supply a total of 509 l/day. As 156 people actually resided at the settlement, each individual received approximately 3.3 l/day. During the 20-day observation period, 163 pack-animals were employed, including 140 camels and 23 donkeys.

2) Vegetation and Pastures

(1) TYPES OF VEGETATION

The panorama of Rendille land is one of stony semi-desert. The ground is dotted with small rocks and scattered shrubbery. Areas of dense grasses are scarce. According to the plant specimens collected, and the distribution map of Lind *et al* [1974], the vegetation zones of the region are forest, wooded grassland, bushland-thicket, semi-desert grassland and desert (Table 4).

The forest zone, which extends throughout the cool, well-watered mountainous regions above 1,500 m in altitude, is found in the Marsabit, Kulal, Nyiru and Ndoto Mountains and accounts for approximately 5% of Rendille land. The higher regions of this vegetation type is also known as "upland forest" or *Juniperus* forest. Only Mt. Marsabit lacks *Juniperus* species [LIND *et al* 1974]. The main plant species in this forest are *Juniperus procera*, *Olea africana*, *Podocarpus gracilior* and *Croton megalocarpus*. A large number of mosses also grow luxuriantly there. The cool forest is not used for pasturing camels, and only occasionally for small-stock. *Juniperus procera* (*hal*) and lichen (*hanano*) are collected for use in certain rituals.

In the mountains and valleys, wooded grassland is found at altitudes of 1,200–1,500 m, and also accounts for about 5% of Rendille land. In general, the wooded grassland zone is relatively well-watered, but less so than the forest zone. Nevertheless, along the rivers it remains perennially green. *Acacia tortilis* is prominent in the upper strata, the middle strata are fairly clear of vegetation, and the lower

Table 4. Vegetation types of Rendille land

Type of vegetation	Main components	Altitude (m)	Description
Forest	<i>Juniperus procera</i> <i>Olea africana</i> <i>Podocarpus gracilior</i> <i>Croton megalocarpus</i>	1500+	mountains (5%)
Wooded grassland	<i>Acacia</i> spp. <i>Themeda triandra</i>	1200—1500	mid-level (5%)
Bushland and thicket	<i>Acacia mellifera</i> <i>Commiphora</i> spp. <i>Cordia simensis</i> <i>Sericomopsis hildebrandtii</i> <i>S. pallida</i> <i>Duosperma eremophilum</i>	600—1200	foot of mountains (40%)
Semi-desert grassland	<i>Acacia</i> spp. <i>Commiphora</i> spp. <i>Cadaba</i> spp. <i>Chrysopogon</i> spp. <i>Duosperma eremophilum</i> <i>Indigofera spinosa</i> <i>Blepharis linariifolia</i>	400—600	lowland plain (40%)
Desert	<i>Pennisetum schimperi</i>	300—400	Chalbi Desert (10%)

(): relative percentage area

strata are dominated by grasses such as *Themeda triandra*, which give a monotonous appearance to landscape. Camels are but rarely herded in this zone and the wooded grassland may be considered as the upper limit of their vertical distribution.

Bush-thicket extends vertically from 600 to 1,200 m, and from the mountainous headwaters of the rivers into the lowlands, along the lower stream courses. Forty percent of Rendille land is covered by bush-thicket, which in appearance is halfway between wooded-grassland and semi-desert. *Acacia tortilis* is conspicuous in the upper strata. In the lower strata, bushes such as *Sericomopsis hildebrandtii*, *S. pallida*, and *Duosperma eremophilum* occur rather than Graminaceae. Thickets of *Cordia simensis*, *Acacia mellifera* and several species of *Commiphora* are especially abundant along the river courses.

Semi-desert grassland extends from 400 to 600 in altitude and covers 40% of Rendille land. No trees are more than 3 m in height and even those 2 m in height are rare. *Acacia reficiens misera*, *A. humalosa*, *A. nubica* and several species of *Commiphora* are scattered throughout the middle and upper strata according to the distribution of various soil elements. Several species of *Cadaba* and *Chrysopogon*, *Blepharis linariifolia*, *Indigofera spinosa* and *Duosperma eremophilum* are noteworthy in the lower strata.

The desert lacks vegetation except for palm trees (*Hyphaene crinita*) fringing the oases, *Indigofera spinosa* in the sandy regions, and *Pennisetum schimperi* around spring. This northern desert comprises the remaining 10% of Rendille land. The highly saline water which springs from the desert and volcanic terrace regions is favored as drinking water for humans as well as camels, but otherwise the desert is not useful to the Rendille.

As noted above, bush-thicket and semi-desert grassland cover some 80% of Rendille land, and *Acacia* and *Commiphora* grow predominantly in the upper and middle strata whereas *Sericomopsis*, *Duosperma*, *Blepharis* and *Indigofera* occur in the lower strata. Grasses almost never occur. This area is called sometimes "thorn bush zone" from the characteristics of the dominant genera *Acacia* and *Commiphora* which enable them to survive the drought periods. In East Africa the thorn bush zone is characteristic from L. Turkana to the Tana River region. Since this vegetation type contains no more than 250 plant species, Rendille land is extremely poor in flora.

(2) DIETARY PATTERNS OF LIVESTOCK

Research on livestock diet was done by recording the number of times each camel fed on a particular plant species or several species in a pasture during a 15-minute foraging period. These observations were carried out during four periods: period 1, from September to October 1975; period 2, 4-26 March, 1976; period 3, 27-31 March, 1976; and period 4, 27 May-13 June, 1976. Although period 3 includes only four days, on 26 March the beginning of the rains marked a change in the appearance of the vegetation. Periods 2 and 3 represent the distinction both before and after the rains began. When a camel took two plant species in a single "feeding behavior"¹⁰, each plant species was scored as 0.5 points. When only one plant species was taken, it was scored as 1 point. The results of this investigation, including the total number of plant species consumed by 213 adult and adolescent camels from three herds, are shown in Table 5.

Including 15 Gramineae grasses, the camels consumed plants of 47 species. Shrubs comprised 42.2% of their diet, and Gramineae grasses, herbs other than Gramineae grasses, trees and vines comprised 29.6%, 24.2%, 3.4% and 0.5% of the diet, respectively. The diet of camels in this region is based on shrubs (42.2%), grasses (29.6%) and herbs (24.2%).

If those plant species that comprise more than 10% of the diet of each period are regarded as "principal foods", then the principal foods of camels are *Blepharis linariifolia* (remark) and *Duosperma eremophilum* (yabah) of the Acanthaceae, *Sericomopsis pallida* (gipp) of the Amaranthaceae, *Indigofera spinosa* (holo) and *Tephrosia uniflora* (fure) of the Papilionaceae, and 15 Gramineae species (hoos). These principal foods comprise from 72.5 to 94.8% of the total diet for each period. Excluding the Gramineae grasses growing in patches in the semi-desert grassland zone and *Tephrosia uniflora* which grows in the marshes after the rains, the remaining

10) When camels feed on pasturage, a single "feeding behavior" starts with lowering the head and ends with the raising the head.

Table 5. Food items of camels

Scientific name	Research periods:					Total
	Sep-Oct, 1975	4-26, Mar, 1975	27-31, Mar, 1976	27, May-13, Jun, 1976	213	
	40	95	40	38		
	No. of camels observed (head)					
	Rendille name					
*Grasses (15 species)	418.0 (31.7)	991.0 (39.8)	22.0 (1.9)	248.0 (29.8)	1679.0 (28.8)	
* <i>Duosperma eremophilum</i>	323.0 (24.5)	38.5 (1.5)	622.0 (52.6)	45.5 (5.5)	1029.0 (17.7)	
* <i>Indigofera spinosa</i>	322.5 (24.5)	299.5 (12.0)	349.5 (29.5)	40.0 (4.8)	1011.5 (17.4)	
* <i>Blepharis linearifolia</i>	169.5 (12.5)	1031.5 (41.5)	100.0 (8.4)	4.0 (0.5)	1303.0 (22.4)	
* <i>Sericomopsis pallida</i>		1.0 (0)	4.5 (0.4)	179.5 (21.5)	185.0 (3.2)	
* <i>Peperostia uniflora</i>				87.0 (10.4)	87.0 (1.5)	
<i>Cadaba farinosa farinosa</i>	43.0 (3.3)	19.0 (0.8)	22.5 (1.9)	18.5 (2.2)	103.0 (1.8)	
<i>Cadaba milabilis</i>	13.0 (1.0)		2.0 (0.2)	1.0 (0.1)	16.0 (0.3)	
<i>Barleria aranthemoides</i>	12.5 (0.9)	7.0 (0.3)		3.0 (0.4)	22.5 (0.4)	
<i>Maerua oblongifolia</i>	10.0 (0.8)	30.0 (1.2)	3.0 (0.3)		43.0 (0.7)	
<i>Heliotropium albobispidium</i>	4.0 (0.3)	21.0 (0.8)	26.0 (2.2)	1.0 (0.1)	52.0 (0.9)	
<i>Justicia</i> sp.	3.0 (0.2)				3.0 (0.1)	
<i>Cyphostemma</i> sp.		30.0 (1.2)	4.5 (0.4)		34.5 (0.6)	
<i>Maerua sesseiflora</i>		8.0 (0.3)	5.5 (0.5)		24.5 (0.4)	
<i>Cadaba ruspolii</i>		8.0 (0.1)		11.0 (1.3)	8.0 (0.1)	
<i>Commiphora flaviflora</i>					9.0 (0.2)	
<i>Kedrostis</i> sp.				2.5 (0.3)	10.0 (0.2)	
<i>Acacia reficiens misera</i>					2.0 (0.2)	
<i>Cordia simensis</i>				64.0 (7.7)	66.0 (1.1)	
<i>Abutilon</i> sp.					0.5 (0)	
<i>Commiphora</i> sp.			1.0 (0)		1.0 (0)	
<i>Cyperus</i> sp.					48.5 (5.8)	
<i>Kedrostis gijef</i>					13.5 (1.6)	
<i>Cadaba glandulosa</i>					20.0 (2.4)	
<i>Aspilia mossambicensis</i>					12.5 (1.5)	
<i>Acacia nubica</i>					9.0 (1.1)	
<i>Acacia tortilis</i>					8.0 (1.0)	
<i>Grewia tenax</i>					7.0 (0.8)	
<i>Leucas nubica</i>					5.0 (0.6)	
<i>Tribulus cistoides</i>	3.0 (0.1)				3.0 (0.4)	
<i>Acacia paolii</i>	0.5 (0)				0.5 (0.1)	
<i>Commiphora boiviniana</i>					1.0 (0)	
<i>Tephrosia subtriflora</i>					0.5 (0)	
					1.0 (0)	
Total	1318.9 (100%)	2487.5 (100%)	1183.5 (100%)	833.5 (100%)	5823.0 (100%)	
Total of principal food (%)	93.2	94.8		72.5	91.0	

*: principal food, Gr: grass, Hr: herb, Tr: tree, Sh: Shrub, Vi: vine.

component plant species occupy a unique ecological niche within the semi-desert grassland. They are not interspersed, but rather each one dominates a particular region within the semi-desert grassland, presenting a single-phased landscape. *Indigofera spinosa* occurs in sandy soil, *Blepharis linariifolia* and *Duosperma eremophilum* in clay-rich soil, and *Sericomopsis pallida* together with *Acacia tortilis* in rocky soil. Many patches of *D. eremophilum*, which can withstand erosion and which grows over an extensive area from the bush-thicket zone to the semi-desert grassland zone, are particularly evident. This is the plant with the widest distribution in Rendille land.

The appearance of the vegetation undergoes a drastic change with the beginning of the heavy rains. The seeds of the *Blepharis linariifolia* burst forth and are crushed by the heavy rains which herald the coming of the spring rainy season. They are scattered by the wind and rain, and within a week fresh leaf buds appear. *B. linariifolia* is the first plant available immediately after rainfall and so is the herald of the rainy season. This plant has three names according to the stage of growth; *remark* is used for the dry mature stage, *kalkuma* for the succulent mature stage with purple flowers, and *halicha* for the cotyledon stage.

A week after the rains, *Oropetium* sp. (*boha*) of the Gramineae, the leaves of which previously were withered, sprout fresh and green. *Commiphora flaviflora* (*duwahadado*), *C. candidula* (*lamo*), *Euphorbia spinescens* (*andilha*) and *Acacia humalosa* (*hadado*) also produce leaf buds. Two or three weeks after the rain, other trees such as *Acacia reficiens misera* (*khasai*) and *A. nubica* (*hoolia*), shrubs such as *Duosperma eremophilum* and vines such as *Kedrostis gijet* (*wada-salhodon*) put forth fresh leaf buds. A month after the rain, all plants are in bud and the landscape takes on a totally green appearance.

Some plants are said to be beneficial to the health of camels, even though they may not be used extensively as principal foods. *Blepharis linariifolia*, *Indigofera schimperi* (*hanuhanis*), *Boswellia hildebrandtii* (*khalale*) and *Justicia flava* (*iliban*) aid in milk production and add fragrance to the milk, and *Commiphora rostrata* (*galidayan*) is said to prevent camel-flies (*dakkar*) from collecting on camels. When camels continue to forage in cooler areas and continue to drink fresh-water the level of blood salt decreases. At these times the camels are fed on *Salsola dendroides africana* (*hadum*) and *Dasysphaera prostrata* (*alaphanis*), which have a strong salty flavor.

Salts are indispensable nourishment for all livestock, and the lack of regular salt may result in a low resistance to lameness, trypanosomiasis, as well as producing a general decline in activity [SPENCER 1973, WILLIAMSON *et al* 1965]. Thus the Rendille intentionally lead their livestock, especially camels, to waterholes with brackish water as well as to salt licks. When watering camels, the Rendille also keep them feeding on salt-shrubs such as *Dasysphaera prostrata* and *Salsola dendroides africana*. Salts are also supplied to camels on the way to waterholes. In Rendille land, however, those salt-shrubs are limited to places in the lowland, namely near Kargi, and brackish water is available only at the Kolale spring, in the Chalbi Desert. The Rendille say that *Capparis tomentosa* (*letludai*) is a poisonous plant and that if camels

feed on it they become giddy, can no longer walk, and die. This plant is distributed in the way up to the mountains, and is one reason why the Rendille do not pasture their camels deeply in the mountains.

The feeding habits of sheep and goats were observed and recorded during the period, 5–15 January, 1979, when the pastureland was in a “*furmat*” rainy season phase. The number of bites taken from each plant species by each animal during a 15-minute foraging period in the pasture were recorded. Observations were made on 50 sheep and 50 goats from a single herd. When an animal took one plant species at one bite (each bite taking about 5 seconds), that plant species was scored as 1 point. When it continued to feed on the same plant species for more than five seconds, the plant species was scored as 1 point for each 5 second period.

Sheep and goats together were found to consume 51 plant species, 39 of which were eaten by both. Of the sheep diet, herbs comprise 45.0%, grasses 32.1%, shrubs 21.4%, vines 1.4% and trees 0.2%. For the goat diet, shrubs comprise 31.6%, grasses 30.0%, herbs 17.9%, trees 15.8% and vines 4.6%. In terms of the grazer/browser distinction, as a whole, graze (herb, grass and vine) comprises 78.4% and browse (shrub and tree) 21.6%, of the sheep diet. For goats, graze comprises 52.5%, and browse, 47.5% (Table 6).

Table 7 shows the 15 staple plant species which sheep and goats consume respectively, and which together comprise 87.5% of the sheep diet and 88.2% of the goat diet. Apart from the staple plant species eaten by both animals, such as *Blepharis linariifolia*, *Tephrosia subtriflora* (*tor*), *Leptothrium senegalensis* (*lilima*), *Stipagrostis uniplumis* (*maho*), *Indigofera spinosa*, *I. schimperi*, *Helitropium albobispidium* (*okomi*) and *Duosperma eremophilum*, sheep prefer succulent herbs, such as *Portulaca quadrifida* (*bakkeila*) and *Selaginella* sp. (*jalda*), which contrasts strongly with the goats' preference for pods, fruits and the leaves of trees, such as *Acacia reficiens misera*, *A. tortilis* (*dahar*), *Commiphora flaviflora* and *C. candidula*.

A comparative examination of the dietary requirements of the livestock shows clearly that sheep tend to graze whereas both goats and camels tend to browse as well as graze. It is clear that camels, goats and sheep compete for grass, since grass, which is very scarce in Rendille land, comprises about 30% of each animal's diet.

Table 6. Dietary analysis of livestock

	Grazing			Browsing		Total
	herb	grass	vine	shrub	tree	
Sheep	2152 (45.0)	1536 (32.1)	65 (1.4)	1023 (21.4)	9 (0.2)	4785 (99.9%)
	grazing=78.4%			browsing=21.6%		
Goats	784 (17.9)	1311 (30.0)	201 (4.6)	1384 (31.6)	690 (15.8)	4370 (99.9%)
	grazing=52.5%			browsing=47.5%		
Camels	(24.4)	(29.7)	(0.2)	(42.0)	(3.8)	(100.1%)
	grazing=54.3%			browsing=45.8%		

Table 7. Description of 15 staple plant species consumed by smallstock

goat diet			sheep diet		
Plant species	Ver. N.	(%)	Plant species	Ver. N.	(%)
1. * <i>Stipagrostis uniplumis</i>	Gr. maho	14.1	1. * <i>Blepharis linariifolia</i>	Hr. haricha	16.8
2. * <i>Leptothrium senegalense</i>	Gr. litima	11.4	2. * <i>Leptothrium senegalensis</i>	Gr. litima	15.7
3. * <i>Indigofera schimperii</i>	Sh. hanuhanis	10.8	3. <i>Portulaca quadrifida</i>	Hr. bakkeira	8.3
4. * <i>I. spinosa</i>	Sh. holo	7.7	4. * <i>Indigofera spinosa</i>	Sh. holo	7.9
5. * <i>Heliotropium albohispidum</i>	Sh. okomi	5.8	5. <i>Aristida adscensionis</i>	Gr. mad	7.0
6. <i>Acacia reficiens misera</i>	Tr. khasai	5.4	6. * <i>Indigofera schimperii</i>	Sh. hanuhanis	6.5
7. <i>Commiphora flaviflora</i>	Tr. duwahadado	4.9	7. * <i>Stipagrostis uniplumis</i>	Gr. maho	5.0
8. *	Hr. geido	4.7	8. * <i>Tephrosia subtriflora</i>	Hr. tor	4.2
9. * <i>Blepharis linariifolia</i>	Hr. halicha	4.6	9. * <i>Heliotropium albohispidum</i>	Sh. okomi	3.8
10. <i>Commiphora candidula</i>	Tr. lamo	4.5	10. <i>Selaginella</i> sp.	Hr. jalda	2.9
11. <i>Kedrostis gijef</i>	Vi. salhodon	4.2	11. ?	Hr. malek	2.3
12. <i>Plectranthus</i> sp.	Hr. dabor	3.2	12. <i>Heliotropium subulatum</i>	Hr. dabarar	2.3
13. * <i>Duosperma eremophilum</i>	Sh. yabah	2.6	13. <i>Cyperus</i> sp.	Gr. chuf	1.9
14. ?	Sh. dibiliot	2.5	14. *	Hr. geido	1.6
15. * <i>Tephrosia subtriflora</i>	Hr. tor	1.7	15. * <i>Duosperma eremophilum</i>	Sh. yabah	1.2
total		88.2	total		87.5
total of other 36 plant species		12.8	total of other 36 plant species		22.5

* : common plant species, Ver.N.: vernacular name, Gr: grass, Hr: herb, Sh: shrub, Vi: vine, Tr: tree

In addition, goats and camels compete for both browse and graze since the proportion of shrubs, grasses, herbs, trees and vines in the goat diet was similar to that of the camels.

