

Commission on Nomadic Peoples

“Camel pastoralism in the Butana and Northeastern Sudan”

B. Abbas, N. Chabeuf, G. Saint-Martin, P. Bonnet, A. Millaird, H. Beshir and B.E.
Musa

Nomadic Peoples, Number 31, 1992

The Commission on Nomadic Peoples of the International Union of Anthropological and Ethnological Sciences (IUAES) is collaborating with the Ford Foundation to digitize, preserve and extend access to the journal of *Nomadic Peoples*. For more information regarding the journal *Nomadic Peoples* visit the Commission on Nomadic Peoples website at www.nomadicpeoples.info and the Berghahn Books website at www.berghahnbooks.com

Camel Pastoralism in the Butana and Northeastern Sudan: an interdisciplinary study

B. Abbas & N. Chabeuf & G. Saint-Martin & P. Bonnet & A. Millaird & H. Beshir & B. E. Musa

This study is concerned with gaps in knowledge about camel pastoralism in the Sudan. Areas of competence-building for researchers have been identified in an interdisciplinary fashion and through consultation with local pastoralists. The results of research activities show different herding strategies paying particular attention to herd status, composition, and to female performance. Four herding systems incorporate a variety of modes of adaption. Future research work, dealing with disease, environmental and nutritional aspects and social aspects surrounding the integration between pastoralism and agriculture is called for. Improvements in nutrition, health and housing are to be recommended.

Camels are mainly reared by pastoralist groups who invariably utilise outlying marginal ecozones in any particular country. These groups, in their search for the most suitable circumstances for camel well-being, have to move over large areas of often diverse habitats. Pastoralist movements—or migrations—are determined by a host of factors such as rains, diseases and insects, predators, range and land use implications (Monod, 1975; Niamir, 1991). Camels are put to various uses even by members of the same pastoralist group (Ahmed, 1976; Abu-Sin, 1982). There is variability in aspects such as herd size, her structure, breed, preference, and complementary activities adopted alongside camel-keeping. All of these variations have definite implications on social development (Putman, 1984; Hogg, 1991; Niamir, 1991).

There is at the present time an upsurge of interest in the actual and potential production of the camel. Scientists, governments and of course a lot of pastoralist groups have realised the most valuable characteristic of the camel, namely, its ability to survive *and produce* under extremely harsh conditions (Knoess, 1977; Hjort and Dahl, 1984; Hussein, 1984; Knoess *et al.*, 1986). The role of camels in sustenance of large sectors of

the rural population (Hailley, 1980; Reusse, 1982; Gebre-Mariam, 1987) as well as the contribution of camels to the international trade of several developing and drought-stricken countries have been well documented (Reusse, 1982; Clark, 1985; Khalifa, 1987).

Scope of the Study

The work presented in this article is part of a research and development project targeted towards pastoralists in eastern Sudan (Saint-Martin, 1990). It was acknowledged from the start that a lot of information is lacking; that we need to understand problems at the grassroots level and that we need to gradually incorporate the interested population in the intended project. Thus, the study was approached in a spirit of "useful dialogue" between pastoralists and a group of workers from different research institutions. In addition to intensifying the social link between researchers and pastoralists, a wide array of multidisciplinary data was obtained. No claim can be forwarded for strict randomness of the survey method, but the large number of camels included in this study is important and will yield reliable observations.

The study employs a standardised survey method used successfully for the collection of interdisciplinary data on camel pastoralism with the following aims:

- a) to describe the patterns of traditional camel herding (in eastern Sudan).
- b) to identify the major constraints in camel production.
- c) to identify the possible research priorities on camel productivity.

The Butana area of Sudan was chosen as the main study area because of its vast plains which are the traditional abode of numerous pastoralist groups who rely mainly on camel husbandry for their living (ILO, 1965; Abbas and Musa, 1986; Abu-Sin, 1986). The salient features of the collected data will be presented here. Further information is to be published subsequently.

Description of the Study Area

The Butana lies in eastern central Sudan, extending over 120,000 km², roughly one third of the area of the Eastern State. The area is a peninsula¹ delimited by the River Nile in the west, the Rahad river in the south and southwest and the Atbara river in the east and north (Map 1). Butana terrain is characterised by easily flooding uniform plains, composed predominantly of clay, and clay-and-sandy soils. Most of the Butana lies within the low rainfall savannah, with a smaller portion extending into the semidesert agro-ecological zones of the Sudan (Darrag, 1989).

