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Composition of Household Herds and Rendille Settlement Patterns

Eric Abella Roth and Elliot Fratkin

To assess the impact and pattern of drought-induced livestock loss on Rendille pastoralists of northern Kenya livestock censuses for a nomadic 1976 and a sedentary 1985 village are compared. Results of a logistic regression analysis support an earlier model (Schwartz 1979) linking Rendille settlement patterns to the distribution of loading camels. These findings are discussed in light of the recent transition to sedentism for the Rendille and the concomitant factors of increased dependence on famine-relief, integration into the cash economy, and overgrazing of existing rangeland.

The Study Population

Until recently, the Rendille of northern Kenya were pastoralists subsisting off their camels and small stock of goats and sheep in the Kaisut Desert of western Marsabit District (see map 1). Their society was not well known until Spencer's (1973) monograph describing the social alliance between the Rendille, the larger cattle-keeping Samburu, and the bilingual Ariaal who keep cattle, camels and small stock. Recent anthropological investigations of Rendille society have included social and historical analyses (Beaman 1981; Schlee 1989; Sobania 1980, 1988), studies of human ecology (Fratkin 1986; O'Leary 1985; Sato 1980), and economic and demographic descriptions of both traditional pastoral production and recent market integration (Beaman 1983; Fratkin 1987a,b, 1989a, b; Roth in press; Tonah 1989).

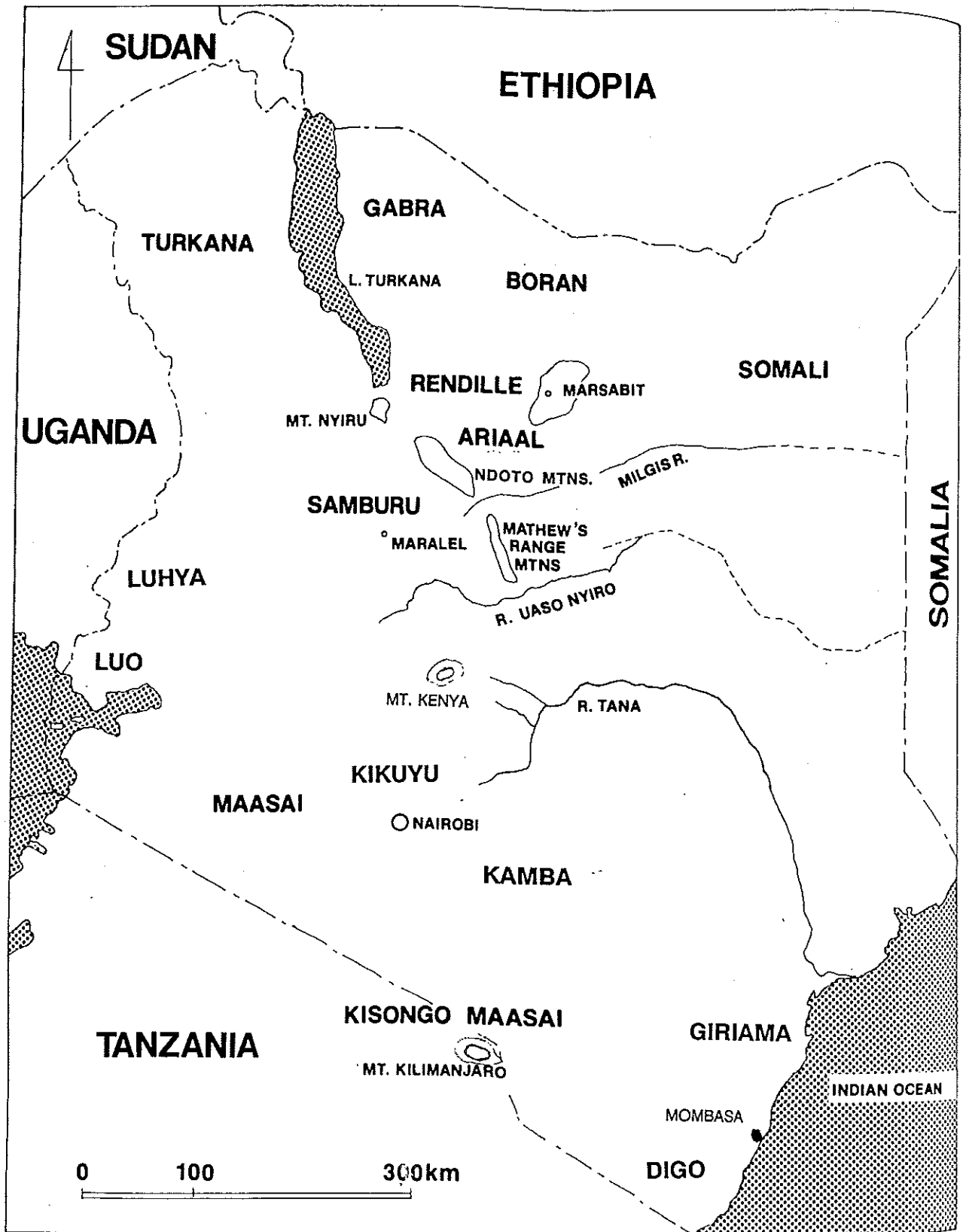
All studies concur that Rendille settlement patterns changed dramatically in the past twenty years due to regional political instability following Independence in 1963 and also to severe drought spanning from the late 1960s to the present (drought years include 1968, 1973, 1976, 1982-84, and 1986). As a result of drought-induced livestock loss Rendille have increasingly settled around small towns formed as famine relief centers adjacent to newly created boreholes. In these