(3) PASTURES

The Rendille camels are herded between the foothills, with an altitude of 1,200 m, and the lowlands, with an altitude of 400 m. Disregarding the desert regions which cannot be used for foraging, the area of camel pastures is divided between the semi-desert grassland and the bush-thicket vegetation types. Because most plant species growing in the semi-desert grassland are shrubs which do not block the view, there is little danger that the camels will become lost. In this region the principal foods such as *Blepharis linariifolia*, *Duosperma eremophilum*, and *Indigofera spinosa*, on which camels thrive, grow abundantly all year round. On the other hand, trees in the upper strata grow only sparsely, so that the semi-desert grassland is hot and arid. Consequently, whereas the herders often suffer from thirst, the intense heat is thought to benefit the camel growth. Conversely, bush-thicket areas are composed of conspicuous middle and large-sized trees, such as *Acacia* and *Commiphora* and *Cordia simensis*, which impaire visibility and make camel herding difficult. There is a danger of camels straying and becoming lost. During the rainy season certain places become marshy and harbor tsetse flies (*dalmi*) and mosquitos (*mune*), but herbs such as *Tephrosia uniflora*, *T. subtriflora* and *Indigofera coerulea occidentalis* grow luxuriantly there, such that camels, goats and sheep can obtain fresh, high quality food.

Tsetse and camel flies are vectors of trypanosomiasis and anthrax in camels [MARES 1965; SPENCER 1973]. The former tends to break out in the bush-thicket area at the end of the rainy season, whereas the latter tends to occur in the rocky lava belt in the same season. Although the prevalence of those diseases has been regarded as one of the factors limiting camel distribution [SPENCER 1973; EPSTEIN 1971], the time and place of the vector occurence fluctuates from year to year and from place to place during a year, depending on the abundance of rainfall. Outbreaks of disease can therefore be only roughly predicted by the herders. Camels are not withdrawn from such fly-infested place unless they actually contract the diseases.

Using the dietary habits of camels as a basis for comparison, whereas semi-desert grasslands support only a limited number of plant species, a stable food supply is assured all year round. In the bush-thicket areas on the other hand, there is a large supply of many different species of herbs of high quality, but they are available only in the rainy season.

Smallstock only obtain good pasturage in the lowlands during the rainy season. They are herded in the lowlands until the arrival of the dry season, but as soon as it becomes difficult to forage they are moved quickly to the humid mountainous regions, where pasturage is still available. Consequently, camels and smallstock can be herded in the same lowlands only for the brief rainy season.

3) Fauna

In the lowlands of Rendille land the moisture evaporation and absorption rates are so high that there are no reliable permanent sources of water except for pumped wells. During the dry season most animals that forage on wild plants move into either the mountains or the wooded areas along the rivers where food and water are somewhat easier to obtain. Carnivores also show a seasonal migration in search of herbivores. The only animals found in the lowlands even during the dry season, are oryx, gerenuk, Grant's and Soemmering's gazelles, that can withstand the aridity.

The common mammals living in the lowlands include the black-backed jackal (*Canis mesomelas*), the bat-eared fox (*Otocyon megalotis*), the striped hyena (*Hyaena hyaena*) and the spotted hyena (*H. crocuta crocuta*), all carnivores; the Cape hare (*Lepus capensis*) and the pallid ground squirrel (*Xerus rutilus*); the Soemmering's gazelle (*Gazella soemmeringi*), the Rainey's gazelle (*G. granti raineyi*), the gerenuk (*Litocranius walleri*), the reticulated giraffe (*Giraffa camelopardalis reticulata*), the

Table 8. Fauna of Rendille land

Scientific name	Common name	Rendille name
<i>Gazella granti raineyi</i>	Rainey's gazelle	holli guuden
<i>G. soemmering</i>	Soemmering gazelle	holli dahan
<i>Litocranius walleri</i>	gerenuk	holli guuden
<i>Giraffa camelopardalis reticulata</i>	reticulated giraffe	geli
<i>Oryx beisa</i>	beisa oryx	ogor
<i>Madoqua saltiana</i>	Phillips's dik-dik	sagali
<i>Rhynchotragus guentheri</i>	Guenther's longsnouted dik-dik	sagali
<i>Syncerus caffer caffer</i>	buffalo	gassar
<i>Hippopotamus amphibius</i>	hippopotamus	ibeh
<i>Phacochoerus aethiopicus</i>	warthog	?
<i>Tragelaphus strepsiceros</i>	greater kudu	mahalole
<i>Canis mesomelas</i>	black-backed jackal	duwaho
<i>Otocyon megalotis</i>	bat-eared fox	doguh
<i>Acinonyx jubatus</i>	cheetah	doho
<i>Felis libyca</i>	african wild cat	gulbikt
<i>Panthera leo</i>	lion	bahasi
<i>P. pardus</i>	leopard	kabili
<i>Hyaena crocuta crocuta</i>	spotted hyaena	walaba
<i>H. hyaena</i>	striped hyaena	walaba
<i>Lycan pictus</i>	wild dog	yai
<i>Lepus capensis</i>	Cape hare	bakkeila
<i>Equus grevyi</i>	Grevy's Zebra	gango
<i>Diceros bicornis</i>	black rhinoceros	wejl
<i>Erythrocebus patas</i>	patas monkey	?
<i>Papio anubis</i>	anubis baboon	racher
<i>Loxodonta africana</i>	elephant	alapp
<i>Xerus rutilus</i>	pallid ground squirrel	ules
<i>Hystrix sp.</i>	crested porcupine	dabbal walaba
<i>Mellivora capensis</i>	ratel	koriente

7 order, 17 families, 26 genera, 29 species

beisa oryx (*Oryx beisa*), the Philips' dik-dik (*Madoqua saltiana*), the Guenther's long-snouted dik-dik (*Rynchotragus quentheri*), and Grevy's zebra (*Equus grevyi*), all of which are ungulates. I observed 26 genera and 29 species of mammals during my stay in the lowlands (Table 8).

Of those animals, only the gerenuk, the gazelles, the oryx, the giraffe, and the dik-diks are regarded by the Rendille as food. They do not actively hunt these animals, however, but only scavenge for them. Only the carnivores that prey on men and livestock exert a direct selective pressure on livestock. The jackal, the fox and the hyena prey only on smallstock, but the lion and the lycaon also prey on camels and men, and are particularly feared. However, such carnivores influence only slightly the spatial movement of livestock, since they descend to the lowlands only in the rainy season, following the movements of their prey, and also because the herdsmen fight them bravely in defense of their livestock as well as to accrue prestige.

4) Topography and Humidity

The southern mountainous regions of Rendille land comprise a jumbled series of dry valleys with a generally rough terrain. The northern lava belts extending from the shore of L. Turkana to the foot of Mt. Marsabit are also extremely stony areas. There are several swamps (*kuya*) in the lowlands, where the soil is composed mainly of clay-sand and where the surface is cracked owing to the high temperature and high evaporation rate during the dry season. During the rainy season, water flows from pools in these areas. During the rainy season, *kuya* are too muddy for the passage of camels, and it is not uncommon for camels to suffer sprained limbs, when passing through the swamps. Thus these regions are unsuitable for the one-humped camels which are indigenous to country with a gentle topography.

High humidity is not good for camels either because it encourages the infestation of such harmful insects as ticks. When rain falls in the pastures, the camels are moved to drier places to continue feeding.

5) Nomadic Range

The Rendille herd their camels year round throughout the lowlands, except for the muddy areas. From October, 1975 to September, 1976, the camel herds of the *Tupcha*, the main subject of this study, covered an area of 10,800 km²; in the central part of Rendille land, corresponding to the region extending from South Horr to Laisamis (Figure 2). During this period it was quite common for the herds to be as much as 100 km from the settlements, but the camels of other clans were sometimes as much as 200 km from their settlements. The Rendille usually keep their goats and sheep together in a mixed herd, and generally refer to them by the common term, *adi*. During the rainy season smallstock are herded in the lowlands, but with the advent of the dry season they are moved for herding in the mountainous regions such as Marsabit, Kulal, Mathews and Ndoto.

The movement of the livestock depends on the ecological factors mentioned

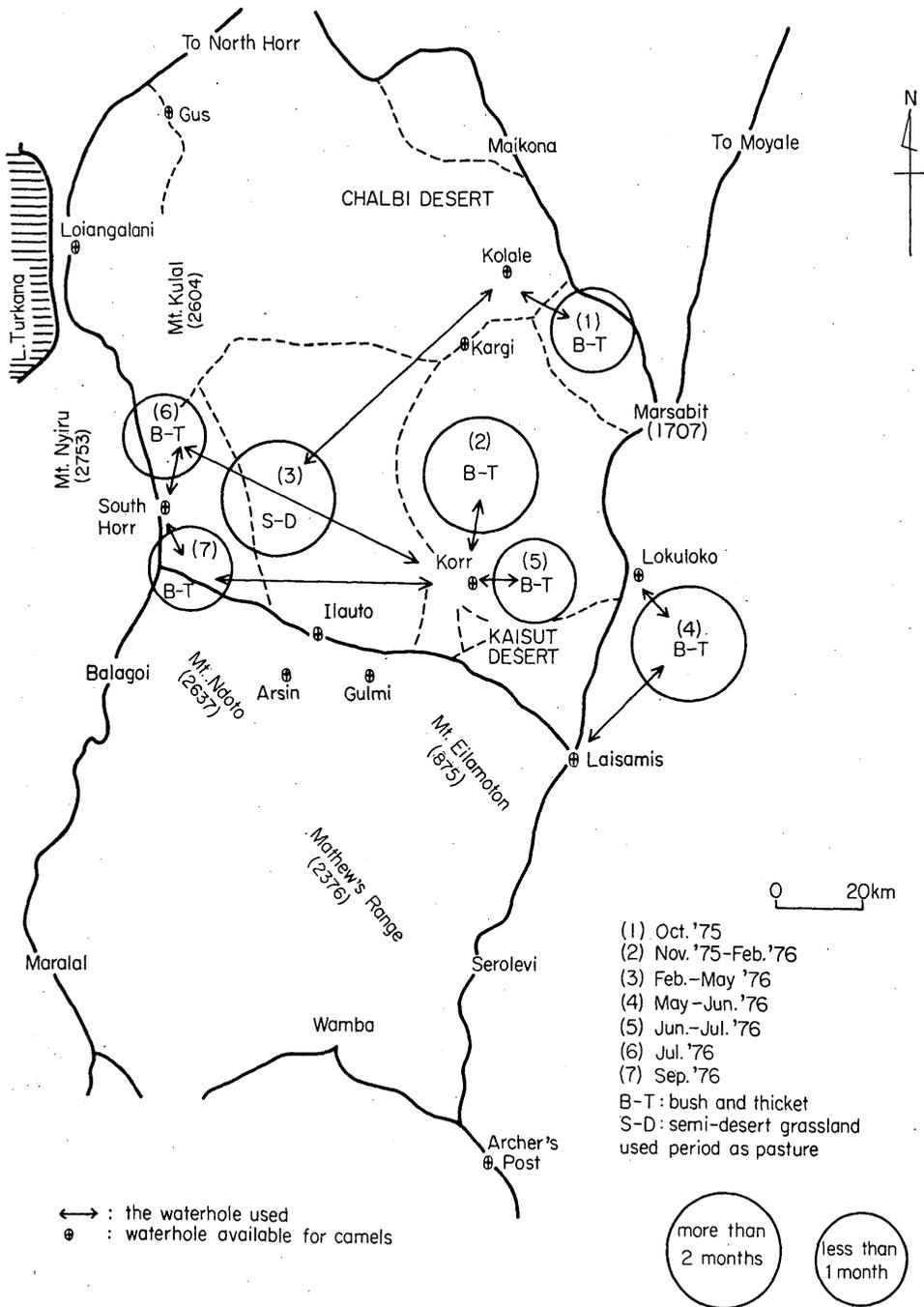


Figure 2. Nomadic range of *Tupcha's* camels

above, and on social factors such as the relations with neighboring tribes and the performance of collective social ceremonies. Inter-tribal relationships, even if the tribes involved are mutually hostile, tend to be adjusted toward efficient use of pastures for all parties.

Most Rendille social ceremonies are performed in the settlements as blessings for the fertility of the livestock, and occur at regular intervals, five times a year. It is formally required that all livestock and all members of a settlement participate in these ceremonies, thus all herders must return their livestock to the settlements. However, under such unavoidable circumstances as prolonged drought, the collective ceremonies take place with a minimum number of participants plus a few representative livestock.

In the semi-desert regions the paucity of plants is so marked that animals must spread out and move over a wide range to remain healthy. In addition to those socio-ecological factors determining the movement of livestock, the other main factors are problems of pasturage and watering. On an average, camels are watered every 11 days and smallstock every 4.5 days. This different watering interval gives rise to a difference in their spatial movement. Camels can feed up to 50–70 km from a waterhole, whereas smallstock cannot feed more than 20–30 km away. The same discrepancy is seen in their respective diets. Camels may be supplied with their principal foods in the lowlands all year round, but smallstock must be moved to the more humid mountainous regions during the dry season to obtain necessary vegetation and to moderate the competition between camels and smallstock for the same food resources. Thus, camels demonstrate a horizontal pattern of movement in that they stay continuously in the lowlands, whereas smallstock have a vertical pattern of movement, moving from the lowlands to the mountains and back again.

The seasonal patterns of livestock movement tend to be governed by a combination of such important factors as frequency of watering, diet, feeding behavior, and the distribution and density of waterholes and pasturages. But, of these factors, the camels are controlled primarily by the availability of pasturage, whereas the smallstock are governed by the distance from waterholes. As a consequence of these differences, the camel herders often suffer from thirst as they lead their livestock over vast areas in search of pasturage whereas the smallstock herders are comparatively well-watered and do not suffer as severely.

3. LIVESTOCK MANAGEMENT

The Rendille seek above all to increase the numbers of their herds and to enable their animals to produce abundant milk, meat and blood. This is clearly reflected not only in the social ceremonies of the Rendille but also in the manner in which they manage and care for their livestock. The life-history of the animals must therefore be regarded as a complex of the natural, biological and ecological characteristics of the animals themselves in addition to the intervention of specific management techniques.

1) Life-History of Livestock

Camels have a gestation period of 12–13 months and give birth to a single calf. Newborn camels (*uer* or *nioloho-nichul*) begin to walk alone after about 10 days and are nursed exclusively for their first two months of life. At three months of age they begin to feed and at the same time gradually to be weaned. Camels are completely weaned by their eighth month and thereafter must be watered regularly. They have now reached juvenility and are called *urbol*. In addition, when mother camels become pregnant, their infants which have not yet been weaned are shifted from their mothers to a group of juveniles. Camels of 3–4 years of age begin to develop sexually and at 4–5 years of age are fully mature. Their adolescent period is divided into an earlier (*gitton*) and a later (*haarim*) period.

Males are most active sexually around their seventh year, but females usually give birth to their first calf (*maale-urahar*) when they are 4–5 years old. They continue to give birth every 2–3 years for a 20-year period. The first and the last calf (*maale-uer-alale*) are usually only the size of an adult goat and their mortality rate is extremely high. For this reason, the end of the fertility period of a female camel is clearly recognizable. The general term for adult females is *aito*, post-menopause females are called *aito-alale*, and a female which has just given birth is called *iliban*.

Male camels which have reached maturity are divided into meat camels (*duffan*), stud camels (*ouli*) and pack camels (*halo*). Those to be used for meat are castrated (*siiban*), usually around their fifth year. Pack camels may or may not be castrated depending on the consent of the woman who actually uses them. Consequently, pack camels are divided between those which have been castrated (*hali-siiben*) and those which have not (*hali-khodo-ahabo*). Camels to be used for breeding are called *tatan* after their first copulation (*fohe*), *tatan-fohe-lama* after their second copulation, *forasi-ouli* after they have developed premolars (*golgor*), which is approximately coincident with their tenth year of age and their third copulation, and then *ouli-uen* after they have developed incisors (*meiho*), which coincident approximately with their fourth copulation, and when a wooden bell is hung from a rope tied around their necks. Male camels born with only one testicle are called *khodile* and are never castrated, but used as breeding animals (*ouli-khodili*). Stud camels (*ouli-lote*) which have had some work experience as pack animals are distinguished from those (*ouli-luhu-ahabo*) which have not, because the hair on the hump (*luhu*) of all pack camels is shaved off for convenience in loading. When their breeding ability has apparently declined, the former are taken back to the settlement where they are slaughtered for meat and collectively consumed with blessing. The latter have a new rope and wooden bell tied around their neck and are abandoned in the bush.

A stud camel is used for breeding every other year, for a period of 14–16 years. This is because the continuous use of a stud camel, without rest, results in a sudden decline in breeding ability. A stud camel prevented from copulating is

called *ouli-kitilen* (camel prohibited from breeding), and a stud camel actually used for breeding is called *ouli-fohan*. When prevented from copulating, the stud camel has one leg tethered and is left alone in an enclosure or in a pasture adjacent an enclosure. Stud camels in use for breeding are tethered in the enclosure over-night so as not to disturb the other camels with their mating activity. During the mating season, if the stud camels and their mothers have been put together in the same herd, the mother camels are shifted to a different herd to avoid possible incest.

According to Rendille standards, the ratio of four male camels should be one pack, one stud and two meat camels. Commonly, one or two studs are allotted to a herd of 50 camels.

Although calves are born at the end of the each rainy season, including both spring and autumn seasons, most camels are born at the end of the spring rainy season. The general term by which they are known is *nioloho-ti-guu* (calves of the *guu* rain). A few calves (none or one per herd) are born at the end of the autumn rainy season, and are known generally by the term, *nioloho-ti-ieli* (calves of the *iel* rain). However, because conception and pregnancy are closely connected with the nutritious fresh herbs regenerated by the heavy rain, a prolonged drought results in a plunge in the breeding rate¹¹⁾.

According to my record of births made for the *Tupcha* camel herds, 111 calves were born at the end of the spring rains in April–July, 1976 as follows:

April	–	11 May	21.4%
12 May	–	13 June	61.5
14 June	–	7 July	17.1

The delivery of calves lasted from April to July and peaked in May.

Every camel herd is divided into 2–5 herding groups according to the growth stage of the camels and the availability of manpower, in order to plan for effective reproduction and milk supply for both suckling camels and humans. Basically, it is divided into two groups at times other than the delivery and the mating seasons: a group of adult and adolescent camels (*gaal*) and a group of juvenile camels which have been weaned but have not yet reached maturity (*nioloho* or *urbol*). As the calves are born, an additional third group (*iliban*) composed of suckling infants and their mothers, is formed.

Soon thereafter, when camels begin to become sexually excited, a group of adult and adolescent camels is first divided into two groups to facilitate reproductive efficiency, and to prevent excited stud camels from fighting among themselves. Each group has one active stud. One group (*gaalimoolo*) is formed to provide for human subsistence and is composed of one stud camel, several pack camels and many milking camels. The other (*gaaliforr*) is formed for the purpose of reproduction. This latter group is composed of one stud camel and adult-adolescent camels of both sexes.

11) Sufficient rainfall, which means that the camels will be provided with an ample supply of food, leads to the production of ova and sperm when the rains end. This is the time when sexual activity reaches its peak [TORRY 1973].

In the latter half of the mating season, a third group (*gaalihoopu*) of adult and adolescent camels is formed and is composed of one stud camel and those females which become still not pregnant in the above-mentioned two groups. This third group is rarely observed, especially in camp-based herding (*vide infra*), because it cannot be formed unless there are enough stud camels (at least three) and herders. Finally, as soon as they become pregnant, female camels are gathered together into a *gaaliforr* group. After the end of the mating season, the camels of *gaalihoopu* are returned to their previous group and the *gaalimoolo* stud camel is shifted to the *gaaliforr*. Thus two groups of adolescent and adult camels are formed, *gaalimoolo* and *gaaliforr*.

As infant camels are gradually weaned they are shifted to *gaalimoolo*, together with their mothers, and after they have been completely weaned the mother-infant group is divided into a *gaalimoolo* and a juvenile group. At this time it is usual for both *gaaliforr* and *gaalimoolo* to be penned in the same enclosure in the settlements, so that they appear like one group of adolescent and adult camels. Finally, the Rendille refer to the group of camels used for subsistence as *gaalimoolo*, and the group for reproduction as *gaaliforr*.