Methods of Study

A pilot survey of the study area was initially made. A number of herders and local leaders were consulted, and it was conveyed to the pastoralists during these encounters that the "outside" world would really like to help them, but that there are problems. One, perhaps the most important, is the lack of knowledge on many specific aspects of their life, their animals, namely the camel, and their economy. Their interest in and effort to open a mutual dialogue between them and the outside world was solicited.

The support of tribal leaders for this study was crucial. However, all the Sheikhs, Chiefs and Subchiefs consulted were enthusiastic and appreciated the need for scientists, technicians and interviewers to have more contact with pastoralists, and to obtain reliable data. It was also made clear that the researchers and the material to be collected had nothing to do with government policy, and that the data would remain anonymous.

Implementation of the Survey

The study area was divided into three sectors and in each sector a town was chosen as a logistics centre. The three sectors (*and towns*) were as follows:

- 1) Central and southern Butana (*New Halfa*) sector.
- 2) Gash, eastern Butana and Atbara river (*Aroma*) sector.
- 3) Northern Butana and the Nile (*Eddamer*) sector.

In each of these sectors a number of locations were chosen as surveyor sites (or camps) from which interviewers would travel 50 km in 5 days going each week in a different direction (i.e. north, northeast, east etc.) for 8 weeks (Fig. 1). A total of 21 sites were selected such that the whole study area and surroundings were represented (Map 2).

The area to be surveyed from each site was either a full circle, a half circle or a triangle, depending on such conditions as terrain, natural barriers and pastoralists' movements during the study (June–September 1987).

The interviewers received a 2-week training session in the survey organisation. They were taught how to ask questions and complete questionnaire formats (described below). A booklet containing detailed procedures for completing the questionnaire as well as some recommendations regarding approach to pastoralist interviewees was given to the interviewers to use as reference throughout the study. Small amounts of animal medicines were provided to dispense to cooperative herders in compensation for answering questions. Three "controller" teams headed alternately by three

of the authors made unscheduled visits along the predetermined path of each interviewer to make independent observations, supervise the work of the interviewer, provide logistics, collect completed questionnaires and supply new ones. These visits were also very important in view of the harsh conditions in the area and the frequent need for supplies. The interviewers used camel-transport most of the time. Occasionally, especially when shifting from one direction to the other (Fig. 1), they used motor vehicles or were picked by one of the controller teams.

The Questionnaire

The questionnaire was based on a model previously tested in Saudi Arabia and Niger. It was adapted to the conditions and requirements of the present study and translated into Arabic.

Each questionnaire included 3 forms (Tables 1-3).

Form 1: Herd Status (Table 1) records data on herd structure regarding species, status of ownership, seasonal movements, need (and source) of non-pasture fodder, water during the dry season, and supportive or main activity besides herding. A section of this form addresses constraints to camel production as perceived by the camel-keepers. The interviewee was asked to mention what he considered to be problems and these were recorded. He was then asked to rate the most important problem, the second most important and so on. Unlabeled boxes in the constraints section are for any other problems interviewers may emphasise.

Form 2: Herd Composition (Table 2) records information on camel-herd composition with, up to 20 animals per sheet. The interviewer used as many sheets as required for each herd. Individual camels composing the herd were viewed, and breed, sex, age, origin, number of pregnancies (for females) and use were recorded.

Form 3: Female Performance (Table 3) records information on breeding and

calving of between three and seven adult female camels in each herd to a maximum of nine calvings. Calves lost from the herd and the causes of loss were recorded.

All adequately completed forms were taken to France for processing, following translation into English.

On average, an interviewer performed one interview per day, allowing sufficient time for detailed and reliable data collection (Fig. 2).

A total of 17,865 camels (11,348 females, 6,517 males) belonging to 822 herds were surveyed².