locales missions distribute famine-grains, and shops and auctions buy livestock, particularly cattle and goats. It is estimated that 45% of the total Rendille population now reside at the mission towns of Korr, Kargi and Laisamis (1990 Kenyan Census).

The Study Problem

Although Rendille continue to keep large herds of camels, small stock, and increasingly cattle raised for the cash market, these are herded by young men and women in mobile livestock camps (*fora*). The majority of married adults and small children live in domestic settlements (*gob*) near permanent water sources (and the newly formed towns), subsisting off a resident herd of milk camels as well as grains, tea and sugar purchased by livestock sales. Today Rendille settlements represent a dichotomy between those fully pastoral, that is, with sufficient livestock in residence to feed the human population with milk, meat, and trade, and those more sedentary, located in permanent or semi-permanent residence around the mission towns without sufficient herds of resident livestock and subsisting on grains obtained from trade, wage labor, or food-aid donated by mission or government agencies.

While much has been written about the social consequences of adopting a more



Map 1. Location of Rendille in North Central Kenya

sedentary existence among pastoralists (cf. Ingold 1987; Fratkin 1989a), empirical investigations of concomitant changes in such areas as economics, subsistence patterns, and human ecology remain relatively rare. Yet these factors are important in understanding the ramifications of pastoralists becoming sedentary. For example, among the Rendille the distance of Domestic settlements from permanent water sources influences how many animals can be kept in residence, as those at greater distances will have more pasture opportunities than those closer to water sources, which tend to be overgrazed. Consequently, those settlements that can remain at some distance from water points can keep more milk animals, and presumably have greater access to food, particularly milk, for human consumption. Factors limiting the distance of settlements from water include both labor time to herd small stock to water (they must have water every two to three days), and the ability to transport water back for the human community.

H. Jurgen Schwartz (1979), a veterinary biologist formerly with the UNESCO Integrated Project in Arid Lands (IPAL), developed a model of Rendille settlement stressing the loss of loading or transport camels (castrated males termed *hal*) as the determining factor in the transition to sedentism. In Rendille society camels are rarely ridden, but serve as the main means of transport for water and household belongings. It is in this last role that Schwartz argues camels determine Rendille land use and pasture utilization.