Goats and sheep have a gestation period of 3–4 months and twinning (*mandano*) is not uncommon. The tendency toward twinning is more frequent among goats. Infant goats (*mahasso-riyott*) and sheep (*mahasso-iiyatt*), *mahar*¹²⁾, are kept together for a month after birth in a small pen, made of piled stones or of wooden bars, in order to prevent exposure to the direct rays of the sun. They are penned together to accustom them to each other's odor so that in the future a mixed herd may be formed easily. Weaning begins by the second month after birth and at that time the young must become accustomed to drinking and feeding on their own. By the third month, weaning has been completed, and between the fourth and sixth months, the juvenile goats (*karat*) and the juvenile sheep (*guus*) are formed into a mixed group for regular herding. They reach adolescent (*teel*¹³⁾) at six months, and after their first year give birth to their first offspring. Goats and sheep are herded during both their adolescent and adult periods in a group consisting of both adolescent and adult animals (*adi*¹⁴⁾). Even if there are enough herders, goats and sheep are not separated into different groups by genus. The reason for this is that sheep alone would be inclined to assemble and to stop both feeding and moving in the pastures with the high temperatures. Thus, goats are needed to lead the herd and facilitate both movement and feeding.

Smallstock are castrated during their adolescence and raised for meat. Uncastrated smallstock are raised for breeding purposes, and continue to breed for about 3–4 years¹⁵⁾. After their breeding role is completed males are castrated and

12) "*Mahar*" is a general term for infant and/or juvenile goats and sheep.

13) "*Teel*" is a general term for adolescent goats and sheep. More precisely, the Rendille use "*heren*" as a general term for adolescent sheep and "*wahal*" for adolescent goats.

14) Castrated goats and sheep are called *kelehei* and *walappu*, respectively. For young adult female goats, the general term is *urahar* and for female sheep, it is *siben*. For mature female goats, the general term is *reheito* and for sheep, it is *rahato*.

15) Breeding goats are called *olgei* and breeding sheep *ouli-iiyat*.

raised for meat animals. Smallstock give birth all year round, but there is a somewhat clear peak in the rainy season. A female generally gives birth several times a year for about ten years. A single breeding male will suffice for as many as 30 adolescent and adult females and the Rendille say that a male goat will copulate with many females a day, but a sheep with only one.

The Rendille distinguish their animals according to age and sex. The age distinctions are drawn among infancy, juvenility, adolescence and adulthood. Females are further differentiated by the number of times they have given birth and males by whether or not they have been castrated, as well as by utility. A herd is divided into those infants which need nursing, juveniles which have been weaned, and adolescent and adult animals which are still reproductive. Each forms separate groups.

2) The Age-Sex Composition of Herds

During the course of research data were obtained on the age-sex composition of 20 of the 26 camel herds in the *Tupcha* settlements (Table 9).

The average size of a herd was 49.1 head, ranging from 24 to 73. It included adult and adolescent females (61.5%), stud camels (3.3%), other adolescent and adult males (14.5%), juveniles (9.5%), and infants (11.1%: females 6.7% and males 4.4%). Stud camels comprised 18.4% of all adolescent and adult males and there was a ratio of one stud camel for every 18.6 adult and adolescent females. Excluding the juveniles for which a sex ratio was not available, the herd was composed of 68.2% females and 22.2% males, a ratio of 1.0 female: 0.325 male. For reproductive animals there was an average of 30.2 adolescent-adult females for each 1.6 stud males, a ratio of 1.0 female: 0.05 male.

The 604 females belonging to the 20 herds gave birth to 111 calves, at a birth rate of 18.4%. One calf was born annually for every five females.

A mortality rate of 3.5% was recorded for the 20 herds, of which infants accounted for 14.4%, juveniles 1.1%, and adolescents and adults 2.2% (Table 9). The mortality rate among infants was extremely high. The camels are under the control of men and are killed and consumed for food when they reach menopause. Many infants die from premature (*lugutt*) or delayed birth (*obobisu*). Camels die in adolescence and adulthood from external wounds from sprains or broken bones, from injuries inflicted by carnivores, or from illness.

The average herd of smallstock was composed of 85.8 head, and the number of both animals in a herd was roughly the same (Table 10). There was little difference between goats and sheep with respect to age composition; adults and adolescents, 66%, and juveniles, 13%. Infants accounted for the remaining 21%.

3) Population Dynamics of Camel Herds

To test hypotheses concerning the population dynamics of camel herds, certain assumptions indicated below have been added to the findings on the age-sex composition of the herds.

Table 9. Age-sex composition of camel herds

Herds	Adult-Adolescent Male		Female	Juvenile	Infant		?	Total
	Stud camel	Pack camel			Male	Female		
1. I-2	1	13	28(1)	3	1	3		48
2. I-1	2	12	22	4	2(1)	3(1)		45(2)
3. P-S	2	12	36	8(1)	1	4		62
4. Q-R-S	2	6	24	4	1	3		40
5. T-N								
6. T	4	8	66(2)	—	8(1)	5	1	—
7. D	2	4	17	—	2(1)	4		—
8. E-F	3	7	35(1)	—	5(1)	7(3)		—
9. L-3	1	8(1)	24	—	3	3		—
				/27/				/240/
10. H-M								
11. H-2	2	12	77(3)	11	3	6(2)		108(2)
12. U-1	1	4	32(1)	4	2(1)	2		44(1)
13. K-K*	2	7	35	6	1	5		56
14. F-2	2	13(2)	43	4	4(1)	3		67(1)
15. A-2	1	7(1)	39	4	2(2)	4		56(2)
16. L-1	1	12	44	7	3	6		73
17. L*-1	1	5	13(1)	2	2(1)	3		25(1)
18. L-2	2	4	15(1)	2	0	1	1(1)	24(1)
19. M	0	6	38(1)	4	2	1		50
20. O	3(1)	2(1)	16	3	1	3		26
Total	32(1)	142(5)	604(11)	93(1)	43(9)	66(6)	2(1)	982(34)
Average (%)	1.6 (3.3)	7.1 (14.5)	30.2 (61.5)	4.7 (9.5)	2.2 (4.4)	3.3 (6.7)		49.1 (100.0)
Mortality (%)		2.2		1.1	14.4			3.5

A, B, C,—S, T.: name of Rendille lineage group

H*: affine of H-lineage group

(): no. of death

?: sex unknown

Table 10. Age-composition of goat-sheep herd

Reference name of Herd	Sheep			TOTAL	Goat			TOTAL	Grand Total
	Ad.-Adol.	Juv.	Inf.		Ad.-Adol.	Juv.	Inf.		
Leh.	38	8	15	61	22	6	5	33	94
Ara.	15	4	9	28	29	5	16	50	78
Eis.	27	5	4	36	22	4	7	33	69
Nai.	36	5	9	50	39	6	7	52	102
TOTAL	116	22	37	175	112	21	35	168	343
Average (%)	29 (66.3)	5.5 (12.6)	9.3 (21.1)	43.8 (100)	28 (66.7)	5.3 (12.5)	8.8 (20.8)	42 (100)	85.8

Ad.; adult, Adol.: adolescent, Juv.: juvenile, Inf.; infant.

Camels give birth to their first calves at 4-5 years of age, and continue giving birth for approximately 20 years thereafter. When they reach menopause they are quickly killed and eaten. It is assumed therefore that: 1) all females give birth to their first calf at four years of age; 2) a camel's life span is 25 years; and 3) the age-sex composition of the herd is constant.

Calculations have been made using algebraic equations with the following variables:

a = number of female calves produced.

b = rate of survival for infant camels.

c = rate of survival for juvenile camels.

d = rate of survival for adolescent and adult camels.

M_n = number of female calves produced per year per female aged n.

P_n = number of camels who survive to n years of age.

R = multiples of the increase of population after one generation.

The number of individuals surviving at age (P_0) is equal to a, $P_1 = a \times b$, $P_2 = a \times b \times c$, $P_3 = a \times b \times c^2$, $P_4 = a \times b \times c^2 \times d$. The number of individuals surviving at age n (P_n), is shown by $P_n = a \times b \times c^2 \times d^{n-3}$ ($n=3, 4, 5, \dots, 25$). The multiples of the increase of population after one generation (R), is shown by the equation,

$$R = \frac{1}{a} \sum_{k=4}^{25} P_k \times M_k$$

Here, the number of infant females was 66 head so that $a=66$. Using the figures shown in Table 9, the following is derived:

$$b=95/111=0.856, c=92/93=0.989, d=761/778=0.978$$

Every year, females of more than four years of age give birth to 66 female calves, so that for each female camel the annual average rate of reproduction of female calves is 0.109. Thus,

$$M_n \begin{cases} =0 & (n=1, 2, 3,) \\ =0.109 & (n=4, 5, 6, \dots, 25) \end{cases}$$

If the number of individuals surviving to age n (P_n), is represented by $P_n = a \times b \times c^2 \times d^{n-3}$, then the multiple of the increase of population after one generation is $R = b \times c^2 \times \sum_{k=4}^{25} d^{k-3} \times M_k = 1.57$, or the herd increases in size 1.57 times in each generation. The number of years in one generation (T) is expressed by:

$$T = \frac{\sum_{k=4}^{25} k \times P_k \times M_k}{\sum_{k=4}^{25} P_k \times M_k} = \frac{21.37}{1.57} = 13.61 \text{ (years)}$$

The intrinsic rate of natural increase (q), for the camel population is expressed by: $q = \frac{\log R}{T} = \frac{\log 1.57}{13.61} = 0.033$. The total camel population t-years later (N_t), is shown by: $N_t = N_0 \times e^{0.033 \times t}$. Here $\lambda = e^q$, where λ is the annual rate of increase of a herd. $\lambda = e^{0.033} = 1.034$, the general formula is $N_t = N_0 \times \lambda^t = N_0 \times 1.034^t$.

The camel herds increase at a rate of 3.4% per year with the result that the number of years in one generation conforms to the time-span of a Rendille age-set. Rendille males increase at a rate of 1.7–2.6% per year. The population growth per year for the Rendille males is slightly lower than that of the camels.

4) Milking and Milk Production

Milking of livestock occurs at least twice daily, early in the morning before the livestock are taken out to pasture, and in the evening after they have been brought back. While producing the colostrum during the weeks after delivery, a mother camel is milked 4–5 times daily. The Rendille classify the colostrum into *habio* and *danbar*. *Habio* refers to the discolored and sticky milk at the top of the colostrum, which is available for two days, and *danbar* refers to the colostrum which follows *habio* and continues for a week. In the case of settlement-based herding in the better rainy season, smallstock herds are returned close to their enclosures once at noon, and the only sheep alone are milked while resting. No animals are ever milked in the pastures, except near an enclosure.

To stimulate the flow of milk the Rendille first gently squeeze and pull a camel's teats and/or encourage the newborn calf to suckle. When a newborn calf dies the Rendille resort to various devices to persuade the mother camel to give milk. They flay the hide from the dead infant's back, rub some of the urine of the mother on it and then have her smell it. In addition they encourage the adoption of another camel's infant and tie it with a rope to the foster mother's neck. Moreover, they stuff her anus with thorns or augers, then slip a cord around her anus and tighten it. Finally, when the foster mother is suffering greatly, she will allow the foster calf to suckle and continue the flow of milk.

The milking of camels is strictly men's work. Camels with suckling infants must be milked by either warriors or uncircumcised boys. Only uncircumcised boys can milk the colostrum of camels. However, there is no particular age-grade related rule for milking camels whose infants have died, and even elders might milk them. Only warriors and uncircumcised boys are permitted to drink the colostrum. Moreover, warriors must not drink it where they can be observed by women. The rules governing the camel's milk are socially formulated for warriors and elders, and if they break them, not only are these men prohibited from sleeping with women but also they are regarded as having injured the camels.

According to a sample of 66 evening milkings, each milking camel gives an average of 668 ml of milk. Since in fact milking occurs twice daily, each milking camel is considered to give an average of 1336 ml per day. One milking smallstock gives 147 ml of milk daily, and each milk-cow an average of 671 ml of milk daily. Camels can supply the Rendille with twice as much milk per milking as cows, and nine times as much as the smallstock (Table 11). The milk yield fluctuates enormously by season, lactation phase, age of the camel and quality of pasturage. Milk yields were intensively measured during the dry season. Since during the good rainy season the livestock may produce 4–8 times as much as during the dry season,

Table 11. Milk yield

livestock	season		sample no. of head	quantity (ml/head)	(ml/head/day)
Camel	Oct. 7-14	'75	13	689.0	
	Feb. 1 & Mar. 5	'76	2	587.2	
	May. 13-31	'76	23	713.1	
	Jun. 1-16	'76	17	580.0	
	Jul. 8-23	'76	11	7.4.6	
	(average)		66	668.0	1336.0
Cattle	Oct. 19	'75	2	335.5	771.0
Goat	Feb. 1	'76	1	73.6	147.2

the amounts produced during the rainy season would be much higher than those given above. The Rendille say that even during the rainy season smallstock can produce large amounts of milk only during the first week after delivery, but that camels continue to give milk at maximal amounts for an entire month. The total period for which the livestock usually produce milk after delivery is 20 months for camels, 3-4 months for small stock, and 10 months for cows. Thus the camels provide the longest, greatest and most reliable source of milk for the Rendille among the livestock.

Unless a camel becomes pregnant again her milk continues to flow for 20 months, but at the end of the first year it decreases by half. It is said that lactation stops on the sixth month after mothers who have delivered premature calves miss them, and that it stops on the fourth or the fifth month after they have conceived. There is a competitive relationship for the milk between humans and suckling calves, since to the extent that humans take more milk than they need, less is available for the infant camels, and *vice versa*. Weaning calves at eight months of age is one way for the Rendille to resolve this dilemma. If milk is drawn from mother camels over a longer period for both humans and infant camels, this competition may be resolved into a mutually satisfactory relationship, but the period of lactation is constantly under pressure from the possibility of the next pregnancy: prolonged milking and nursing delay the next pregnancy and consequently bring about a decline in herd growth.

Camels with nursing infants are generally called *aiti-iliban* and those which have lost their infants are called *aiti-yoode*. Camels whose calves have come into their fourth month and are still suckling are called *aiti-hauet*. Camels which have conceived are called *aiti-rime*. The milk given by these mother camels is also classified by terms corresponding to each category, but slightly different in content. An *aiti-iliban* can produce more milk than other camels. Despite slight differences in the milk supply according to the lactation phase of an animal, the Rendille roughly recognize that the milk supply of any camel declines by half after one year.

Milking camels may be divided into two distinct groups according to the lactation phase, survival or mortality of infants and the amount of milk yield. Here,

for convenience' sake, for the first year after delivery a camel will be regarded as a "fresh-milk camel", whereas a camel which is producing only half the previous amount at the end of one year is regarded as an "old-milk camel". Fresh-milk camels include *aiti-iliban*, *aiti-yoode*, most *aiti-hauet* and a few *aiti-rimei*. Old-milk camels include a few *aiti-hauet* and most *aiti-rimei*.

In the course of herding, groups of mothers and their infants are led to nearby waterholes, whereas other groups such as juvenile, adolescent, or adult camels are taken to those further away, for better water. The herders in charge of mother-infant groups can obtain fresh milk from these new mothers, but other herders must depend on old-milk camels. Except for these periods, all herders usually obtain milk exclusively from fresh-milk camels.

Assuming that the number of fresh-milk camels is equal to the number of infant camels, 5.6 fresh-milk camels are included in an average herd. The amount of milk which may be obtained daily from such an average herd is the daily milk yield per head multiplied by the total number of fresh-milk camels per herd, or about 7482 ml (5237 Cal.¹⁶).

To persuade smallstock to give milk, the Rendille encourage suckling infants to push from below against their mothers' teats and to gently squeeze and pull on the teats. Only females and uncircumcised boys, are permitted to milk smallstock, and so it is usually the females who perform the task. In an average herd there are 18.1 infant smallstock, and using the same calculation as above, the daily milk yield is estimated at 2661 ml (2342 Cal.¹⁷) per herd.

5) Day's Herding

Every day, after they have finished the early morning milking, the herders leave either to tend their livestock at that day's pasture or for a waterhole. In the evening, the herds are returned to their enclosures and milked again. If the pasture or the waterhole is too far for a one-day round-trip, the enclosure is moved to a more convenient location nearby. As the result, the herders leave their settlement with the livestock and build livestock camps near good pastures or waterholes. They may be built far from the home settlements as the dry seasons become intense. Thus, the day's herding activity may be divided between settlement-based herding and camp-based herding according to the place to which the herds return after feeding or watering. Both the camps and the settlements are regarded as cooperative groups sharing enclosures in which the several herds are concentrated in one place. Such groups may be defined as those groups which share these places of enclosures, and thus may be referred to as the "cooperative herding group". The members of the

16) Camel milk has 70 Cal./100g. [Kon 1972].

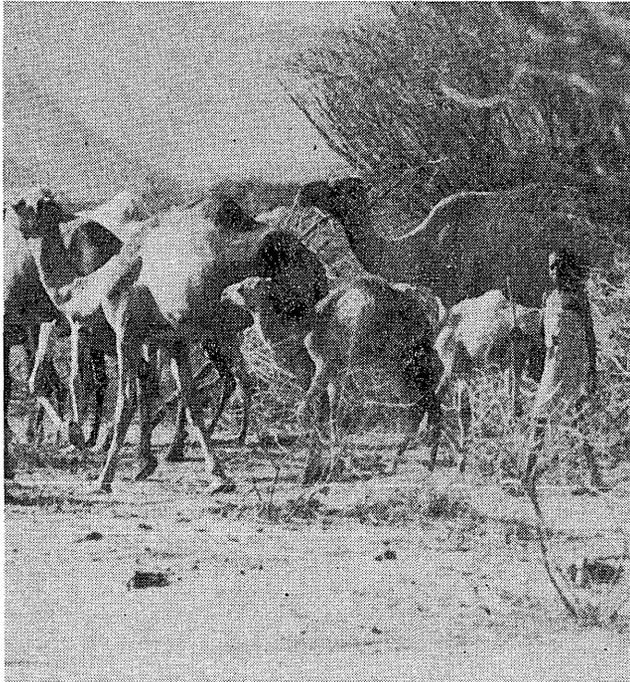
17) Goat milk has 71 Cal./100 g., and that of sheep, 105 Cal./100 g. [Kon 1972]. The proportion of goats and sheep within a herd was roughly equal (Table 10) so that by multiplying the above figures for caloric value by the amount of milk yield and by adding the two figures, the caloric value for the entire herd can be determined.

same cooperative herding group are, in principal, most apt at collaborating among themselves for feeding, watering and defense.

(1) DAILY HERDING OF CAMELS

When the sun has risen enough to light and warm the land, the adolescent-adult groups of camels are first led from their enclosure to the day's pasture or waterhole. Then, the juvenile groups are taken to a pasture somewhat nearer the enclosure. When night falls the camels are led back in reverse order. By the time the last groups are led back, it is already completely dark. Suckling infants together with their mothers, as well as those camels in the last month of pregnancy, are allowed to feed near the enclosure.

When the herder takes his camels from the enclosure, they are driven in the direction of the day's pasture. The herder must ensure that the camels do not intermingle with other herds. He accompanies his camels at their flanks or rear until they reach the feeding ground, occasionally tapping a herding stick on their abdomen or neck to keep them in close formation. This is particularly necessary in the bush-thicket where the trees would otherwise prevent the camels from going ahead and would disrupt their formation. When they reach the feeding ground, the herder turns the stud camel around to feed in the center of the herd. At this time the remaining camels form themselves into three types of aggregates of 5-15 head and then in turn begin to feed. The first type is composed of a stud camel and several



Photograph 3. Young boys taking the mother-infant group of camels from an enclosure

females who follow him; the second is composed mainly of adult-adolescent females and a few males; and the third is composed exclusively of adult-adolescent males. The second type is the largest in size. When the camels are not too dispersed, the herder may rest comfortably in the shade of trees, paying only intermittent attention to make sure that the animals do not wander too far and that they are feeding properly.