Results

The mean herd size was 29.36 camels. Means for other species raised alongside camels are shown in Table 4. The pastoralists encountered during the study belonged to 20 major tribes. The most predominant tribes were the Shukriya (24%), the Kowahla (14%), the Lahawine (13%), the Hadendowa (12%) and the Rashaida (11%). It is interesting to note that the sample contained groups of Fulanis (0,1%) and Kabábish (0,2%), which had probably recently migrated into eastern Sudan, as both tribes are traditional natives (or en-route emigrants) of western Sudan (Table 5).

Herding Systems

Multivariable factor analysis was used to group the 822 different herds into clusters using the following characteristics as determinant factors:

- a) herd size
- b) number of owners
- c) level of sedentarisation/nomadism
- d) use of labour for herd-keeping
- e) owner's supportive activities
- f) dry-season feeding
- g) watering source

Other factors such as tribe, location and camel breeds were taken into account. As a result, four distinct herd types or herding systems were obtained as follows:

Type 1

These are herds belonging to a semi-sedentary single owner, keeping a small number of camels (sixth percentile=1-5 camels; third percentile=5-30 camels, mean=12 camels). The herds depend mainly on trees and herbage in the riverine areas of Aroma, Atbara river and the Nile, rarely grazing during the dry season, depending almost exclusively on forests and crop residues from irrigated agriculture. The diet of these herds is always supplemented, and the herd-owners do not pay for water. A high percentage of males are devoted to labour (30 percent compared to 15 percent general average). Representing tribes included the Hadendowa (Gash area); Gaalyin, Fadnyia and Hassanyia (Nile); Lahawine, Busharin and Manasir (Atbara river). The herds in this group invariably include a number of small ruminants. The owners are seasonal farm employees in the irrigated schemes or towns (Shendi, Alyab, Berber, Eddamer, Shewak, Aroma) in the area. These herds are also characterised by a high and early offtake rate: between 15 percent and 24 percent after 2 years of age, compared to and general average of between 3 percent and 5 percent.

Type 2

These are camels usually belonging to several owners who hire between one and four keepers and rarely raise other ruminants. The herds move over large areas extending throughout eastern and northeastern Sudan, but range predominantly in eastern Butana, Gedaref and Gallabat during the rainy season. Some go as far as the Red Sea hills during the winter. The mean number of camels in these herds was 84 and the range was 37 to 156. Most of the time, the herd-owners pay for watering and utilise crop residues from rainfed agriculture. Representative tribes are the Bawadra and Rashaida, with a few Kowahla, Massalamia and a small group of Lahawine (Mageet and Gawamis subtribes). The predominant occupation of herd-owners (except for the Rashaidas) is agriculture and commerce. Some (6 percent) cultivate areas during a good rainy season.

Type 3

These are herds belonging to a single agropastoralist who keeps camels in addition to cattle and small ruminants. During the rainy season, the camels are always taken into the Butana, where a paid keeper is employed. In the dry season, camels are fed on crop residues from irrigated schemes. The owner is a sedentarized farmer during most of the year. Herd size ranged between 9 and 65 with a mean of 39 camels. Tribes practising this type of herding are mainly the Shukriya (86 percent), Kowahla and a few Lahawine. These herders are slowly becoming sedentarized around the New Halfa Scheme.

Type 4

These are herds belonging to a single owner who is a true transhumant pastoralist. They graze only on natural pasture and their diet is occasionally (selectively) supplemented during the dry season. The herd-size is highly variable, but predominantly large (over 50 camels) in addition to small numbers of sheep and goats. Herd size ranged between 20 and 200 with a mean of 62 camels. This type of herding is practised by most of the pastoralists who utilise Gedaref and New Halfa districts as homelands and rarely move outside this circle. The representative tribes are Kowahla, Rashaidas, Lahawine, Kenana, Araqee, some of the Shukriya, and a small portion of Hadendowa. Type 4 herds are characterised by a low mortality rate before the age of 1 year (8 percent compared to a general average of 12 percent). They also have a low adult offtake rate (9.5 percent compared to a general average of 15 percent).