Schwartz' model is based on thirty-one Rendille settlements observed in 1979. For each, the average number of camels per household was recorded, as was the distance in kilometers to the nearest water source. Consideration of factors including the walking pace, water transport capacity, and ratio of working to feeding time of loading camels in relation to average Rendille household water requirements, led Schwartz to hypothesize that households with less than two camels would have to settle within walking distance (2-3 kilometers) of a main

water source. Interpreting his data, Schwartz (1979:165) noted:

All settlements with less than three camels per household were located within 2.5 kilometers from the water source. Five out of eight settlements with three to six camels per household were at or beyond five kilometers from water and four out of eight with more than six camels per household settled at or beyond eight kilometers from the water source.

Ramifications of the linkage between loading camels and mobility are three-fold. First, households within five kilometers of water are commonly on poor, overgrazed pasture, resulting in inferior milk production year round. Second, the annual load of intestinal parasites and ectoparasites is heavier in much frequented pastures close to permanent waterholes, further reducing animal health and inevitably, milk production. Third, settlements within a five kilometer radius of permanent water must send a larger proportion of their already reduced herds to distant fora camps due to poor grazing conditions. Consequently, largely sedentary groups clustered around waterholes are at much greater risk of drought-induced famine.

If the model is correct, variation in the number of loading camels per household is a prime determinant of Rendille land and pasture utilization, a major factor in the transition to sedentism and should be an important factor in any future Rendille restocking program.

In a first attempt to further test this model we applied binary Ordinary Least Squares regression to Schwartz' data (as adopted from Schwartz' original Diagram 1, Schwartz 1979:172). This revealed a significant relationship between camels and settling distance ($F = 23.85, p < 0.001$) but explained less than one-half the variation in the data ($r^2 = 0.43$). As such, the veracity of the original model remains debatable. Yet due to its potential importance to past and future Rendille settlement patterns we attempted to further, albeit indirectly, test Schwartz' model.

Material and Methods

While not possessing cross-sectional data pertaining to distance from water source and number of loading camels, Fratkin (1987b) completed species-specific livestock counts from two Rendille settlements, separated by a ten-year time span. The first was drawn from the pastoralist settlement of Rungumo in 1976, located in the Kaisut Desert between Illaut and Korr, while the second was conducted among sedentary Rendille at the town of Korr in 1985 (see map 2).

In both cases households formed the unit of analysis, with household defined as the smallest domestic group with its own herd (n. Rungumo = 19, n. Korr = 20). To assess differences in herd composition with respect to camels, cattle and small stock univariate and multivariate analyses were performed. Univariate tests centered on Student t-tests per species. Multivariate analysis focused on logistic regression analysis with the dependent variable settlement pattern, represented by the dichotomy "Nomadic/Sedentary". As reviewed by Aldrich and Nelson (1984:12-19), the use of logistic versus Ordinary Least Squares regression is favored in the case of categorical dependent variables, since the use of such variables frequently violates the OLS specification of a linear model. Logistic regression utilizes the logit transformation to assess dependent variables', either discrete or continuous, effects upon a categorical dependent variable.

Results

A) Univariate Analysis

Univariate analysis of the two samples on a species-by-species basis is shown in Table I. Statistical measures include the sample means, standard deviations, coefficients of variation and Student t-scores. The overwhelming first impression of the data is the magnitude of impoverishment for the 1985 sample with respect to camels and cattle. The average household's camel holdings is only 7% of the earlier, pastoralist sample ($t < 0.001$).

Another ramification of drought is the change in herd composition. In the 1976 sample camels are the predominant species, with cattle in a secondary role. This reflects traditional Rendille animal husbandry patterns. Camels are highly adapted to the arid Kaisut Desert environment of the Rendille, while cattle, which must be watered more regularly, are better suited to the wetter highland environments utilized by the neighboring Samburu or Ariaal (Fratkin 1987a). Yet by 1985, under sedentary conditions, cattle constituted the primary large stock species in the Korr sample. This Ariaal-like herd composition was also noted in livestock censuses conducted on a *per capita* basis for Ariaal and Rendille, as shown in Table II. Despite different sample sizes and collection techniques (ground counts versus aerial surveys) the IPAL and Korr data concur in the shift to cattle for the Rendille.