During the hottest period of the day, from about 12:30 p.m. until about 3:30 p.m., the camels hardly feed, unless urged to do so by the herder. During this period the camels lie in the shade of trees and ruminate continually. When the heat lessens somewhat the camels resume feeding, continuing until about 5:00 p.m., when the herder makes preparations to return them to their enclosure. A day's intensive feeding activity lasts for approximately four hours, and occurs in two peaks, one of which is observed for about 2.5 hours in the morning and the other about 1.5 hours in the afternoon.

When it is time to return, the herder again gathers the camels around the stud camel and drives them toward the enclosure. As they move toward the enclosure, the herder gradually urges them into close formation. During this time, the herder pays little attention to those stray camels which have joined his own herd or to the few which have been lost, since stray camels are all returned to their proper owners when all the herds of the same cooperative herding group have been gathered together for driving home. If stray camels are not returned at such times, a herder will entrust a member of the same cooperative herding group to take his herd safely back to the enclosure while he himself goes in search of stray camels. He then makes a circuit of the area where his camels fed that day as well those nearby used by other cooperative herding groups. If he has fails to find his strays that day, he continues the search for a few days, sometimes accompanied by friends, until finds the lost camels.

In Rendille land the sun sets at about 7:00 p.m. and night always falls while the herds are still being returned to their enclosures. The exact location of the enclosure to which the herds must be returned has to be ascertained while it is still light. The herder employs the special bleating call characteristic of stud camels as well as the sound of the wooden bell suspended from their necks to keep the camels closely bunched as the night march proceeds. If the camels have not been penned by about 9:00p.m., the people in the camps or settlements make bonfires to help both the herder and his camels find their way back.

Thus the daily herding techniques consist of driving the herd to the destination (pasture, waterhole and enclosure), of the keeping the camels closely bunched together while on route, and of the use of stud camels as the center of the feeding camels. The stud camel plays an important role in keeping the camels together, but this is not to say that all camels automatically follow him. In one case involving the herd A-2 in Table 9, the uncircumcised boy who was customarily in charge of the adult-adolescent group of herd A-2 entrusted his herd to another boy who was a member of the same cooperative herding group, while he went in search of two stray

camels that had become lost on the way back to the enclosure. While the boy so entrusted was trying to get both herds into the enclosure, most camels from his friend's herd strayed. In this instance, only one stud camel and one female from herd A-2 returned safely to the enclosure. A second example involves the herd F-2 in Table 9. Here the herder also entrusted his herd to a friend and had him return it to the enclosure. But only 11 head of herd F-2 actually returned to the enclosure, apart from the two stud camels. These examples suggest that the stud camel alone is not sufficient to keep camels grouped together and that the herder must also keep a close watch on them.

In the pasture there are many feeding and resting groups of from 5-15 camels, among which are many females. This may reflect spatially the relationship between the individuals within a herd, and moreover calls to mind the problem of herd formation itself.

There are few apparent major differences in the techniques used for daily herding between camp-based and settlement-based herdings, but there is a great difference in terms of the composition of the herders and the time required for the day's work.

There are three occasions which call for settlement-based herding. The first occurs when the settlements and the herds are moved to assemble in an area where fresh pasturages are sprouting after rainfall. The second occurs at the peak of the dry season when all camels cannot be provided with sufficient pasturages if they remain in the settlements. At this time, while the several pack camels necessary to transport huts, water containers and other materials, and the several milk camels together with their nursing infants (*gaalimoolo*) to supply the remaining inhabitants with milk are left behind in the settlements, the remainder of the herd is moved out to a camp which is set up in a locality with better pasturage. The third occasion occurs when the camels are returned from the camps to the settlements, even if it is during the dry season, for 4-5 days, when religious ceremonies are held.

In settlement-based herding the available pasturages are nearby and watering is not necessary during the rainy season, so the daily work is less arduous. But at the height of the dry season, when there is not enough pasturage in the areas neighboring the settlements for all the animals, the camels of a herd must be split up between those which are taken to the new camp and those which are left behind. Since it is the healthiest unmarried men who lead the camels to camp at such times, the camels left behind must be herded daily by members of the age-grades "daughters" and "boys". But when eventually there is not even enough pasturage for those camels remaining behind, and the available pastures are increasingly further removed, these camels, too, are moved into the camp. Thus the period from the time when a herd must be separated between settlement and camp until the time when the camels remaining in the settlement must also be moved to the camp indicates the limits between which settlement-based herding is possible.

The average number of camels left behind in the settlement is approximately 8-11% (3.8-5.3 head) of the total herd (where the average number of camels is 49.1)

Table 12. Number of camels separated from main herd

Herd	21. Sep. '75		17. Oct. '75		4. Feb. '76			23. Feb. '76			Residents (persons)
	Adult	Inf	Adult	Inf	AdF	AdM	Inf	AdF	AdM	Inf	
A-2	7	1	5	—	4	3	—	4	2	—	12
F	5	2	3	—	4	3	—	2	3	—	14
I-I*	5	2	5	2	————*			1	1	—	10
I-J	—	—	—	—	————*			2	1	—	7
K-K*	9	1	7	1	————*			4	2	—	19
U-2	1	1	1	1	1	—	—	—	1	—	8
M	5	1	4	—	3	2	2	3	2	—	8
O	3	—	3	—	2	—	1	2	—	—	12
L-2	2	1	2	1	2	—	1	2	—	1	3
U-1	2	1	2	1	————*			1	1	—	6
L-1	1	—	—	—	5	1	3	4	1	—	6
L*-1	—	—	—	—	3	2	2	2	2	—	9
H-M)	8	5	3	2	5	2	—	7	3	4	3
H					3	1	2	3	—	1	15
P-T	6	1	4	—	2	2	—	3	2	—	8
Q-R-S	6	2	6	2	3	4	—	3	2	—	7
P-S	7	3	5	1	—	1	—	2	3	—	9
Total 17	67	21	54	11	37	21	11	45	26	6	156
Total	88		65		69			77			
Average per herd	5.2		3.8		5.3			4.5			9.2

AdF: Adult female, AdM: Adult male, Inf.: Infant, ———*: main herd

and 46–50% (2.6–2.8 head) out of the total number of milk camels (5.6 head) within an average herd, respectively (Table 12). The camels of each herd left in the same settlement are collectively cared for in 2–3 groups. According to the daily herding activity record from September 23 to October 3, 1975 (11 days), daughters comprised 51% of the total person-day herding work force, young girls, 21%, uncircumcised boys, 26%, and warriors, 2%. (Table 13). Among the Rendille, management control and herding control of camels is, in principle, entrusted to males. But in the case of settlement-based herding, where a single herd is separated between two diffe-

Table 13. Herders of the camels remaining in settlement

Herders	Male Warriors	Boys-II	Boys-I	Female Daughters	Girls	Total
Herder	1	—	3	7	2	13
Frequency	1	—	15	29	12	57
[days]	(1.8)	—	(26.3)	(50.9)	(21.1)	(100%)

Boys-II: boys over 15 years of age, Boys-I: boys between 7 and 14 years of age.
Period: 23. Sep.-3. Oct. '75 (11 days)

rent locations and manpower is insufficient to care for both groups at the same time, or when the exhausted herders returned their camels to the settlement for a religious ceremony and must take a temporary rest to relieve the fatigue brought on by long-term herding in camp, the unmarried daughters or girls take the camels out for their daily herding. Only at such times do they herd camels instead of the males.

During the dry season, camp-based herding is carried out under conditions such that the feeding ground is relatively near but the waterhole is distant, whereas the situation is the reverse in the case of settlement-based herding. Thus the following contrasting conditions are evident: the herd averages a 14.5 km round-trip each day between the enclosure and either feeding ground or waterhole in the case of camp-based herding, and a 26.7 km round-trip each day in the case of settlement-based herding. The latter involves almost twice the total distance of the former (Table 14). The camels of a herd move at an average speed of 3.52 km/hr, so camp-based herding requires an average of 4.1 hours for the round-trip between the enclosure and either feeding ground or waterhole. Settlement-based herding requires 7.6 hours. The total time required for the round-trip is 11.5 hours (from 8:30 a.m. to about 8:00 p.m.) in the case of camp-based herding and about 13.0 hours (from 7:30 a.m. to about 8:30 p.m.) in settlement-based herding. The time spent at the feeding ground is therefore about 7.4 hours in camp-based herding and about 5.4 hours in settlement-based herding. Compared with Williamson and Payne's recommendation [1965] that camels should be allowed to forage for at least 6 hours per day, settlement-based herding at the height of the dry season is carried out under the most marginal conditions, and can allow camels to forage for only 5.4 hours per day. That is to say, in the marginal condition the distance between the enclosure and the feeding ground is maximally 13.5 km and it is impossible to allot 5.4 hours to foraging unless the time spent in daily herding is extended to 13.0 hours. Moreover, the herder must

Table 14. Comparison between camp-based herding and settlement-based herding by distances moved daily

Type of herding	Destination from an enclosure			total	No. of days observed	Distance per day	No. of herds
	waterhole	pasture	new enclosure				
camp-based herding	300 km	208 km	19 km	527 km	32 days	16.47 km/day	5
	300	117	14	431	24	17.96	3
	300	195	23	518	32	16.19	5
	150	221	14	385	32	12.03	1
	300	91	27	418	28	14.93	8
	210	65	23	298	20	14.90	4
	26	494	64	584	44	13.27	18
	50	494	40	584	44	13.27	7
settlement-based herding					Average: 14.5 km/day		
	30	237	0	267	10	26.7 km/day	1*

*: based on camels separated from main herd.

Table 15. Rates of movement and staying at camel-camp site

Season	Observed no. of herds	Movement (day) (day-herd)	Staying (day) (day-herd)	Total	
Non-birth Mar. 2-Apr. 2	9	21 189	7 63	28 252	
	5	16 80	16 80	32 160	
	6	17 102	15 90	32 192	
	3	15 45	5 15	20 60	
	3	15 45	9 27	24 72	
	total.	26	461	275	736
	average per herd [days] (%)		17.7 (62.6)	10.6 (37.4)	28.5 (100)
Birth May. 4-June. 17	22	7 154	38 836	45 990	
	average per herd [days]		7	38	45
	(%)		(15.6)	(84.4)	(100)

continually press his camels to feed, so that both the animals and the herders have little opportunity for taking a rest.

Even in the case of camp-based herding the marginal situation can occur during the delivery season. If the total number of days when the enclosure is stationed in one place is compared with the total number of days when it is moved, it can be seen that during the dry season, when camels are not giving birth, the enclosure is moved for approximately three days and kept fixed for about two out of an average five-day period; and during the rainy season, when the camels are giving birth, the enclosure is moved only one day and kept fixed for four days out of an average five-day period (Table 15, Figure 3). Camels become pregnant after the rains, so that in general calves are born during the rainy season of the following year. Since camels do not need to be watered during the rainy season, they are not taken to the waterholes. Moreover, the newborn calves which still have difficulty in walking¹⁸⁾ and the females that are just about to give birth may still be kept with the herd. Thus it is difficult to move the enclosure frequently. During this period, the longer the enclosure is stationed in one place, the more the pasturages near the enclosure are exhausted. Therefore those adolescent-adult camels which have been led to feeding grounds very far away cannot be brought back to the camp enclosure within

18) When the newborn calves which still cannot walk any real distance must be transported, they are put in a basket made from the branches of *Acacia reficiens misera* and the bark of either *A. tortilis* or *A. nubica*, and carried on the backs of their mothers.

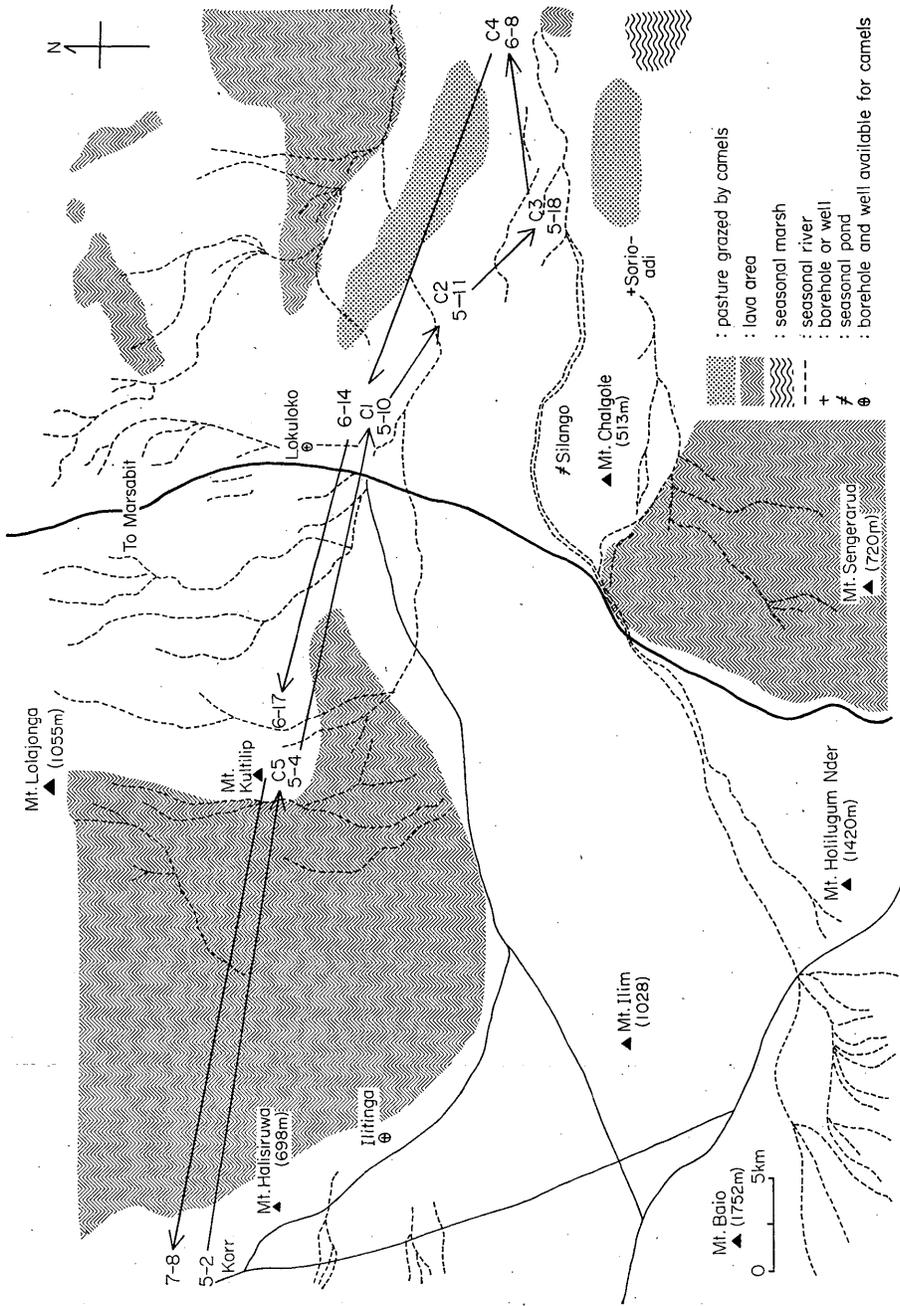


Figure 3. Nomadic route of camels (2nd May to 17th Jun., '76)
(C-1~C-4 refers to camp sites.)

the day. When this happens, there is nothing to do but to make a temporary enclosure which will serve for that one night. The camels are then taken back to camp on the following day.

Work done in the camel camp is divided into five patterns, which are essentially the same as those in the settlement:

- (Ha) : Herding the adolescent-adult group of camels.
- (Hj) : Herding the juvenile group of camels.
- (S) : Scouting for better pasture and searching for the stray camels.
- (R) : Helping camels give birth, guarding the camps, drawing water¹⁹⁾ and doing other trivial jobs while resting in camp sites.
- (Ab) : Collecting information or merely visiting other camp sites (at which times an individual is absent from his own camp site).

During the 28 days from 12 May–13 June, 1976, camp members who performed those tasks were recorded by age-grade and age-set (Table 16). The left side of Table 16 shows the age-grades and the age-sets according to seniority. The age-sets, *elibalis*, *libale* and *iribandiff*, comprise the elderhood age-grade, and *defgudo* is the age-set comprising the warriorhood age-grade. Boys-II includes all of the uncircumcised boys over 15 years of age and Boys-I includes the boys in 7–14 years of age. The number of days when an individual performed one of those five tasks are shown, with 100 representing 28 days. The numerical values calculated in this way are summed by each age-category into the upper rows. The figures in the upper rows are divided by the numbers of members comprising each age-category, with the results indicated in the lower rows.

During the 28 days for which data were recorded, a total of 76 males stayed at or visited the camp. Of this total, 19 belonged to the elderhood and did not stay long. Even had they stayed, they would not have performed such tasks as herding the camels, and would only have rendered trivial, supplementary assistance at the time of a camel's delivery. In effect all they did was to lie around and make idle conversation. Of those who stayed at the camp, 19 belonged to the warriorhood and made up 64.7% in terms of sheer presence; but rather than herding the camels, they performed such tasks as scouting for the better pasture, looking for stray camels, or guarding the camp. Visiting other camps frequently occurs among the warriors. Herding the camels was entrusted entirely to the boys, who performed almost 100% of the total herding activity; Boys-II took charge of the adolescent-adult group of camels, and Boys-I took charge of the juvenile group. The actual herding is entrusted entirely to unmarried males over 7 years of age. There are other noteworthy divisions of labor throughout the age-system.

(2) DAILY HERDING OF SMALLSTOCK

The smallstock begin to feed soon after the sun has risen. First, at about 7:00 a.m., the adolescent-adult animals and then the juveniles, in their respective separate

19) It is unusual for them to go for water when they are in the herding camps, but when they do go, they make use of nearby standing pools and thus the job is easy.

Table 16. Pattern of work by age-set in camel camp

age-set	No. of component	Pattern of work			total	Re	Degree of presence total	Degree of absence (Ab)
		Hi	Ha	S				
<i>elibalis</i>	8	10.7 1.3	—	—	410.6 51.3	421.3 52.7	378.7 47.3	
<i>libale</i>	5	—	—	—	135.6 27.1	135.6 27.1	364.4 72.9	
<i>iribandiff</i>	6	—	—	—	146.4 24.4	146.4 24.4	453.6 75.6	
(total of elders)	(19)				1.3 (0.7%)			
<i>defgudo</i>	19	3.6 0.2	85.8 4.5	46.5 2.4	1092.9 57.5	1228.8 64.7	671.4 35.3	
					7.1 (3.7%)			
boy-II	17	139.4 8.2	1400.1 82.4	7.1 0.4	82.0 4.8	1628.6 95.8	71.5 4.2	
boy-I	21	921.5 43.9	974.9 46.4	—	192.7 9.2	2039.1 99.5	3.6 0.2	
(total of boy)	(38)				181.1 (95.5%)			
Total	76	1075.2 53.6	2460.8 133.3	53.6 2.8	2060.2 174.3	5649.8 364.2	1943.2 235.5	
(%)		(19.0)	(43.6)	(0.9)	(36.5)	(100)		

Hj: herding work for juvenile group

Boy-II: boys over 15 years of age.

Ha: herding work for adult-adolescent group

Boy-I: boys between 7 and 14 years of age

S: scouting for better pasture and searching for lost camels

Re: resting and doing other trivial jobs

groups, are led out of the enclosures to the feeding ground. They are returned at sunset, about 6:30 p.m. Infants are kept penned until the ground becomes warm, at about 8:30 a.m., and then they are led to feed in the areas immediately surrounding the enclosure.

When the herder leads his smallstock out of their enclosure, he presses them to go ahead by whistling or tapping them with a herding stick. Accompanying them as they move, he gradually drives them in the direction of the day's feeding ground by tapping the lead animals on the right or left flank. If the animals move in the wrong direction the herder throws a stone in front of them or at their flanks to bring them back. Camels rarely feed on route to the feeding ground, where they then break up the close formation and spread out to feed. But smallstock are different in that they feed on route to the feeding ground, and maintain close formation while feeding in the pastures. It is perhaps better, therefore, to refer to their activity as foraging, rather than feeding.