Camel Breeds in the Area

The breed distribution is given in Table 6. The major breeds were the Arabi (66 percent), Anafi (19 percent) and the Bushare (12 percent). A limited number of cross-breeds (Arabi-Bushari; Arabi-Anafi etc.) and unidentified crosses, totalling 0.9 percent were recorded. Two breeds, namely the Kenana and Hasab were recorded for the

first time, although in small numbers. The Kenana camels were originally owned by tribes residing along the Blue Nile and the Rahad River (Kenana, Araqee etc.), while the Hasab refers to a small focus of an as yet undescribed camel breed from the Gash area. Most of the camels (92 percent) are obtained by breeding within the herd, while 7.3 percent are purchased (Table 7). A small number of camels are exchanged as gifts or left with another herd as a "trust".

Camel Uses

Table 8 summarises uses of camels. It shows that 86.3 percent of camels are used for breeding purposes (and milk production); 3.7 percent for sale, 5.4 percent for racing, 2.3 percent for riding, 1.0 percent for work (earning income), while 1.3 percent are used for packing by the family or the herder.

The original computer output produced 22 different uses of camels (not shown) which were in fact a detail of the seven basic uses illustrated in Table 8. For example, 0.025 percent of males are designated as stud animals for riding-breeding, in comparison to 0.3 percent of females are used for that purpose; 0.4 percent of males and 0.8 percent of females are used as breeders of racing camels. It is worthwhile noting that most—if not all—camels bred for racing are intended for sale as soon as they are spotted by the numerous middlemen engaged in the racer-camel trade between Sudan and Arabia³.

Female Reproductive Performance

The frequencies of gestation were recorded according to the age of the camels (Table 9). It is clear that camels in the area have a very low rate of reproduction. Extremely few females (2 percent) have their first calf between the age of 3 and 4 years, while 10 percent have it between 4 and 5 years; only by the age of 5–6 years would 37 percent of dams have their first calf. Most camels (58 percent) however, have their first calf at 6–7 years of age. A constant 3–4 percent of

females remain unproductive throughout the years. The intercalving interval was found to be 2.4 years. However, the camels have a relatively long breeding life; 50 percent of third calvings and 47% of fourth calvings take place between 13 and 15 years of age. The annual calving rate of breeding females was 35 percent.

Most of the births (70 percent) occurred between May and August, while the rest were scattered throughout the year with a minor peak (20 percent) during the winter (January–March). Figure 3, the global composition of the camel herd, is a diagram of the "pyramid of ages", which shows that males are kept until 16 years of age and females up to 20 years. The general shape is coherent with that of a herd which is freshly managed with a low scarcity of animals aged 1 to 2 years which could not be due to mortality alone, since the latter should also be reflected in later years or other generations.

Discussion

Research is being conducted on the camel in many parts of the world. However, progress in this field has been relatively slow, partly because of the inaccessibility of camel pastoralists and their continuous movements. Another factor is the tendency for piecemeal handling by researchers of an area of study which should be considered in broader terms (Hogg, 1990). The need for regional and international coordination of research on camel pastoralism has been duly emphasised (Little, 1984; Wilson, Araya and Melaku, 1990).

Statistical analysis demonstrated (at least) four distinct types of herding or herd management and land-use strategies. Only one system of herding, namely type 4 is reminiscent of the classical nomadist—transhumant character upon which most of the ancient literature on "camelmen" was based. The other three categories of pastoralists are slowly sedentarizing around rural towns or new agricultural schemes, while strongly retaining their camel (and other

livestock)-keeping culture. Thus, more subtle analysis or observation could well reveal a more dynamic nature of pastoralism in this area (Morton, 1987) such as has been observed in other countries, particularly in Somalia (Al-Najim, 1991). For instance, as a result of agricultural development in the area, i.e. the New Halfa Agricultural Scheme, most of the Shukriya have deserted their old villages and camps in the Butana in favour of new settlements around the new town (New Halfa) and scheme. Interestingly, they have retained the names of their ancient camps and villages; thus there is a New Suffia; New Subaq; New Gailey etc. They have also retained camel-keeping, in addition to incorporating cattle in the herd, obviously to exploit the now more readily available feed from the Scheme. In fact, in some specific instances, individuals have established new camel herds by purchasing camels very cheaply at the peak of the most recent drought in 1984. This could mean a cultural bond towards camel-keeping or a realisation of economy in the venture, or both (Dahl, 1981; Western, 1982). However, one thing is definite, namely that camel-keeping is compatible with farming development. A consideration of the data on camel uses, in conjunction with herding strategies would show that camel-keeping is even complementary to agricultural development. Camels can provide labour, traction, milk, meat and sporting activity (race shows) in a set-up socially vantaged for these utilities. Unfortunately these aspects are too often neglected by planning authorities (Salih, 1990).