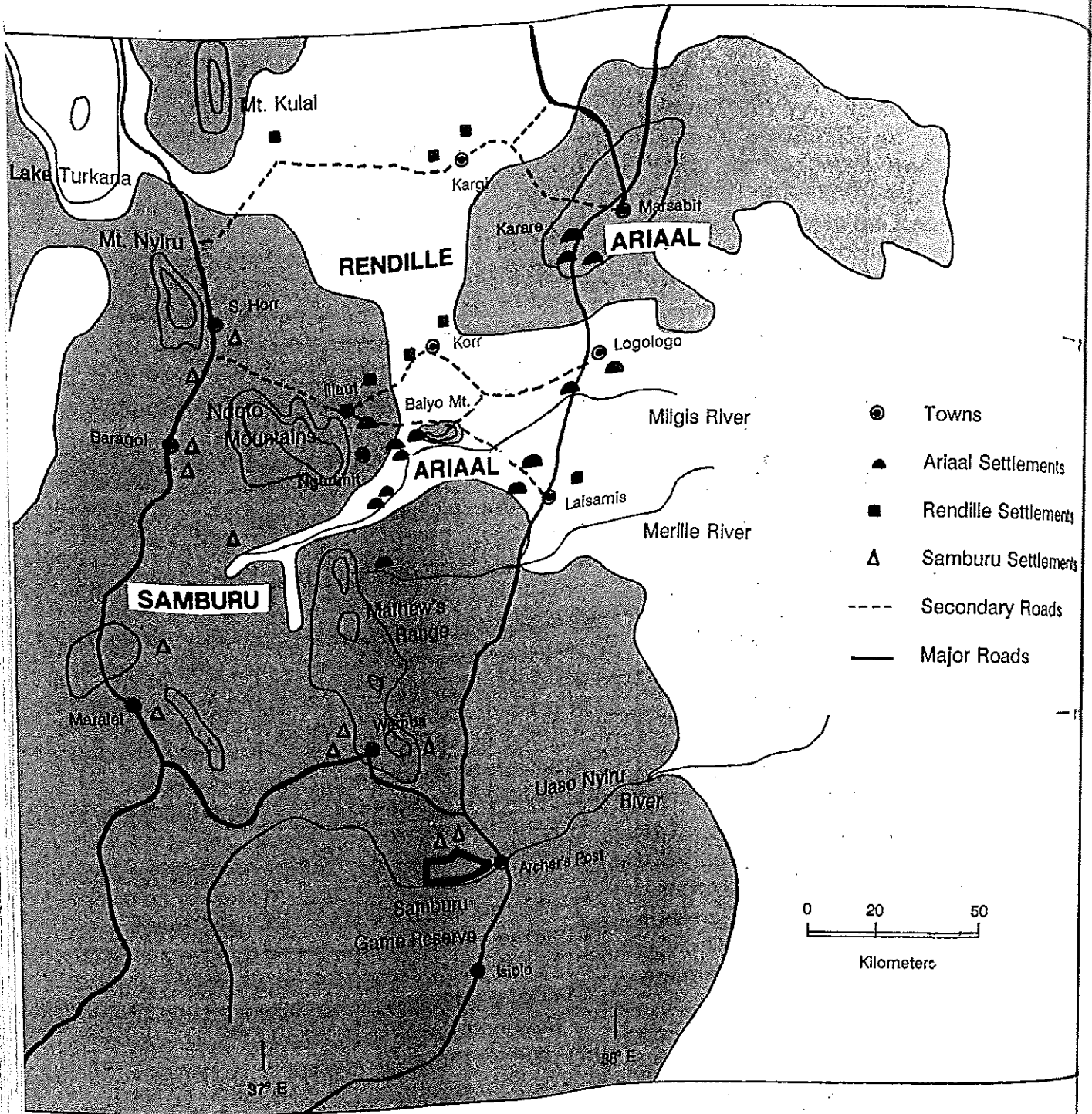
This break with traditional Rendille camel pastoralism is due to an increased involvement with a cash economy. In northern Kenya beef has a greater commercial value than camel meat, owing to a market brought about by greater demand and a larger supply. In addition, Rendille are reluctant to sell their slow-reproducing camels, on which they depend primarily for milk and transport (see Fratkin 1990; O'Leary 1985; Sato 1980; Schwartz 1979). As such, the recent emphasis on cattle production is encouraged by the Kenyan government and IPAL, who have urged the development of improved marketing conditions, veterinary services, registering of tribal rangelands, and grazing controls (Fratkin 1991, chapter 6; IPAL 1984:485-489; Republic of Kenya 1983:35).