As the sun gradually becomes fierce, from about 10:30–11:00 a.m., foraging activity declines and sheep more so than goats tend to cease feeding and enter the shade of trees to rest and ruminate. At this time the herder must break up such

aggregations of sheep by tapping them with his herding stick or throwing stones at them, and press them to feed.

During the hottest part of the day from about 12:30–15:30, hardly any feeding occurs. During this period, the herder collects the smallstock into the shade of trees and rests with them there. At about 3:30 p.m., when the sun has weakened somewhat, the herder again presses the animals to forage, and then gradually begins to drive them in the direction of the enclosure.

In foraging, the goats go to the head and flanks of the group formation and then spread out more widely, whereas the sheep stay bunched together and tend to seek the shade to escape the fierce sunlight. Therefore the herder must regulate both the dispersion of foraging smallstock and the speed of foraging movement.

The daily herding techniques for smallstock thus consist of driving the animals to the destination, of regulating both the dispersion and foraging speed of the herd, and of pressing them to forage.

Unlike camels, smallstock are herded from sunrise to sunset everyday, and where pasturages are available near the enclosure during the rainy season, they are brought back near the enclosure once at noon.

There is little difference between camp-based and settlement-based herdings in that in both cases the warriors are responsible for building the enclosures for their smallstock, scouting for the better pasture and guarding the animals. They also commonly supervise herding control whereas the unmarried females and the boys mainly do the actual herding. In settlement-based herding married women sometimes herd the infants and juveniles, but this does not go beyond the level of supplementary assistance.

4. DISPERSION AND AGGREGATION OF SOCIAL GROUPS

1) The Subsistence Unit

In Rendille society men own the livestock, and when a man dies, his eldest son inherits his father's livestock. If there is no agnatic descendant, all the livestock are passed on to his eldest brother. Thus females are always excluded from the inheritance of animals. According to the Rendille, men cannot escape the control of their fathers and cannot legitimately own livestock until they marry and their fathers pass away. The per capita average of livestock among the Rendille is 9.4 head of smallstock and 3.0 head of camels. An average hut contains 4.86 persons. For the socio-ecological reasons that an owner must compensate for the shortage of manpower and must maintain his herds at an effective breeding size, all livestock are penned in a communal enclosure and managed cooperatively among the legal owners of livestock. Since those men who engage in this cooperative effort arrange their huts near the enclosure, for convenience of management, the cooperative management group is projected spatially as a residential aggregation within the settlement.

The settlements of the *Tupcha* clan, the main subject of the present investigation, include 45 herds of smallstock and 26 herds of camels, but one of each type of herd

is excluded from consideration here because of incomplete demographic data. Of the men engaging in the cooperative management of smallstock, the managers of 39 herds (89%) were related to each other through agnatic ties, those of 4 herds (9%) were members of the same sub-clan, and those of 1 herds (2%) were related to each other through affinal ties. It can be concluded, therefore, that agnatic ties overwhelmingly provide the basis for cooperative management of smallstock. Among these, 21 herds (48%) were held by elders and their unmarried sons together. Another 8 herds (18%) were held by full-brothers working together, the fathers of whom had died.

Of the men engaging in cooperative management of camels, the managers of 12 herds (48%) were members of the same sub-clan, those of 11 herds (44%) were related to each other through agnatic ties and those of 2 herds (8%) were related through affinal ties. When the relationships among the cooperative managers of camels are compared with those of smallstock, it is evident that while agnatic ties in the cooperative management of smallstock are more predominant than for camels, sub-clanship is more important in the cooperative management of camels than for that of smallstock. In any case, affinal ties play only a minor role in the cooperative management of both types of livestock (Table 17).

The members of a group engaging in the cooperative management of camels build their huts in adjacent areas and form themselves into a single homestead.

Table 17. Relationships of the cooperative management groups

Relationships	Herds Smallstock	Camels
a) close agnatic relationships;		
independent elder	21 (47.7%)	2 (8.0%)
independent warrior	3 (6.8)	—
full-brother	8 (18.3)	5 (20.0)
half-brother	2 (4.5)	—
paternal uncle-nephew	2 (4.5)	2 (8.0)
paternal cousin	3 (6.8)	2 (8.0)
sub-total	39 (88.6)	11 (44.0)
b) agnatic relationships except for close agnates;		
same lineage group	2 (4.5)	3 (12.0)
same sub-clan	2 (4.5)	9 (36.0)
sub-total	4 (9.0)	12 (48.0)
c) affinal relationships;		
son-in-law	—	1 (4.0)
brother-in-law	1 (2.4)	1 (4.0)
sub-total	1 (2.4)	2 (8.0)
TOTAL	44 (100.0%)	25 (100.0%)

They assist each other with the task of fetching water and they frequently share food among themselves. A cooperative management group for camels includes several stable livestock-holding units in terms of customary law. They form themselves into a stable economic unit in order to be self-sufficient in the recruitment of herders and the maintenance of herds of effective breeding size, and also to manage the two types of livestock which are essentially different in their ecological characteristics. There is almost no intensive cooperation in the management of smallstock among the groups which subsist on different camel herds. For these reasons, I have distinguished the cooperative management group for camels as the subsistence unit of the Rendille. The membership on which a subsistence unit is based shows a tendency for family groups to associate with each other based on agnatic ties within the same sub-clan. Demographically, this subsistence unit is composed of between 1-7 huts, and 6-34 persons, with an average of 16.12 persons and 3.3 huts. It is also coincident with a camel herd and includes from 1-3 smallstock herds, with an average of 1.8 herds (Table 18). Since the task of livestock herding is performed by the unmarried youths over 7 years of age, they are regarded as the main support of the subsistence unit. They account for 62% (9.92 persons²⁰) of the total membership of a subsistence unit, and the remaining 38% (6.20 persons) are dependant on their subsistence activities. Thus, the effectives [LEE 1969] of a subsistence unit are 62.

Moreover, in Rendille culture, although the expressed ideal is for a single extended family to establish a subsistence unit, in practice, 2 (8%) of the 25 subsistence units conformed to that ideal.

2) The Dual-Residential System

The Rendille live in two different types of residences, the settlement (*goup*) and the herding camp (*forr*). The herding camps are distinguished according to the type of animals to be herded, the smallstock camp (*adi-forr*), the camel camp (*gaali-forr*) and the cattle camp (*loio-forr*)²¹. Occasionally cattle are combined in the same camp with smallstock, but in principle the three types of camp often move and live in distinct geographical regions.

(1) THE SETTLEMENTS

In the settlement a central circle (*nabo*) is always constructed and surrounded with a fence of thorn trees. Toward the outside of this thorn-fence, the enclosures for the livestock (*sun*) are built in the same fashion. Enclosures for smallstock are constructed adjacent to the outer thorn-fence of the camel enclosure. The huts are then arranged and built in a rough circle between the enclosures for livestock and the outer circular fence of thorn trees which guards against carnivores and

20) According to the Table 1, the number of 7-10 year olds can be calculated as a proportional distribution of those from 0-10 years of age.

21) The number of cattle per person is so low in the *Tupcha* settlements that they are kept together in one group and cared for by 2-3 men in Mt. Marsabit. This paper does not discuss the treatment of the cattle in the herding camps.

Table 18. The composition of subsistence units by age-system (October, 1976)

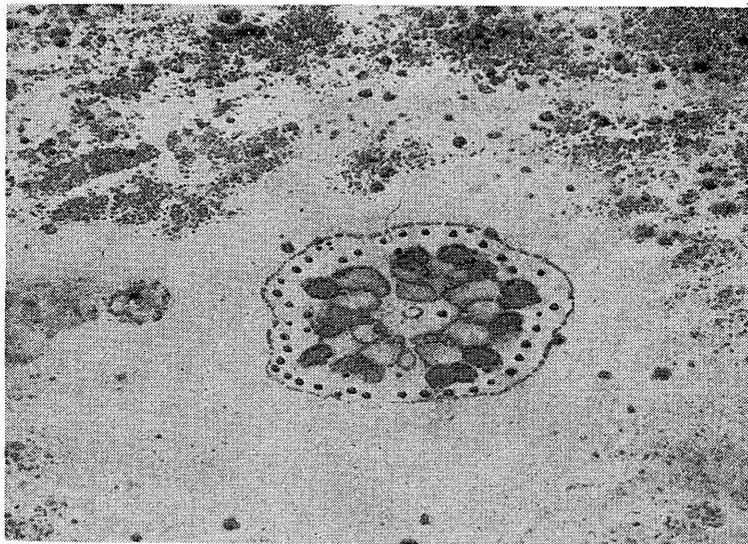
Reference of camel- herds	No. of smallstock herds	No. of huts	Males		Females			Total					
			Elders	Warriors	Boys	Women	Daughters		Girls				
A-1	2	4	(1)	2	—	7	(1)	4	1	(2)	1	15	(3)
A-2	1	3		1	1	6	(1)	3	2		4	17	(1)
A-G	2	2		2	4	5		2	4	[1]	—	17	[1]
B-C	2	3		2	3	4		4	6		6	25	
D	1	1		—	2	1		1	3		—	7	
E-F	2	3		2	3	4		2	6		1	18	
F-2	3	7		3	5	7	(1)	6	7		5	33	(1)
H-M	2	4		3	3	3	(1)	4	10		2	25	(1)
H-2	1	2		—	1	2		1	3		—	7	
I-1	1	3		—	2	2		2	3		1	10	[2]
I-2	2	3		1	2	2		2	3		—	10	(1)
K-K*	3	5		3	—	5	(1)	5	4		6	23	(1)
L-1	1	3		1	3	2		3	2		2	13	(1)
L*-1	1	3		2	1	2		3	—		3	11	(1)
L-2	1	2		—	1	3		2	—		—	6	
L-3	2	3		1	2	1		2	2		—	8	
M	2	4		2	2	9		3	1		3	20	(1)
O	1	6	(3)	3	3	3	(1)	6	4	(1)	4	23	(1)
P-T	3	4		1	3	2		4	4		1	15	(1)
Q-R-S	3	4	(1)	2	2	8	(1)	4	5	(1)	1	22	(3)
P-S	2	2		1	1	4		2	3		1	12	(1)
T	1	3		—	1	4	[1]	3	2		1	11	[1]
T-N	2	5		2	1	8		5	3		6	25	
U-1	2	2		2	1	2		2	2		—	9	
U-2	1	2		1	1	3	(1)	1	2		2	10	(1)
Total 25	44	83	(5)	37	(1)	48	(4)	99	[8]	(7)	76	392	[11](19)
#Average per subsistence unit	1.8	3.3		1.48		1.92		4.28			3.04	3.32	16.12
(%)				(9.1)		(11.9)		(26.6)			(18.9)	(20.6)	(100.0)

(): No. of people working outside of the *Tupcha's* settlements, []: No. of people moving from native place to *Tupcha's* settlements for jobs.#: People working outside the *Tupcha's* settlements are excluded.

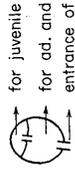
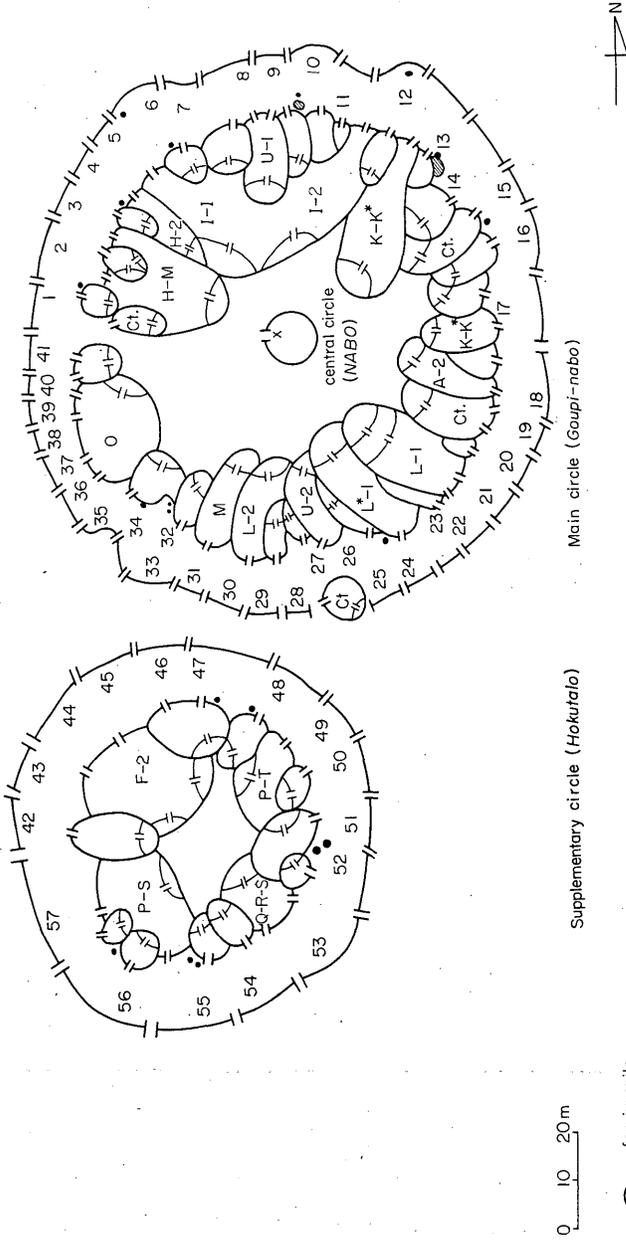
marauders. An entrance (*ali*) for each hut is made in the outer thorn-fence (*outo*) (Figure 4). Physically, the settlement consists of a cluster of portable huts, each of which is made of skins and mats draped over a hemispherical frame of curved wooden supports and held together by vegetable-fiber rope-lashings and tethering ropes [SATO 1978d]. Each married woman or widow has her own hut, and each hut is the residence of a nuclear family. Only elders (and very young boys, if accompanied by their fathers) are permitted to enter the central circle, where they meet together every evening to discuss the day's problems and events. It is in this central circle that they hold public discussions, make decisions, formally receive guests and perform their collective ceremonies.

In preparing to relocate, the main hut supports are packed upside down together with the mats and skin coverings and all the other household furnishings and accouterments on the backs of pack camels, or rarely on donkeys. Usually, 1-3 pack camels are needed to move a single hut, but since each family has only 1-2 pack camels at most, they borrow others from friends, relatives or neighbors. The huts of newcomers who have moved into the settlement are at first arranged on the outskirts of the outer fence, but when the settlement is relocated in another site and new thorn-fences are constructed, they are absorbed into the circumference of the hut formation. When there are too many huts for them all to be included in one circle, an additional circle is constructed in an adjoining area, but no central circle is provided in this group. When two groups of huts are constructed, that with a central circle is called *goupinabo*, which means a settlement with a central circle, whereas the other known as a supplementary circle (*hokutalo*).

A survey of the number of huts in 22 settlements revealed that on the average one circle consists of 22.2 huts, with a range of 9-50 huts. The average number of



Photograph 4. A Rendille settlement



for juvenile
for ad. and adol.
entrance of enclosure
No. : reference no. of hut
Letters in enclosure means reference name of camel herd
Enclosure without letter means that of goats and sheep.
Enclosure with Ct. means enclosure of cattle.

• : Stony shelter for infant goats and sheep.
◐ : Wooden shelter for infant goats and sheep.

Main circle (Goupi-nabo)

Supplementary circle (Hokutata)

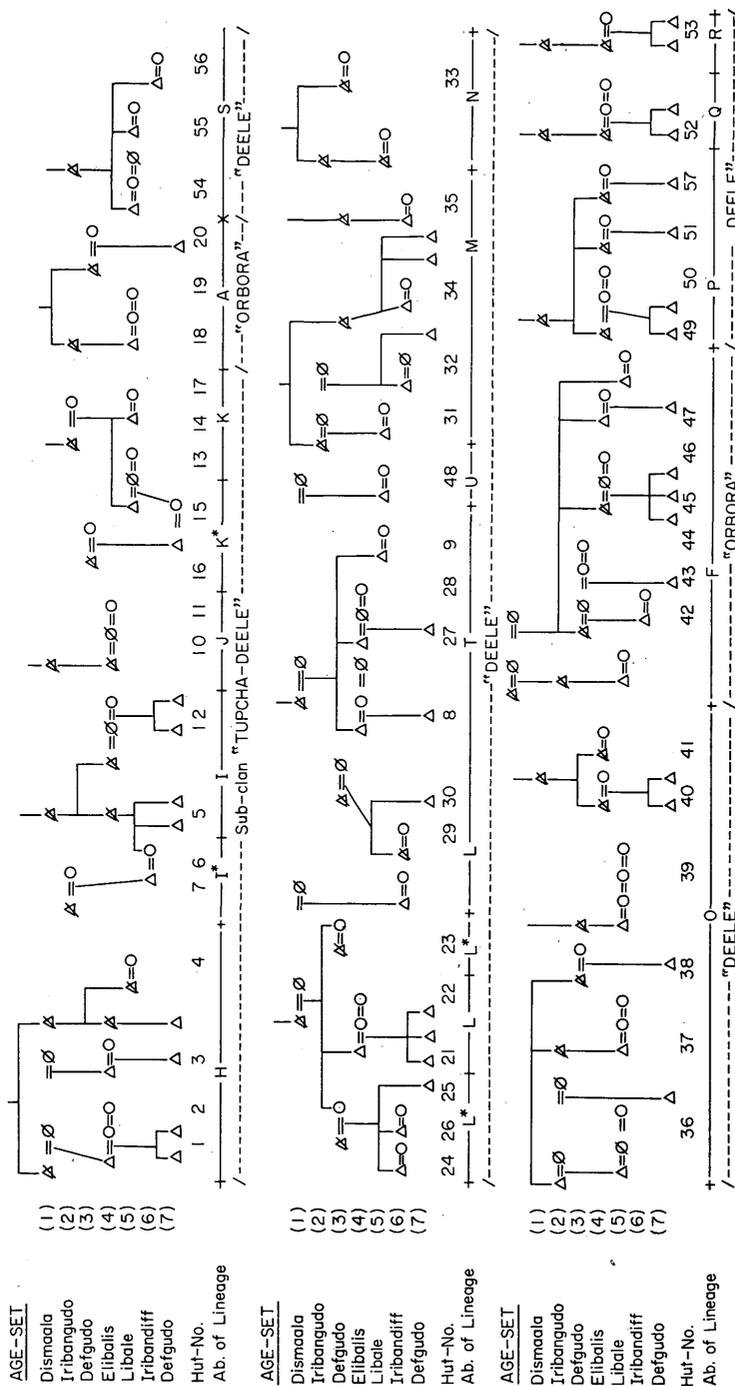


Figure 4. Plan and genealogy of a Rendille settlement (16th Dec. 1975)

huts per settlement was 25.2 huts, and the range from 9 to 65. During the period of field research, the *Tupcha* settlements were composed of 95 huts dispersed among 2–4 sites. When dispersed among 4 sites, the *Tupcha* settlements consisted of 10–61 huts, averaging 23.8 per settlement. A population census of 92 huts, when 95 existed, revealed a population of 423 persons. This indicates an average 106 persons per settlement. These results accord well with those of Grum [1976] that showed an average settlement consisting of 23 huts and 125 persons.

Among the 95 huts comprising the *Tupcha* settlements, there were 20 (21.1%) whose inhabitants belonged to other clans. These were as follows:

- 1) Men who had married daughters of the *Tupcha* clan and lived with the parents-in-law (7 lineage groups, 12 huts);
- 2) Widows who had married out of *Tupcha* clans into others and then returned to their native *Tupcha* clan alone or together with their sons' families (2 lineage groups, 4 huts);
- 3) One wife whose husband had left to engage in wage labor. She then returned to her native clan (2 lineage groups, 3 huts);
- 4) One widow living with her daughters who had married into the *Tupcha* clan (1 lineage group, 1 hut).