Recurrent droughts, misguided policies and an imbalanced demographic set-up have taken their toll over the years in Sudan. From an exporter of food in the 1960s, the country is now "managing crisis". The pastoralists pay for the chronic grain shortage in two vicious ways: first they lose more pastures year after year to make room for haphazardly-expanding mechanised agriculture; and secondly they resort to destocking at unfair prices at the peak of each crisis. In order to forward the case of

pastoralists, we recommend appropriating land for them for agricultural development (with the necessary technical and financial assistance) rather than continued insistence on "preservation" of their method of land use in the face of current pressures and circumstances. Pastoralists stand to lose in the end, basically because of their weak political structure in comparison to other pressure groups, namely the bank-backed farmers and farming merchants. Proof of the feasibility of this option is to be found in examining the composite type 2 herding system. The herd-owners (except the Rashaidas) are predominantly ex-pastoralists who have accumulated wealth from agriculture and re-invested in wholesale crop trade or camel exporting (Rashaidas). This group includes owners of some of the largest herds in the area. Yet their way of life and interests are alien to those of all other herders, and perhaps even the Rashaidas who statistically fall into the same category. By acquiring more and more scheme land annually, they increase their income (from sesame and sorghum sales, rent of machinery, bank loans) and are guaranteed plenty of fodder from crop residues, often enough to supplement the herd until the next rainy season. Willing pastoralists are excluded from this system by a series of regulations or mortgage requirements etc. A notable example of the latter are the Rashaidas, who have the necessary capital and the interest (often voiced in council meetings and letters to Governors, Presidents etc.), but no "tribal rights". As a result, the Rashaidas are the biggest buyers of scheme residues in the Gedaref and New Halfa areas. Those who do not choose to buy residues (often a considerable expenditure⁴) migrate to pastures in remote areas, such as the Red Sea hills or the Dinder forest (well beyond the natural camel habitat).

Another option concerns those pastoralists who are slowly settling around irrigated schemes in New Halfa (type 2 or on the Atbara river, in Nile Province and the Gash delta (type 1). These pastoralists or agro-pastoralists have apparently abandoned the

classic camel-keepers' mode of living (e.g. type 4) and are slowly taking up farming as an alternative. The driving force behind their choice appears to be the ongoing desertification of their traditional rangelands (Abbas and Musa, 1987). They have moved closer to the aforementioned rivers and become involved in share-cropping or hired labour, while still keeping camels, which they use both as beasts of burden and a source of milk. They provide a valuable service to the population of small-scale farmers (5 to 10 hectare plots) by transporting crops, wood, fodder etc. Hence the significance of packing animals in their herds.

In order to raise the standard of living of these groups as well as afford them some measure of food security, they could be allotted small plots alongside the settled farmers. Since the major problem hindering expansion of the schemes in the areas mentioned (New Halfa, Gash, Atbara, Nile valley) is irrigation, the administration of these schemes could be subsidised to use better technology with the purpose of allocating water for new plots specifically designed for these potential mixed-farmers. Such investments need not be prohibitively expensive, and the cost can gradually be retrieved. The planners of such a venture should bear in mind, right from the start, the pastoralist background of these new beneficiaries.

The different ways pastoralists utilise camels demonstrate that camels are still useful. Most of the camels are kept for breeding and milk production. Camel milk (and sorghum) are the main food items throughout the study area. In view of the increasing use of motor vehicles as a means of transport, the value of camels as milk producers (Knoess *et al.*, 1986) is gaining more significance. Thus camels today can justifiably be termed the "cows of the desert" rather than the "ship of the desert" of previous decades.

In addition, camels contribute to local traffic, crop trade, and rural industry. A total of 50 oil mills powered by camels were in-

cluded as components of the labour uses of camels summarised in Table 8. These mills press sesame and groundnuts and have been in operation since time immemorial in Kassala, Kordofan and Darfur Provinces. In fact, the present S.M.S., a relatively large and modern Sudanese vegetable-oil company, was originally a camel-powered oil mill established in the 1920s. Other labour uses of camels included drawing water from wells, a tradition still in operation in the northern peripheries of the Butana (Nile Province).