Another difference between the pastoral and sedentary samples is the increased small stock holdings of the latter. Although not statistically significant, increased small stock herd size in Korr reflects both impoverishment and traditional economic strategies. Rendille society measures wealth and prestige via large stock whose status is related both to their copious supplies of milk and their role in ritual consumption and exchange, e.g. age-set rituals and brideprice.

Table 1. Household herd sizes, Rongumo 1976 versus Korr 1985 by species

SPECIES	Rongumo		Korr
Camels			
x	18.95		1.37
S.D.	10.43		1.38
C.V.	55.04		101.06
Student's t	7.28***		
Cattle			
x	11.65		2.63
S.D.	10.99		4.25
C.V.	94.37		161.33
Student's t	3.44**		
Small stock			
x	38.35		60.68
S.D.	19.54		93.18
C.V.	50.95		153.55
Student's t	1.05*		

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$



Map 2. Rendille, Ariaal, and Samburu Settlements

Lacking large stock, poorer Rendille families concentrate on small stock, specifically goats and sheep. Their faster reproductive rates relative to camels and cattle (cf. Wilson et al. 1985:140-142) permit quick cash sales or trading to acquire desired large stock.

A final noteworthy aspect of the univariate measures shown in Table I is the increased variation in the Korr sample for all species considered, as measured by the Coefficient of Variation (Thomas 1986:86). This measure expresses standard deviations as percentages, allowing comparison between samples with greatly different means. The extremely large coefficients for the Korr sample denote increased variation in holdings despite greatly reduced herd sizes. This agrees with findings that drought exacerbates rather than negates, household wealth differences as measured in livestock holdings (Fratkin and Roth 1990).

Rendille pastoralism is provided by multivariate analysis, which simultaneously considers camel, cattle, and small stock composition, yielding a closer approximation of Rendille mixed-species pastoralism.

Table III presents results of the logistic regression analysis as performed by the SAS (1986) CATMOD routine. The table shows the independent variables, CATTLE, CAMELS, and SMALL STOCK, along with Maximum Likelihood Coefficients, standard errors, chi-square values, and individual coefficients multiplied by their antilog. The dependent variable was settlement pattern, dichotomized as sedentary versus nomadic. Maximum Likelihood Coefficients refer to the logarithm of the odds of belonging to the sedentary Korr sample relative to the pastoral Rungumo settlement. Invoking the odds of probability makes these coefficients difficult to interpret. Therefore, following the

Table 2. *Per capita livestock ownership, Ariaal and Rendille Proper*

sample	human population		camels	cattle	small stock
Ariaal-Lewokoso	1976*	269	1.62	4.59	8.02
Ariaal-Lewokoso	1985*	239	2.69	3.64	13.40
Rendille Rongumo	1976*	119	3.46	2.30	9.19
Rendille Proper	1976-81	12,900**	1.40	1.90	9.50

*Fratkin 1987:98

**IPAL 1984:268

B) Multivariate Analysis

Univariate analysis indicated that the most significant difference between the sedentary and nomadic samples was with respect to camels. However a better representation of

methodology of El Tom et al. (1985) Maximum Likelihood Estimation coefficients were multiplied by their antilogs to determine the multiplicative effect on an independent variable upon a dependent variable. Thus a

Table 3. Results of logistic regression analysis

variable	maximum likelihood coefficient	standard error	chi-squared value	coefficient X antilog
cattle	-0.0862	0.0825	1.09*	0.9174
camels	-0.1405	0.0671	4.39**	0.8690
small stock	+0.0082	0.1011	0.66*	1.0082

* $p > 0.05$

** $p < 0.05$

coefficient of 1.0 indicates no effect, those above 1.0 a positive effect, and those less than 1.0 a negative effect.