Seventy-nine percent of the huts making up the *Tupcha* settlements were those of persons belonging to the same patrilineal clan, whereas no one who lacked kinship relations there lived in the *Tupcha* settlements. Postmarital residential rules prescribe that a bridegroom must remain for some time after marriage in the bride's settlement and only later, with the consent of parents-in-law, can he move to his native place of residence. Within the settlement, a patrilineal extended family arranges its component huts on the circumference of the circle, with that of the family head in the center. The huts of affines are built in areas adjoining those of their closest relatives, as if wedged into a fan-shaped compound of a patrilineal extended family. Moreover, a woman becomes a member of her husband's clan after marriage.

The settlements are moved and built in a completely different geographical region from that of the herding camps, although they are not moved as frequently as the herding camps. A settlement remains in one location for an average of 2–3 months. Two types of settlement movement occur. One is seasonal; the settlement moving in the rainy season to areas where both fresh pasturages and reliable waterholes are available, and in the dry season relocating closer to permanent waterholes. Such movements require 1–2 days and cover a distance of 15–40 km. The other type of movement is non-seasonal; people relocate to perform collective ceremonies, to escape an outbreak of the ticks that swarm around livestock excrement, or to build enough enclosures to accommodate the herds which have been returned to the settlement. Such movements involve only a few hundred meters.

From August 1975 to October 1976, the *Tupcha* settlements dispersed and aggregated into 2–4 sites. In the course of these movements, 19 (20%) of the huts moved in and out, and the remaining 76 huts (80%) formed the stable components of

each settlement. For each settlement, the stable component huts can be described as follows:

- Settlement-1: comprised of 4 lineage groups including 11 huts, all of which belonged to the same sub-clan (*Orbora*);
- Settlement-2: comprised of 3 lineage groups, including 10 huts, nine of which belonged to the same sub-clan (*Orbora*) with the remaining one belonging to a different sub-clan (*Deele*) within the same clan;
- Settlement-3: comprised of 8 lineage groups, including 18 huts, of which 10 huts belonged to one sub-clan (*Orbora*), 4 to the other sub-clan (*Deele*) within the same clan and the remaining 4 huts having affinal ties with those sub-clan members;
- Settlement-4: comprised of 15 lineage groups, including 37 huts, of which 34 belonged to the same sub-clan (*Deele*) with the remaining 3 huts having affinal ties to it.

The residential group of *Tupcha* settlements consisted of a cluster of members of the same sub-clan with the addition of a few affines. The residential groups within a settlement tended to change in membership within the same clan.

(2) CAMEL HERDING CAMPS

Mother-infant groups of camels formed separately during the delivery season are broken up as the infants are weaned, and following the subdivision of the herd, the arrangement of enclosures in the camp undergoes changes (Figure 5). Physically, the camel camp consists of a double concentric circle of thorn-fences. The inner circle (*sun-ki-nioloho*, pen of infant camels) is principally for the juveniles. Adolescent and adult camels are penned in the area between the inner circle and the outer circle. An enclosure for the mother-infant group (*sun-ki-iliban*) is built for the first two months in the area where the adolescent-adult group is penned (type-1). This enclosure is constructed so that the infants can be nursed and also to prevent the mothers from injuring other camels owing to protective excitation soon after delivery. After two months, the mother-infant group is transferred to the enclosure for juveniles (i.e., the inner circle), but within this enclosure the infants are separated from their mothers and penned in a special enclosure, while the remaining mothers are penned with the juveniles (type-2). After two months in the type-2 situation, the mothers are brought back to the adolescent-adult group, while the infants are included with the juveniles. Consequently, the mother-infant group would appear to have been dissolved (type-3). The transformation process of the camel enclosure from type-1 to type-3 by the way of type-2 indicates the development of the spatial separation in order to wean a calf from the mother.

The separation of the mother-infant group from the other camels within the same herd is done not only to prevent the mothers from injuring the other camels and to secure milk for the calves, but also to prepare a stable herd for the future through the medium of mother-infant bonds. At the time of birth the herder delivers the

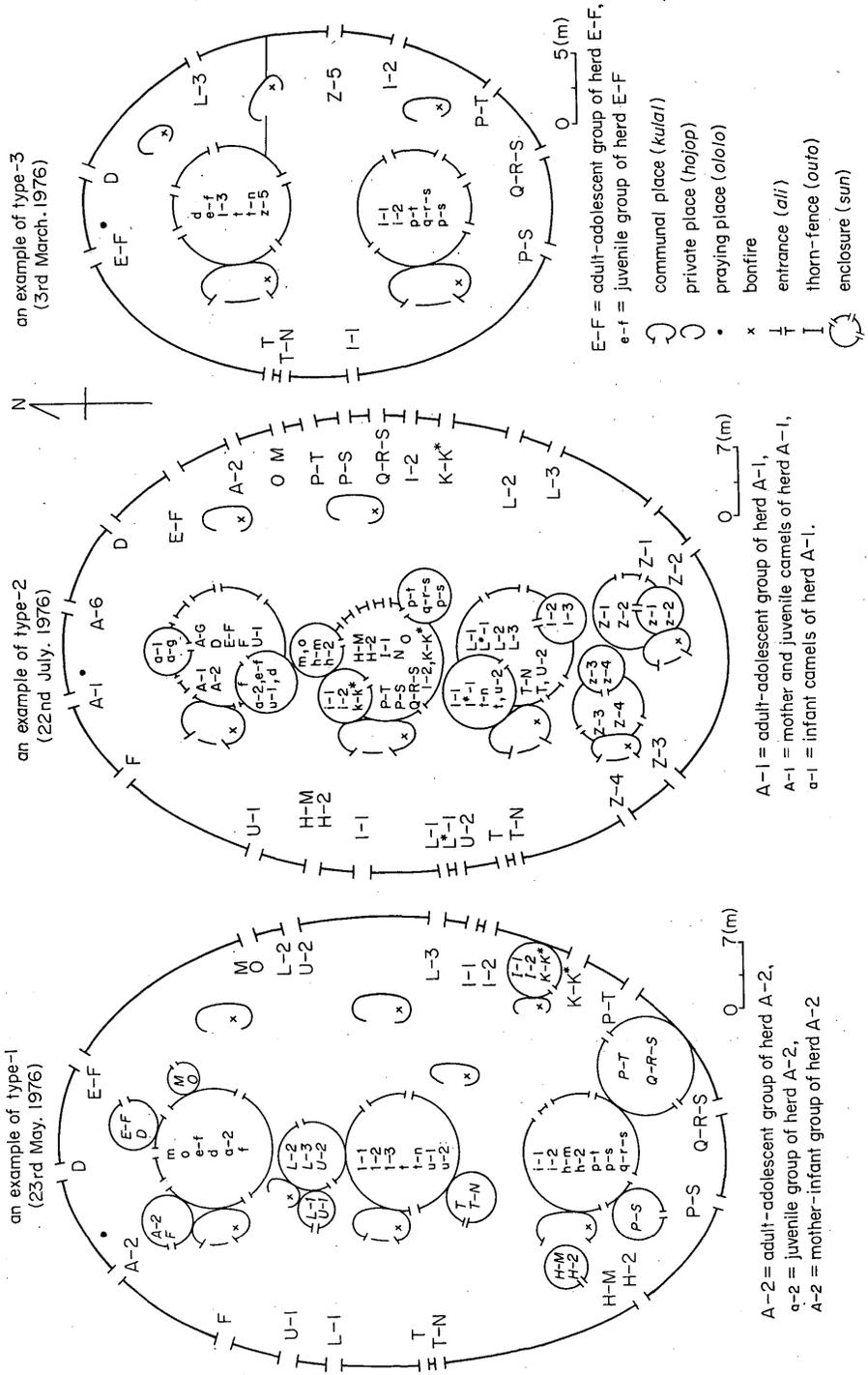


Figure 5. Transformation process of the camel camp

calf and then he observes the mother until she puts her nose close to the calf and gives low, affectionate bellow and, which indicates the affection of the mother toward the calf. If she abandons her calf or refuses to let it suckle, the herder ties the mother and calf with a rope around both their necks, or stuffs her anus with thorns or augers and then slips a cord round her anus and ties it until she allows the calf to suckle. After having secured the nursing-suckling relationship, the herder removes the calf from the night enclosure in the morning and returns it in the evening, carrying it on his back until the calf can walk properly. The mother follows. When the calf can walk properly the herder pens it with thorn trees in the area adjoining the night enclosure, so that the mothers are kept within earshot of their calves' bleats for milk, and do not abandon them.

Only unmarried males (boys and warriors) are permitted to live in the camel camps and take primary care of the camels. The administration of the camel camps is left to the warriors. Even when visiting, elders may not publicly complain about the way in which the camps are administered. The communal place (*kulal*), where the herders take their meals and talk together, is built at the western side of the inner circle fence. A private place (*hojop*) for herders is built within the area occupied by the adolescent and adult camels. The northern edge of the camp site is the place (*ololo*) where evening prayers are held. Newcomers occupy their own area where they initially pen their camels, at the southern end of the camp site.

During the period of the field study, 30 camel camps were observed just before the delivery season, at which time the number of entrances per camp ranged from 2 to 29, with an average of 9.1. The rule is that one entrance should be constructed in the livestock enclosure for each herd, but in the *Tupcha* camps there was only one entrance for each 1.24 herds. The average number of entrances in the camel camps is therefore 9.1 for 11.3 herds.

Following the subdivision of a camel herd, the number of herders considered adequate for each subdivided group is different. In practice, however, each adolescent-adult group of a herd is entrusted to either one warrior or one boy, and juvenile groups and mother-infant groups from several different herds are joined respectively in herding and entrusted to 2-3 boys. Through the cooperation within a cooperative herding group, the average number of herders required for each camel herd is reduced to only 2.55 persons for type-1, 1.82 persons for type-2 and 1.55 persons for type-3. This average tends to increase during the delivery season and to decrease at other periods (Table 19).

(3) SMALLSTOCK CAMPS

In smallstock camps, the enclosure for juvenile animals is built in the center and surrounding it is the enclosure for the adults and adolescents. Infants are accommodated in wood or stone shelters built within the area set aside for adult and adolescent animals. Private places in which the herders take their meals and sleep are constructed of thorn trees near the entrances to the enclosure for the adult and adolescent animals. These private places are segregated by sex (Figure 6).

Twenty to thirty unmarried males and females live as herders in each smallstock

Table 19. Seasonal change of population structure in the *Tupcha* camel camp

Type of camp formation	No. of herds	Males Elders	Warriors	Boys-2	Boys-1	Total	Composition per herd	Date
Type-1	22	8 (14)	12 (21)	16 (29)	20 (36)	56 (100%)	2.55	30. May '76
Type-2	28	—	13 (26)	21 (41)	17 (33)	51 (100%)	1.82	22. Jul '76
Type-3	24	—	9	13	11	33		31. Mar '76
	21	—	6	16	13	35		5. Oct '75
[total]	45	—	15 (22)	29 (43)	24 (35)	68 (100%)	1.50	
TOTAL	95	8 (5)	40 (23)	66 (38)	61 (35)	175 (100%)		

Boy-1: uncircumcised boys more than 15 years old

Boy-2: uncircumcised boys between 7 and 15 years of age

camp, which, like the camel camp, is run by the warriors. Usually, one smallstock camp is composed of 5–10 herds. Because smallstock are more easily plundered than camels, they must be guarded closely by the warriors. Since smallstock do not give birth during a fixed season, they are divided normally into three groups, infant, juvenile, and adult-adolescent. Moreover, because many animals are included in each group, unlike camels, it is difficult to put juveniles from different herds together in one group for collective herding. For these reasons, the number of herders required for each smallstock herd is necessarily greater than for the camels, and averages 3.2 persons per herd (Table 20).

3) Seasonal Dispersion within a Subsistence Unit

A subsistence unit may be considered self-sufficient in terms of subsistence activity, but typically it is divided into at least two residential units, a settlement and

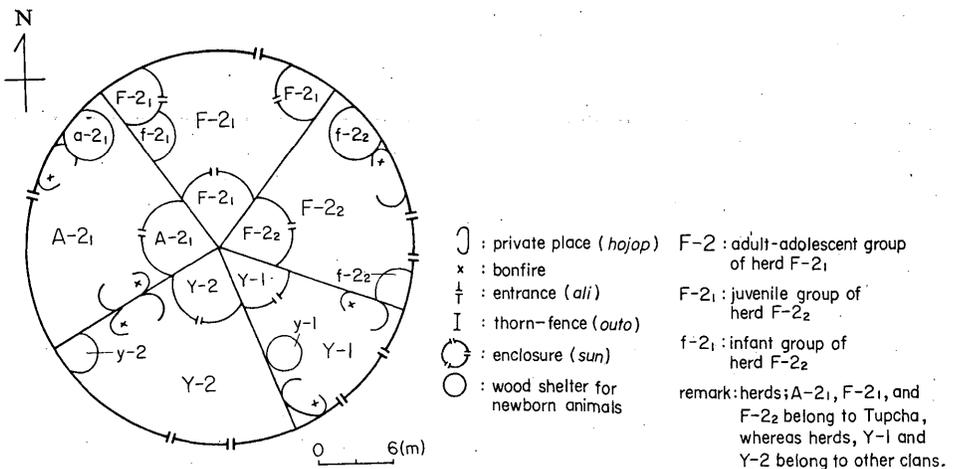
**Figure 6.** Plan of smallstock camp (8th, May 1976)

Table 20. Population structure of a smallstock camp

	Males Elders	Warriors	Boys	Females Women	Daughters	Girls	Total	No. of herds	Date
	—	6	8	—	10	5	29	10	16. Oct. '75
	1	5	1	—	6	6	19	5	8. May '76
Total	1	11	9	—	16	11	48	15	
Average per herd	0.07 (2.1)	0.73 (22.9)	0.6 (18.8)	—	1.07 (33.3)	0.73 (22.9)	3.2 (100%)		

at least one herding camp, in response to socio-ecological conditions. According to the 15-month record from August 1975 to October 1976, changes in the composition of inhabitants are classified into six different phases in terms of the herding patterns and the types of camel camps existing at particular times (Table 21²²).

Phase I: All livestock were herded through settlement-based herding (December 1975, one month);

Phase II: Only camels were herded through settlement-based herding, while

Table 21. Seasonal changes of the membership of a subsistence unit

Phase	Duration (month)	Residential place	Males			Females			Total
			Elders	Warriors	Boys	Women	Daughters	Girls	
I	1	set.	1.48	1.92	4.28	3.04	3.32	2.08	16.12
		A-cam.	—	—	—	—	—	—	—
		C-ca. (t-3)	—	—	—	—	—	—	—
II	1.5	set.	1.35	0.61	3.20	3.04	1.39	0.77	10.36
		A-cam.	0.13	1.31	1.08	—	1.93	1.31	5.76
		C-cam. (t-3)	—	—	—	—	—	—	—
III	3	set.	1.35	0.28	2.03	3.04	1.39	0.77	8.86
		A-cam.	0.13	1.31	1.08	—	1.93	1.31	5.76
		C-cam. (t-3)	—	0.33	1.17	—	—	—	1.50
IV	2	set.	0.99	0.06	1.56	3.04	1.39	0.77	7.81
		A-cam.	0.13	1.31	1.08	—	1.93	1.31	5.76
		C-cam. (t-1)	0.36	0.55	1.64	—	—	—	2.55
V	2	set.	1.35	0.15	1.84	3.04	1.39	0.77	8.54
		A-cam.	0.13	1.31	1.08	—	1.93	1.31	5.76
		C-cam. (t-2)	—	0.46	1.36	—	—	—	1.82
VI	5.5	set.	1.35	0.28	2.03	3.04	1.39	0.77	8.86
		A-cam.	0.13	1.31	1.08	—	1.93	1.31	5.76
		C-cam. (t-3)	—	0.33	1.17	—	—	—	1.50

set.: settlement, A-cam: smallstock camp, C-cam: camel camp,

t-1: type-1 formation of camel camp, t-2; type-2 formation of camel camp,

t-3: type-3 formation of camel camp.

(August 1975 to October 1976).

22) Table 21 shows the changes in membership for each subsistence unit. It should be noted that the number of herders required for each smallstock camp per subsistence unit is modified by the number of herders per smallstock herd (i.e., 3.2 persons) multiplied by the average number of herds per subsistence unit (i.e., 1.8 herds).

the smallstock were moved to camp for camp-based herding (August 1975 and January 1976, for a total of about 1.5 months);

Phase III: One portion of the camel herd was left in the settlement, while the other camels and the smallstock were moved to the camps. The camel camp at that time was of type-3 (August to October 1975 and February 1976, for a total of 3 months);

Phase IV: All the livestock were moved to the herding camps, and the camel camps were of type-1 (May to June 1976, for a total of 2 months);

Phase V: This phase is the same as Phase IV except that the camel camp was of type-2 (July to August 1976, for a total of 2 months);

Phase VI: This phase also is the same as Phase IV except that the camel camp was of type-3 (October to November 1975, March to April 1976 and September to October of the same year, for a total of 5.5 months).

During that 15-month period, the smallstock and the camels were brought back to the settlement for only 1.5 months (7%) and 5.5 months (37%), respectively. During Phase IV of the subsistence unit, 48% of the membership (7.81 persons) were in the settlement, 36% (5.76 persons) were in the smallstock camp and the remaining 16% (2.55 persons) were in the camel camp. During this phase the settlement population was at its lowest during the 15-month period. The average of 7.81 persons per subsistence unit who lived in the settlements at the time included 3.04 women (39%), 1.39 daughters (18%), 0.77 girls (10%), 0.99 elders (13%), 0.06 warriors (0.8%) and 1.56 boys (20%). Of the average of 7.81 settlement inhabitants per subsistence unit, 6.36 (81%) were married persons and young children.

The membership of residence is not constantly stable in time and space. Members do not reside continuously in a particular site throughout the year, and when a dry season becomes severe the married persons and young children who do not intensively engage in herding remain in the settlement, while the unmarried persons move to a new sites with the livestock. At these times all members of any residence site, whether settlement or herding camp, move, and may go together to a new site, or may split up and form other settlements or herding camps. The members of a settlement may go as a body to join an existing settlement, or they may divide, some joining an existing settlement and others building a new one. This applies also to members of smallstock and camel camps. Moreover, the settlement where the political and religious affairs are administered and where the children are cared for is under the control of the elders. The herding camps, where the livestock are herded for maintenance and growth, are under the control of the warriors. It can be concluded, therefore, that the dispersion of a subsistence unit between the settlement and the herding camps shows a heterogeneous fissioning of social groups in terms of economic function and age-sex composition.

4) Cooperative Herding Groups

In this section the way in which the herders of a cooperative herding group split up and form other cooperative herding groups for camels will be considered. One

herd joins another to form a new cooperative herding group, a herd joins an existing cooperative herding group, or several cooperative herding groups join to form a larger one. This summarizes the ways in which individual herders establish and dissolve the cooperative herding group among themselves. Such joining and splitting takes place at the discretion of the herders in charge, but the important factors involved in these processes of fission and fusion include such ecological factors as the availability of pasturages and waterholes, and such social factors as religious ceremonies, a consciousness of belonging to specific social groups (i.e., age-set or descent group), and the wish to alleviate tensions among individual herders. Some factors are inextricably bound up with others, and because it is difficult to isolate specific causes, it is probably better simply to note that these factors sometimes operate to increase the size of the cooperative herding group and at other times to reduce it.

(1) ADJUSTMENTS IN THE SIZE OF THE COOPERATIVE HERDING GROUPS IN RESPONSE TO THE DENSITY AND DISTRIBUTION OF PASTURAGES:

From the rainy season until the beginning of the dry season the pastures have an abundance and variety of fresh plants and can support a large cooperative herding group. At the height of the dry season, however, the land becomes both parched and often overgrazed. At such times, a large cooperative herding group divides into 2-3 smaller groups, each of which moves independently in search of better pasturages. This phenomenon is observable during transitional periods from settlement-based herding in the rainy season to camp-based herding in the dry.