Coefficients for the CATTLE, and CAMELS variables are negatively signed, reflecting the lower herd sizes for these animals in the Korr group. In contrast, the SMALL STOCK coefficient is positively signed, denoting increased small stock holdings for sedentary households. While these findings conform to the univariate analysis, a major difference is that only one variable, CAMELS, is statistically significant ($p < 0.05$) while the other two are not (prob. SMALL STOCK = 0.30, prob. CATTLE = 0.42). We interpret these findings as supporting Schwartz' (1979) model of camel holdings, especially loading camels, as the prime determinant of Rendille mobility.

Summary and Discussion

The preceding analysis of diachronic livestock data represented a household-level viewpoint of the historic trend towards decreased mobility for Rendille pastoralists. Inherent in this analysis is the recognition that different species within a mixed-species pastoral system have different economic utilizations. Among the Rendille goats and sheep are viewed as sources of meat, while their high

reproductive rates enable them to be used as sources of income. In contrast, cattle constitute a source of milk during the wet season, after they have calved, as well as possessing an increasing cash value. Camels represent the most valuable livestock in terms of food production and transport. Their long lactation periods (up to nine months) translate into a year long milk source. Camel blood, either mixed with milk, or alone, is an important source of protein, while camel meat is consumed, primarily during ritual feasts or upon the natural death of an animal. In addition to dietary usages camels are the main means of water and household transport (Schwartz 1979).

It is in this last role that Schwartz proposed loading camels as the prime determinant of Rendille settlement patterns. In the present sample camel holdings represent the most significant difference between pastoralist and sedentary samples in the univariate comparison, as well as the only significant difference in the multivariate analysis.

These results are interpreted as supporting Schwartz' original model. However, lacking data on sex-specific camel holdings necessary for discriminating hal from other camels, and having small sample sizes means that this support is indirect. Yet, these findings do

clearly point to important considerations for the future of Rendille pastoralism. For example, they suggest that any future restocking programs should feature camels, rather than the usual concentration on small stock (cf. Hogg 1983). Sedentary Rendille could not regain a pastoralist way of life from small stock restocking. Indeed, the immediate result of such programs could be an even greater concentration of livestock in a limited area, exacerbating the rangeland degeneration and desertification sometimes attributed to Rendille sedentism (cf. O'Leary 1984, 1990).

While increasing livestock densities, small stock would most likely be utilized by the Rendille as a means of acquiring large stock. As noted, while the former possess faster reproductive rates, permitting higher take-off levels, the latter are more important for Rendille nutrition, economics, and ritual. An interesting question arising from the 1985 data is, would Rendille now primarily invest in camels or cattle? While the cattle dominated Ariaal livestock composition represents ecological strategies as well as Samburu cultural influences, the recent Rendille emphasis on cattle reflects an increasing interaction with a cash economy. Once again this phenomenon entails practical implications, for much has recently been made of the advantages of camels over cattle in arid zones of northern Kenya, with respect to factors ranging from population growth to rangeland overgrazing (cf. Stiles 1983a,b,c).

A continuing trend toward cattle for the Rendille may result in adoption of the Ariaal pattern of moving cattle camps from the Kaisut Desert to the moister Ndoto or Mt. Marsabit Highlands. Conversely, it may also lead to increased sedentarization, with settlements devoid of milk camels forced to live in close proximity to famine-relief centers. Already home to most sedentary Rendille, these locales could suffer the synergistic consequences of increased rangeland degeneration coupled with higher rates of sedentism. Consideration of these factors highlights the future, as well as the past, roles of camels in Rendille pastoralism, with respect

to mobility, nutrition, economics, and culture change. In light of our findings current restocking programs being considered in this area should focus on the camel as a main priority.

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