(2) THE CARRYING CAPACITY OF A WATERHOLE

At present, the only waterholes that the camels can use throughout the year are pumped wells, excluding the Kolale spring in the Chalbi Desert. Because these pumped wells are small, only 10-15 herds can be watered at any one during a day. Thus when there is ample pasturage near a waterhole a large-sized cooperative herding group will remain in one place for two days and take turns drinking. However, when such pastures are not available, the group must divide into two smaller groups, each of which will be taken to different places for watering.

The interval with which camels are watered is to some extent fixed. Thus when herds often meet at the same waterholes or pools, they can easily be joined into a new cooperative herding group.

(3) AGGREGATIONS FOR THE PURPOSE OF COLLABORATION

When a herd is divided into 2-3 groups on the basis of its stage of growth, or when it has to be separated spatially between the settlement and the herding camp, the camels from different herds are herded as one group to overcome the problem of manpower shortage. Moreover, if a cooperative herding group is large in size, the manpower needed to scout for better pasturages or to search for stray camels is recruited from within its own membership.

(4) AGGREGATION FOR SECURITY

If a herder falls ill or suffers an injury, he must entrust his herd to the care of another person. Also, to protect the herds from plunder, a large-sized group is safer and more effective.

(5) THE LACK OF TERRITORIALITY

The distribution of pasturages and their quality are uneven and dependent on rainfall conditions, so that camels cannot remain for long in one place. The herd must move frequently to places where pasturages and water are available.

No exclusive rights to any pasture are vested in individuals or groups. All pasture is shared among all Rendille, and herders can choose freely the pastures that they wish to use in accordance with such customs as reciprocal access to pastures and waterholes, and mutual distance is maintained between the herds involved. This lack of institutionalized territoriality guarantees a wide nomadic range, extending over 10,800 km².

(6) THE DIVISION OF LABOR ACCORDING TO THE AGE-SYSTEM

Although herding control of camels is left to warriors, in practise the boys take care of the camels under their administration. The age-system imposes on them such social norms as egalitarianism and mutual aid among age-mates, and allotment of duties among different age-groups. Because the Rendille age-system is organized at the tribal level, an individual is easily aware of his own social status throughout Rendille land. These social norms are also considered to facilitate homogeneous fission and fusion of the cooperative herding groups.

(7) RESOLUTION OF CONFLICT BY FISSION

This can be observed more easily in the herding camps than in the settlement. Each camp is administered by two camp leaders (*forri-uen*) chosen every two months from among the warriors. They make the final decisions concerning the movement of their cooperative herding group, the formation of scouting parties, the designation of camp sites and waterholes to be used, and all affairs necessary for the maintenance of the camp. But not uncommonly there are many conflicting opinions among the herders, especially concerning the assessment of pastures, and the resultant petty quarrels or interpersonal animosities give rise to complicated situations, which eventually lead to the fissioning of a cooperative herding group.

(8) AGGREGATION FOR COLLECTIVE SOCIAL CEREMONIES

Ceremonies in praise of the camels and the warriors (*sorio*), those in honor of the elders and the smallstock (*almado*), and the circumcision ceremony for the boys who enter into warriorhood are held at the settlement. Ceremonies to give a name to a new age-set (*gaaligurme*), and those which announce the beginning of a warrior's wedding (*nabo*), are held away from the settlement. At such times, the participants' herds are gathered together at one place.

That accounts for some of the more important reasons why herds aggregate and disperse. An examination of the process of fission and fusion permits the membership of a cooperative herding group to be ascertained to some degree.

Based on the 26 camel herds in the *Tupcha* settlements, "the membership of the cooperative herding group" (cooperative herding rate) from March to October, 1976 (Table 22) is now considered. Now, let p = the rate of cooperative herding;

Table 23. Rate of cooperative herding among the clusters (from Table 22)

	No. of herd.	Cluster			
		I	II	III	IV
Cluster-I	3	100	16.3	21.2	15.6
Cluster-II	3		64.7	34.6	60.9
Cluster-III	6			65.3	28.8
Cluster-IV	14				57.1
Average=40.6					

Cluster-I, -II, -III, -IV, : stable clusters of four *Tupcha* settlements

a=the number of days during which herd-A formed a cooperative herding group with herds other than herd-B;

b=the number of days during which herd-B formed a cooperative herding group with herds other than herd-A;

c=the number of days during which herd-A and -B formed the same cooperative herding group with another herd.

When p=the rate at which herd-A and -B formed a cooperative herding group together, the cooperative herding rate may be expressed as:

$$p = \frac{c}{a+b+c} \times 100$$

The following results were obtained (Table 23):

- (1) The rate of cooperative herding with the herds of another clan was 24.2;
- (2) The rate of cooperative herding within the same clan, excluding (3), was 42.5;
- (3) The rate of cooperative herding within the same sub-clan was 46.7 and 50.1;
- (4) Within the same settlement (cluster) the rate of cooperative herding was 57.1, 64.7, 65.3 and 100,

A cooperative herding group tends to be formed mainly from among herds within the same settlement, and the fission and fusion among herds goes on within the same clan.

5. CONCLUSIONS AND DISCUSSION

This paper has described and analysed those socio-ecological aspects of Rendille pastoral nomadism important to an understanding Rendille society. The following discussion is organized around five topics:

- (1) Camels as the most important and reliable livestock in Rendille land;
- (2) Technological adjustments to camel rearing for a stable food resource;
- (3) Determinants of pastoral movement and its patterns;
- (4) Social adaptations to camel herding; and
- (5) Peculiarities of camel pastoral society.

Together these topics may provide answers to questions about the relationship of

pastoralism as a subsistence activity to a living environment and livestock rearing, and how the biological, demographic and ethological characteristics of the livestock herded provide the organizational basis of the social groups of the Rendille.

1) Camels as the Basis of Rendille Subsistence

Rendille land forms part of the semi-desert area of the lowlands of Kenya, Ethiopia and Somalia. The fauna and flora are so impoverished, the population density of wild animals so low and edible wild plants are so scarce that hunting and gathering activities cannot support human life. Moreover, the rainfall amounts are not only extremely meagre and geographically variable, but the cyclical droughts which affect the area continue for years. Even the rain which falls in a heavy shower either evaporates soon after it has stopped, owing to the extreme heat and low humidity, or may disappear underground. Thus sources of water are extremely limited.

A large portion of this land is covered by bush-thicket and semi-desert grassland, and grasses are rare. Under such conditions it is difficult for grazers such as cattle and sheep, which live on grasses and need frequent watering, to exist. This marginality of natural environment forces even sheep, which are regarded as "extreme grazers" [ASAD 1970, GULLIVER 1955, GWYNNE 1977], to depend inevitably on graze for less than 78.4% of their diet during the rainy season, and goats on browse for 47.5% of their diet, and graze for 52.5%. This is close to the camel browse-graze ratio of 45.8% and 54.3%, respectively. Although both goats and camels are better adapted to Rendille land than are sheep, camels survive best in the lowlands because, owing to particular features of their adaptive physiology, they can go 1-3 months without drinking, depending on climatic conditions and diet [SCHMIDT-NIELSEN 1964].

The Rendille, except for children, the old and the sick or handicapped, who cannot walk alone, do not ride their camels, nor do they make clothing, rugs or tents from the hides. Neither do they like dispose of their camels by sale but prefer to transfer them through a rental system (the custom of sharing noted in Spencer [1973]) to enhance socio-economic advantage [SATO 1978b]. Transfer of animals may serve as an insurance which guarantees the security and continuity of the group as a whole, especially under conditions of economic uncertainty. It also provides a socio-economic base line for a system maintained by subsistence herding [GULLIVER 1955; DYSON-HUDSON *et al* 1969; TOMIKAWA 1972; WADA 1978; SWIFT 1977].

The Rendille make exclusive use of their camels for the milk, meat and blood required for daily subsistence. Camels can continue to provide milk for 20 months after giving birth, and supply twice as much milk per capita as cattle and nine times as much as goats and sheep. Average herds of camels (49.1 head) and smallstock (85.8 head) can supply daily 7482 ml and 2661 ml of milk, respectively. The daily milk yield per subsistence unit, which is composed of one camel herd and 1.8 small-stock herds, is 7482 ml (5237 Cal.) from camels and 4790 ml (4216 Cal.) from small-stock. Of the total milk intake of a subsistence unit, camel milk comprises 61%

by weight and 55% of calories. Camels are the most stable provider of milk of all of Rendille livestock both in terms of the amount and duration of supply. It must be concluded, therefore, that the Rendille could not survive unless they convert the barren natural resources which cannot be directly exploited into the milk, meat and blood of their camels, and unless they employ the camels as pack animals.

2) Technological Adjustments to Camel Rearing for a Stable Food Resource

Rendille pastoralism is based on subsistence herding, which aims to produce not a marketable surplus but a regular daily supply of food [DYSON-HUDSON *et al* 1969]. This characteristic is common in African pastoralism. Owing to subsistence-oriented constraints, pastoral people must keep their livestock near at hand to secure food for themselves and must make every effort to obtain more milk without interrupting the milk supply. Also, they must maintain their food resources with a small but stable and effective number of persons. Not until those three above-mentioned requirements have been fulfilled can they subsist on their livestock [TANI 1976].

According to Gauthier-Pilters's [1974] observations on free-ranging camels, such camels divide into 3 groups. One is a mixed group of females, juveniles and several males led by an elderly female; the second is a small group of females with infants (mother-infant group); and the third is composed of bachelor males (all-male group). Some of the old males as well as a few females with their young may go off by themselves. During the mating season herds are always guarded, and three types of group are found; those with one male and up to 30 females plus their one-year and two-year-old juveniles (one-male group); bachelor groups consisting of males (all-male group); and groups of females with infants (mother-infant group).

In the case of Rendille camel rearing, every herd is divided into 2-5 herding groups according to the growth stage of the animals and the availability of manpower, so as to plan for effective reproduction and supply milk for both nursing infant camels and humans. The fundamental division is between the adult-adolescent group and the juvenile group. When calves are born, a mother-infant group, consisting of mothers with their nursing infants, is formed separately. When camels begin to show sexual excitement, adult and adolescent camels are divided into 2-3 one-male groups, each of which consists of one stud, many females and from none to several castrated camels.

When group formation in a Rendille camel herd is compared with that in a herd of free-ranging camels, two important characteristics can be discerned. First, mother-infant ties are distinctive in the free-ranging state, and this nature is utilized for group formation of camels by the Rendille. Second, the Rendille merge castrated males into mixed groups, and separate juvenile camels into another group. This results from the pastoral requirements [TANI 1976] of keeping their livestock close at hand, since a day's herding is not completed until pastoral people have prevented their livestock from arbitrary movement while at the same time moving them to and from the pen daily.

It has been suggested that daily cattle herding is technologically effected by taking infants as hostages [UMESAO 1951, 1976; TANI 1976]. Not only in daily cattle herding but also in daily camel herding, the taking of infants as hostage is fundamental to the process of group formation and manipulation. It is recognized that this is achieved through the nursing-suckling relationship between mother and infant or the adoption of nursing infants by milking camels, and by the separation of the mother-infant group from other camels within the same herd after delivery, and from juveniles throughout the year. However, mother camels tend to behave as if their mother instinct were less strong than that of cattle in that camels not uncommonly abandon their calves and reject attempts to suckle. Thus the Rendille resort to various devices to persuade camels to nurse their infants.

During the mating season, male camels do not tolerate one another in the presence of females, and as a result they disturb group coherence. To maintain camels in a stable group, the Rendille employ two methods; the castration of surplus males and preservation of stud camels. They castrate surplus males and slaughter them for ritual use or for subsistence, thereby reducing the number of surplus males. This explains why the sex ratio of adult and adolescent camels (0.29) is lower than that of infants (0.66) and why the sex ratio of reproductive animals is extremely low (0.05). Although this figure for the sex ratio of a herd is higher than that estimated by other researchers, around 0.01 to 0.03 [ASAD 1970; LEWIS 1961], an extremely low proportion of stud camels is common in pastoral livestock herds [DAHL, *et al* 1976].

The other method is to preserve the breeding ability of stud camels. The Rendille make only one stud from the males within a several-year span to prevent them from fighting with one another during the mating season. This results in each stud of a herd being different in age. They allow only one stud camel to join the adult and adolescent females during the mating season. Moreover, a stud camel is used for breeding purpose in order to retain his breeding ability for a 14-16 year period. Taking of infants as hostages, based on the exclusive mother-infant relationship, and controlling males so as not to disturb the herd, provide the technological bases for keeping livestock together in a group. However, as noted above, the herder must also watch the camels closely when they are together in a group.

There is no reliable socio-ecological information about wild camels, and only indirect information is presented by Gauthier-Pilters [1974]. According to her observations, wild camels aggregate separately into mixed groups led by an elder female, mother-infant groups, and all-male groups during the non-mating season. She also indicates that it is difficult to make arbitrarily one camel the leader of a group, and that male camels will not tolerate each other in the presence of females during the mating season. This suggests that wild camels do not maintain one-male groups throughout the year. The Rendille keep their camels together in one-male groups even during the non-mating season, and they believe that the stud camel, with its wooden bell and distinctive bellow, leads the other camels. But in practice the stud camel alone cannot keep the others together in a group, since only one stud camel

and one female in a herd or only 11 camels other than the studs sometimes return separately to their pens. This separation from the stud is a result of the inconsistencies between the socio-ecological characteristics of camels and the subsistence requirements of humans. These inconsistencies may be resolved through the daily herding techniques.

The problem of obtaining more milk without interrupting the milk supply is resolved by the attempt to increase the camel population and/or the reproductive rate, and by prolonging the mating period while decreasing the number of stud camels. Apart from purely sociological techniques such as animal transfer and raiding to increase herd size, another technique is employed which aims to increase reproductive rates within the limitations of herd size. Adult and adolescent camels are divided into two one-male groups. One is formed to satisfy subsistence needs, and consists of one stud, several pack camels and milk camels (*gaalimoolo*). The other is formed for reproduction, and consists of one stud and adult-adolescent camels of the both sexes (*gaaliforr*). In the latter half of the mating period a third group, called *gaalihoo pu*, is formed for the purpose of reproduction, and consists of one stud and those females which have never been pregnant. However, such a group cannot be formed in the absence of enough stud camels and herders. In this process, as soon as the females become pregnant, they are shifted and gathered together into *gaaliforr*. At the end of the mating season, both the camels of *gaalihoo pu* and the stud camel of *gaalimoolo* are shifted to *gaaliforr*. In this way, the Rendille use a few stud camels to facilitate reproductive efficiency. Moreover, an important result of this method of prolonging the mating period is that the period of milk supply for the Rendille is prolonged, within the limits set by the number of females.

Although conception and pregnancy are closely dependent on the nutritious fresh herbs which are available after the heavy rain, in good year it is usual for delivery to occur twice, the major delivery season occurring at the end of the spring rains and the minor delivery season occurring at the end of the autumn rains. Since most calves are born in the former period, much more milk is available for the Rendille daily subsistence at that time. Field observations showed that the height of the major delivery season occurs in May, and that the season lasts from April to July. Although milk is available in the minor delivery season, between October and November, the Rendille obtain little additional milk because of the small number of mother camels. Camels continue to lactate for 20 months unless they become pregnant again, but the amount of milk decreases by half after about one year. Since infant mortality is extremely high (14.4%), after the major delivery season some mothers conceive in the following autumn. However, it is said that lactation ceases on the sixth month after the loss of a calf, and on the fourth or the fifth month after conception. As lactation gradually decreases in quantity because of either natural decline or pregnancy, the Rendille are confronted with the period of cessation of lactation immediately before the major delivery season. This problem tends to be resolved because the major delivery season extends over 3 months.

3) Determinants of Pastoral Movement and its Patterns

In general, pastoral movements of herds are regulated by such ecological factors as the availability of water, food plants and salt, the distribution of predators, the prevalence of diseases, physiological characteristics and topography, and by such social factors as relations with neighboring tribes and the performance of collective social ceremonies. It is of course imperative that a reasonable number of herders should efficiently exploit the pastoral products.

Inter-tribal relations, even if the tribes involved are hostile to each other, tend to be adjusted to permit efficient mutual use of pastures. Although the Rendille's collective social ceremonies formally require the participation of all livestock herds and either all warriors or elders, under such unavoidable circumstances as prolonged drought they may be performed by just a few participants with several head of livestock. It is of primary importance in pastoral societies that livestock be kept in good condition, hence social ceremonies and inter-tribal relations are dependent on the requirements of livestock welfare. The pastoral movement of livestock herds results from adjustments of these requirements, and to conditions of and changes in the biological and physical environments.

Salts are indispensable for all livestock and a lack of regular salt intake may result in a low resistance to diseases. The Rendille intentionally lead their livestock, especially the camels, to brackish waterholes and salt licks. On every watering day they also feed their camels on salt-shrubs such as *Dasyphaera prostrata* and *Salsola dendroides africana*. Salts are supplied during the watering process. However, in Rendille land those salt-shrubs have only a limited distribution in the lowlands.

Although the amount and frequency of water required depends on meteorological factors, on the quality, quantity and water-content of the forage, and on the age of the animal and its work load, most camels generally drink only 120–140 l. at one watering in summer [GAUTHIER-PILTERS 1974] and smallstock drink 0.7 l. daily [LEITCH *et al* 1944]. Thus it can be calculated for Rendille livestock that an average herd of camels (49.1 head) and smallstock (85.8 head) require about 5900–6900 l. and about 60 l., respectively, at a single watering. Since it is all that the Rendille can do to carry 3.3 l. of water with pack animals for daily individual human consumption, it is impossible to fulfill the water requirements of camels by bringing water to them. It is sometimes possible, however, to bring water from a waterhole for a few head of smallstock. Waterholes that can support the needs of camels are rare in the highlands and most are located in the lowlands. Small waterholes suitable for smallstock are abundant in the lowlands, but they soon dry up after the rains in the dry season.

It is recommended that where water is available, camels should be watered every day, to stimulate growth [WILLIAMSON *et al* 1965]. However, because the Rendille believe that overwatering leads to physical weakness, smallstock are not watered for a full month after they are born, and infant camels for as long as 8 months after birth. Female camels are not watered at all during the month after they have

given birth. The Rendille regulate the frequency of the watering to acclimate livestock to marginal conditions under which water may become extremely difficult to obtain. Camels are watered every 11 days on an average during the dry season and may go without water for up to 3 months during the rainy season, all their moisture requirements being satisfied by the plants they feed on. This accords with Gauthier-Pilters's result; where daily temperature is below 40°C and the vegetation is not too dry, camels need not drink for 10–15 days. It also agrees with observations on the frequency of watering among the camel pastoralists of East Africa [LEWIS 1961; ASAD 1970; TORRY 1973].

On the average, Rendille smallstock must be watered every 4.5 days in the dry season, whereas they can go without water for several months in the rainy period. This figure also reflects conditions in East African pastoral societies [cf. Dahl *et al* 1976]. The difference in frequency of watering between camels and smallstock results in a great difference in the distance from a waterhole at which each may be herded. In the dry season, because camels can be herded at a distance of 50–70 km from waterholes, they can move freely over an area of about 10,800 km², whereas smallstock must remain at furthest no more than 20–30 km from the nearest waterhole. In the rainy season, disregarding the problems of the herder's thirst and the human milk requirements, it is theoretically possible for camels and even for smallstock to be herded further away from waterholes in order to avail them of fresh pasturages. Thus Spencer [1973] correctly points out that the effective grazing area of camels is not limited by their capacity to travel a given distance in one day, but rather by the capacity of the herders to travel this distance on foot.

In terms of the dietary requirements of livestock, sheep overwhelmingly tend to graze (78.4% of their diet) whereas both goats and camels tend to browse in addition to grazing. Camels, goats and sheep compete for grass, because grass, which is scarce in Rendille land, comprises about 30% of each animals diet. Additionally, goats and camels compete for both browse and graze because the shrub-grass-herb ratio in the goat diet is similar to that of camel.

The competition for food resources among the three types of livestock is regulated as a consequence of their different feeding habits and by the steps taken to separate their feeding grounds. During the rainy season, when fresh pasturages are widely abundant, all livestock are brought back to the settlement and are herded extensively through settlement-based herding. Sheep tend to feed on those plant species that grow in the lower strata, goats on those in the middle to lower strata, and camels on those in the higher to middle strata. This difference in feeding habits moderates the competition for fresh pasturage, which consists of leaf buds, *Acacia* pods, young shoots and fruits.

As the dry season advances pasturage becomes scarce and can no longer support the livestock. In turn, camels will be herded on one pasture and smallstock on another, so that the competition for the main components of dry season food will be moderated.

The bush-thicket and semi-desert grassland zones cover about 80% of

Rendille land, in these zones vegetation density is extremely low. The former zone, during a brief rainy season, can provide all the livestock with various types of fresh pasturages, but the latter only provides limited types of browse year-round. Thus, camels can utilize year-round plants which exist in the lowlands, and while they are foraging on these plants they can be watered on a march of 5-6 days. But in the dry season, smallstock, especially sheep, cannot be provided with pasturages in the nearby lowlands and so are taken to the mountainous regions where plentiful pasturages remain in the moister areas. They must be moved around to obtain water and pasturages.

Other subsidiary factors partially regulate the spatial movement of camels. These include the existence of predators, the prevalence of diseases, and physiological and topographical characteristics. Carnivores, especially lions and lycaons, are dangerous, but they exert only a slight influence on pastoral movement. Further, tsetse and camel flies cause trypanosomiasis and anthrax to camels [MARES 1965; SPENCER 1973], outbreaks of which can be predicted only approximately. Because one-humped camels are more suited to flat country and are able to thrive in the heat of the summer [EPSTEIN 1971], and because a poisonous plant species (*Capparis tomentosa*) is distributed in the mountainous regions, the Rendille do not lead their camels deeply into the mountainous regions. The herders do not withdraw their camels from the harmful places infested with disease-bearing flies unless their camels actually have suffered serious damage. Thus, the Rendille do not always take the degree of humidity and temperature, the occurrence of harmful flies, the presence of poisonous plant and carnivores, and topographical factors into such fine consideration in the process of camel herding. But they do prevent their camels from moving into the mountainous regions.

Consequently, the camel herds are characterized by a horizontal movement pattern in that they continue to be herded in the lowlands all year, whereas smallstock herds are characterized by a vertical movement pattern since during the rainy season they are herded in the lowlands but in the dry season are driven up to the mountainous regions.

4) Social Adaptations to Camel Herding

The camels can exist for long periods without water, provide a stable source of food and serve as a tough pack animals. On the other hand, they require a vast foraging area, and, compared with other types of livestock, exhibit an extremely low rate of population growth. It is reasonable to expect that the ecological characteristics of camels are reflected in the basic features of Rendille social life and subsistence activities.

(1) STRICT POPULATION CONTROL AND PRIMOGENITURE

Population growth among pastoral peoples is closely correlated with the reproductivity of their livestock [SWIFT 1977]. In Rendille society, infanticide of first-born twins and illegitimate children is practised. Those daughters known as *sapadi*, whose fathers belong to a specific age-set line (*teeria*), are forced to marry later than

the daughters of men in other age-set lines. At the earliest, the first son should be circumcised into the third age-set after that of his father and each age-set is formed every 14 years. Moreover, Spencer [1965, 1975] reports that those infants born on the Wednesday after a new moon and boys born after their elder brothers have been circumcised are killed. It seems that this social institution, the age-system, and late marriages (males marry at an average age of 31.8 years and females at an average age of 25.1 years), accounts for the slow population growth of the Rendille.

In Somali society, males and females marry for the first time at the age of 18–25 years and at the age of 15–20 years, respectively [LEWIS 1961]; in Samburu society, the first marriage age averages about 30 years of age for males and about 15 years for females [SPENCER 1965]; among the Gabra, it is 30–35 years-old for males and shortly after puberty for females [TORRY 1973]. Compared with other pastoral societies, the Rendille, especially females, are extremely slow to marry.

This strict control of the human population results in annual increase rate of 1.7–2.6%. The annual rate of increase for cattle is 11 to 14% [SPENCER 1965; FUKUI 1978], almost three to four times that of camels (3.4%). In terms of population growth per year, that of Rendille males is slightly lower than that of camels. This agrees well with Spencer's description [1965, 1975] that cattle herds increase at a faster rate than the human population whereas camel herds grow at a slower rate.

The Samburu husband allots his cattle among his wives when he is still alive, and the wives pass them on to their sons. The main source to which a young man looks for cattle to build up his own herd is the herd allotted to his mother [SPENCER 1965]. But no one entertains this sort of expectation of inheritance of livestock among the Rendille, where women cannot claim ownership of camels, and a husband's herd should be inherited by his eldest son of the first wife, immediately following his death. Younger sons are given only a few camels at marriage.

The strict control of human population and inheritance of camels by primogeniture are clearly related to the reproductivity of the camels. Were the Rendille to divide their camels among sons in inheritance and unable to place controls on their own population, it is conceivable that the entire human population might die out if they continued to rely on animals with such a low rate of increase. This is certainly why the Rendille strictly control their population by rigorous social norms as well as the rules pertaining to the age-system.

Of course it may be merely by chance that the population growth of the Rendille is slightly lower than that of camel herds, but the Rendille are aware of the growth rate of camel herds as a fact of daily life and they have constructed both their social institutions and their social customs to conform with the growth of the camel herds. This is regarded as their major social adaptation to the camels on which they depend entirely for their subsistence.

(2) FISSION AND FUSION OF SOCIAL GROUPS

The Rendille subsistence unit itself is different from the Turkana nomadic home-stead [GULLIVER 1955], in that among the Rendille all its members do not always accompany the herds throughout the year in order to care for the livestock and live

on pastoral products; instead, it is a self-sufficient economic cooperative unit that includes one herd of camels and 1–3 herds of smallstock, and is self-sufficient in terms of food production and consumption and the recruitment of manpower. It is divided into three nomadic units both by age-sex composition and the type of the livestock herded. The nomadic unit which takes care of smallstock is composed of unmarried members of both sexes, and that for camels of only unmarried men. The appearance of a subsistence unit changes temporally and spatially in response to the changing biological and physical environments. As the dry season advances, married people with young children are left behind in the settlement, while the herders must take the herds away in search of better pasturages. Thus the dependants, or married people and children under 7 years of age, live in the settlement, whereas some unmarried people over 7 years of age live in the smallstock camps and unmarried men in the camel camp. After the rains fall, those people who were dispersed between herding camps and settlement, join together into the same area where fresh pasturages and waterholes are available. In other words, camp-based herding dissolves into settlement-based herding. In this way, there is heterogeneous fission and fusion between the settlement and herding camps in terms of the economic functions of the group and age-sex composition.

Dahl *et al.* [1976] expect that when a household is split, the goats are more likely to stay in the settlement rather than follow the camels, as they are more useful to the home encampment, providing an accessible “store” of meat and milk. However, according to my observation of Rendille herding strategy, from August, 1975 to October, 1976, smallstock were more often taken out to the herding camps than camels: the former were brought back to the settlement for only 1.5 months (7%) out of 15 months while the latter was brought back to the settlement for 5.5 months (37%).

After the herders have left with their livestock for the herding camps, no livestock remains in the settlement for subsistence use. People who remain in the settlement at this time move to a nearby permanent waterhole, where they can purchase foodstuff with cash at the trading post. In this process, they may go together as a body to a new site, or they may divide, some joining an existing settlement in which they have relatives, and others building a settlement at a new site. At this time, settlements of the same clan split up into 2–4 groups. Similarly, the members of a camel camp and smallstock camps, respectively, move in search of better pasturages and waterholes, with repeated homogeneous fission—fusion.

Thus, the seasonal changes in the composition of the Rendille social groups can be considered as including both heterogeneous and homogeneous fission—fusion in terms of the economic functions of the groups and age-sex composition.

With an extremely low population density of 0.34 persons per km², the Rendille need to herd camels over Rendille land of approximately 50,000 km² and for that purpose fluidity within and among social groups is obviously indispensable [LEE 1968, 1969; TANAKA 1971; HARAKO 1978]. The major factors which regulate the seasonal changes in the composition of groups are ecological and sociological.

Ecological factors include the distribution and availability of water sources and pasturages, together with the watering rhythms of the particular animals. Sociological factors include the cooperation and maintenance of security, the lack of territoriality, the division of labor by age-system and sex distinctions, the resolution of emotional conflicts by fission, as well as religious and social activities. Some factors are inextricably bound up with others and it is perhaps better to say that these factors sometimes make the cooperative herding group grow larger in size and at other times reduce it. More precisely, however, married people with young children, and herding groups consisting of unmarried people, join together into the same area in the rainy season and separate in the dry season. Furthermore, they join together also at the beginning of the dry seasons for short periods to perform annual ceremonies. It may be concluded that the size of social groups increases in the rainy seasons and decreases in the dry and that the pattern of fission-fusion and seasonal change of social groups is regulated first by ecological factors and secondly by sociological factors.

Milk yields fluctuate considerably from the rainy season to the dry season, and are lowest during the dry season. At this time, the herders who perform more rigorous tasks leave the settlements for the herding camps and dispersion of social groups is at its height: of the average members of a subsistence unit (16.12 persons), 48% reside in the settlement, 36% reside in the smallstock camps and 16% reside in the camel camp. In the camel camp, the herders live exclusively on camel products, whereas in the settlement the people live on maize flour purchased with cash received from selling smallstock. Based on the proportions of the human population distributed among different segments of subsistence units, the herders in the herding camps can consume 3-6 times as much of the livestock products as they could if they were in the settlement, where they would have to share the products with dependants. This also means that when herding conditions change for the worse, they can dispose of some of their smallstock which suffer directly from environmental pressure in exchange for maize flour, to provide high calorie nourishment for the people in the settlement. In other words, the Rendille make effective use of the limited products from their livestock by means of the dispersal of their social groups coupled with complementary external trading.

(3) SPECIALIZATION AND DISTRIBUTION OF LABOR IN HERDING ACTIVITIES

In Rendille society, the herding control of livestock devolves on the warriors, whereas management control rests with the elders. But in practise, boys and girls over 7 years of age play a substantial part in the daily herding of livestock. Married people only contribute to it as part-time assistants. Moreover, it is the same young herders who alone perform the tasks of milking and the daily herding. Thus it may be said that the herders become specialists in the care of the herds entrusted to them.

Subsistence activities are divided on the basis of age-system and sex distinctions, and the herders of each herd become specialists. The task of herding camels is primarily entrusted to the young males, whereas that of smallstock is primarily entrusted to the unmarried females. In particular, since camels must move over a

wider region without water, in which food plants are extremely scattered and scarce, camel herders must be physically fit and able in order to move about freely and accompany the herds during movement.

The "subsistence-independents" compose 62% of a subsistence unit and "dependents" the remaining 38%. Subsistence-independents are unmarried persons over 7 years of age. This is a further adaptive aspect of subsistence activities because young persons perform the heavy labor of herding, at a lower energy cost than adults whereas adults perform the more sedentary subsistence tasks in daily round of activity [THOMAS 1973].

(4) THE MEMBERSHIP OF ECONOMIC COOPERATIVE GROUPS

A subsistence unit tends to be formed on the basis of agnatic relations within the same sub-clan. Settlements which include many subsistence units tend to be formed on the basis of sub-clanship and the fission-fusion of their groups occurs mainly within the same clan. Likewise, the cooperative herding groups tend to be formed on the basis of membership in the same settlement and the fission-fusion of these groups occurs mainly within the same clan. Affinal relations play only a very slight role in group formation.

As has been reported elsewhere [SATO 1978b], the Rendille share camel marks, which consist of ear-clipping and brand-marking, among the male members of the same sub-clan or the same lineage group. The domain of the "sharing group", whose members commonly use the same mark for their camels, and that of the clan, respectively, may be regarded as "barriers" [BARTH 1967] to the camel rental system, in that a group of "rental" camels can never be transferred back into a domain through which they have previously passed. As Spencer [1973] mentions, sharing (or rental) camels is a custom which seems to be well-adapted to the scarcity of camels and the slow growth of the herds. Although individuals have primary rights over camels and their own marks, they deal with the camels as if they were part of the communal property of certain unilineal descent groups such as the sub-clan or the lineage group. In Rendille society, the fission-fusion of both residential and economic cooperative groups occurs on the basis of agnatic relations within the same clan. Moreover, the clan, a component segment of the segmentary descent system, is not only regarded as the unit of exogamy and the limiting boundary of economic cooperation, but also includes several joint-wealth groups.

The following are considered as the reasons for the construction of such large-sized cooperative groups in Rendille society:

- (1) Because the population growth of camels is extremely low and the number of camels per person is also very low (3 camels per person), cooperation among the jural owners of camels is imperative to build effective breeding groups;
- (2) Because the society favors late marriage as a means of strict population control and because a small-sized family by itself cannot recruit enough manpower to care for the livestock, cooperative effort among such small families is advantageous; and

- (3) Not only damage resulting from the unpredictable nature of camels (which may increase or decrease in number owing to the skill or lack thereof on the part of the herders), but also the process of primogeniture (which means that camels tend to become unequally distributed among sons to the advantage of the first son) may be mitigated through camel transfers among friends or relatives. The larger the cooperative group becomes, the more effective the systems of mutual aid. In Rendille society, primogeniture seems to be highly dependent on large-sized cooperative groups.

The social features of Rendille society which may be regarded as social adaptations to camel herding are:

- (1) To a degree seen almost nowhere else, the Rendille maintain extremely strict control over their population through infanticide and the age-system;
- (2) Primogeniture is retained against a background of large-sized cooperative unilineal descent groups;
- (3) Based on a dual-residential system, social groups show two-phase fission-fusion in terms of their economic functions and age-sex composition;
- (4) The herds are maintained through specialization and clear-cut division of labor on the basis of the age-system and sex distinction;
- (5) The clan within the segmentary descent system can be regarded as a non-territorial, exogamous, economically cooperative unilineal descent group; and
- (6) Flexibility in the composition of subsistence activity groups and residence groups occurs within the same clan and membership in such groups is based on agnatic relations, and only more rarely on a affinal relations.

5) Peculiarities of Camel Pastoral Societies: Comparative Considerations

The tribes neighboring the Rendille include cattle herders such as the Borana, Samburu and Turkana tribes and camel herders such as the Gabra and Somali. Comparisons with these neighboring tribes should, of course, be based on a comprehensive appraisal of their historical and cultural backgrounds. Here, however, only the degree to which the special features on the Rendille society are shared with these neighboring tribes is examined.

The Somali [LEWIS 1961, 1962, 1965] have a dual-residential system, the camel herding camp and the nomadic hamlet with smallstock. Unmarried men in charge of the camels live in the camel camps and family groups which attend to the herding of smallstock live in the nomadic hamlets. The camel herding camp includes only those agnates and their herds that belong to the same "*dia*-paying group", a lineage group that includes 300-3000 agnates to a depth of 3-4 generations. The hamlet consists mainly of a group of nuclear families whose herds are principally closely related agnatic kin, although affines and other non-agnatic male kin are also frequently included. The hamlets of these people of the same *dia*-paying group congregate to form temporary neighboring groups at the common waterholes and in the common pastures.

In Gabra society [TORRY 1973, 1976], social groups disperse between the herding camps (or satellite camps) and the settlements (or main camps), each of which shows independent changes in its composition and in its movement, although herding camps join together seasonally. It is chiefly married people who live in the settlements and unmarried people who live in the herding camps as herders. In their settlements, people of the same phratry build their huts adjacent to one another and form *solola* based on agnatic or affinal relations. This *solola* is similar in shape and economic function to the Rendille subsistence unit. Affinal relations determine almost exclusively the patterns of residential grouping. Moreover, both among the Somali and among the Gabra there is seasonal fission-fusion between the herding camps and the settlements.

There are some differences between the Somali and the Gabra as far as group membership is concerned, but the seasonal changes in composition are based on a two-phased fission-fusion pattern similar to that of the Rendille in terms of the economic functions and the age-sex composition of the groups which result from these transformations. Furthermore, the Somali and Gabra also show specialization in the maintenance of livestock, the men taking charge of the camels and the women of the smallstock. The maintenance of livestock is carried out through a division of labor by age and sex distinctions. In both tribes inheritance of camels is almost completely limited to the first son of the first wife. But both tribes differ from the Rendille in the presence or absence of an age-system and its content: the Somali have no age-system and the Gabra have an age-system rather different from that of the Rendille. Further, they differ at various points in their social structures and in the memberships of their social groups, as previously described.

The camel owning systems of both Gabra and Somali are similar to those of Rendille. Although individuals have primary rights over camels and their own marks, camels are also regarded as if they were part of the communal property of a certain descent group and, in addition to the private mark, bear a lineage brand which is usually that of the *dia*-paying group among the Somali or a phratry brand among the Gabra. Among the North Arabian Bedouin tribes this is also common [SWEET 1965]. In both societies all the livestock acquired by the father through camel transfers during his lifetime are inherited by the eldest son. The camel transfer system is maintained over several generations through the father-first son tie.

Among cattle raising societies, except for the Samburu who practise infanticide on illegitimate children or first-born twins [SPENCER 1965, 1975], first-born twins, illegitimate children and boys born after the circumcision of their elder brothers are generally not killed. For example, illegitimate children are handled as the siblings of the mother in the Karimojong [DYSON-HUDSON 1966]. Rather, in cattle herding societies the increase in cattle is one means of amassing wealth to pay for a bride, and thus many wives can be obtained. Because of this, hostility often arises between fathers and sons when the number of marriageable girls becomes insufficient [SPENCER 1965, 1973; GULLIVER 1955; DYSON-HUDSON 1966]. In cattle herding societies, strict control of population is not found and there is a tendency to divide the cattle,

except for a residual herd, among a man's wives and sons instead of having the first son of the first wife alone succeed to it. The unmarried men carry out the daily herding of cattle and the unmarried women that of the smallstock. But it is common for the married women to milk both types of livestock, so that maintenance of herds is less specialized among cattle herders than among camel herders.

Although cattle do bear a clan mark, social relations involved between stock-associates have no legal content whatsoever [GULLIVER 1955]. The Samburu make outright gifts to other stock owners, create debts, or make loans from a herd of cattle, but they do not have the custom of sharing with other stock owners [SPENCER 1973].

In a Samburu settlement, the average number of huts is 5.6, with an average population of 24 persons [SPENCER 1965]; and for the Turkana, the average is 3 huts with 12 persons [GULLIVER 1955]. In both societies, neighboring groups called "local clan group", and "first or secondary neighborhood" are formed, the average size of which is 25-26 huts, with a population of 81-110 persons. The patrilineal extended family of the Turkana is divided into the "chief-homestead", which tends to serve as the nomadic unit for the browsing herds, and the "secondary homestead", the nomadic unit for the grazing herds. A man's first wife with her children tend to live in the former, and in the latter the same man's other wives and their children. Although there is seasonal fission-fusion between the two homesteads, each herding unit is independent and also may join with herding units from other families. Among the Turkana the seasonal changes in the composition of social groups show only the homogeneous fission-fusion in terms of economic functions and age-sex composition of the groups.

Neither do the Samburu construct their herding camps so far from the settlements, and they are usually able to maintain daily contact between the two: sometimes they are even able to live together with their families. Compared with the Somali, Gabra and Rendille forms of residence, this type of dual-residential system is extremely undifferentiated.

The results of this brief comparison reveal that among East African pastoral peoples, camel pastoralists show the following special features: inheritance of camels by primogeniture; a two-phased seasonal fission-fusion of social groups on the basis of a dual-residential system; the specialization and clear-cut division of labor by age and sex distinctions in herding livestock; and camel transfers based on legal contract against a background of large-sized cooperative unilineal descent groups.

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