The structure of camel herds recorded in this study is consistent with that observed elsewhere (e.g. Hjort and Hussein, 1986) and indicates that males are marketed when they reach the age of 5 to 6 years, while females are retained as long as possible even when they are sterile. A constant 2-4 percent of females remain unproductive throughout the years.

The low percentage of animals aged 1 to 2 years can best be explained by reference to the climatic conditions prevailing in the area during the 2-3 years preceding the study period. The years 1983-85 were the worst years in decades for Sudanese pastoralists in terms of rainfall and pasture condition (Abbas and Musa, 1986; Abdalla and Akasha, 1987). As a result, we suggest that camel breeding was minimal during those years. This hypothesis is supported by several observations indicating that the breeding activity of both male and female camels is directly associated with humidity, lower temperatures and good nutrition (Volcani, 1954; Novoa, 1970; Abdel-Raouf *et al.*, 1975; Yagil and Etzion, 1980; Osman, 1986). These observations are also in line with the opinion expressed by several pastoralists, namely that male camels would not rut and females would not show signs of heat in a bad year.

Since gestation takes approximately 1 year and because of the rather long intercalving interval of she-camels (Wilson, 1989), the low percentage of camels aged 1 to 2 years during the year of study (1987) could be a reflection of the diminished re-

productive activity of camels in response to the drought prevailing from 1984 to 1986.

The low fertility of camels has been observed by several workers (e.g. Wilson, 1984, 1989; Hjort and Hussein, 1986), but specific causes have not yet been clarified. Endocrinological studies seem to point to the male camel as the controller of the species prolificacy. For example, male rutting is associated with internal hierarchy, so that only one male camel ruts at a particular time, and in most instances this single male continues its dominance over other males through the breeding season (Ramous and Tingari, 1983; Tingari, Rahama and Saad, 1984; Osman and Ploen, 1986). Osman (1986) suggested that most control over male camel sexual behaviour is vested in the pineal gland. At high temperatures, this gland exerts an inhibitory effect on gonadotropin secretion, leading to reduced secretion of testosterone and diminished sexual activity. On the other hand, Yagil and Etzion (1984) attributed the low fertility of camels to female factors, i.e. delayed puberty, long intercalving period, delayed postpartum oestrus and a short oestrous cycle. With improved nutrition, the same authors were able to obtain oestrus 25–40 days postpartum and to reduce the intercalving period to 1 year. However, their observations were based on only six camels, and the early oestrus obtained (after gonadotropin administration) in two camels was not followed by pregnancy. Likewise, Homeida *et al.* (1986) were able to induce an early oestrus in two she-camels by hormonal modulation, but the oestrus was not followed by the development of a functioning corpus luteum. Since mating is prerequisite for ovulation in the camel (Novoa, 1970; Musa and AbuSineeina, 1978), the role of male camel behaviour in overall reproductive efficiency cannot be overemphasised.

Conclusions and Recommendations

Camel husbandry continues to be a viable mode of living for pastoralist groups in eastern Sudan.

Development of the old system of transhumance and nomadism has included partial sedenterization around agricultural schemes and investment of wealth accumulated from trade and grain production in camel-rearing.

There is need for research into a number of aspects of camel pastoralism. The following objectives could be prioritised for research at the present time:

- a) Causes of low fertility, e.g. male factors, environmental and nutritional effects, causes of neonatal or prepartum mortality.
- b) Incorporation of pastoralists in agricultural development, e.g. the allocation of land and other sources for camel (and other livestock)-rearing, co-operative ranching, improvement of veterinary and range services.
- c) Performance of camels under improved conditions of nutrition and health and housing, e.g. fattening projects; milk production in the vicinity of provincial capitals and reproductive performance using techniques similar to the cattle industry.

Notes

¹ Indeed, in ancient literature, Butana was referred to as "Merowe Island" (see [From Sudan Folk Culture] by Dr. Abdel Magid Abdeen, *Dar El Sudania*, Khartoum 1972, pp. 6–9 [Arabic]).

² The cost of sampling one camel was (calculated) 2.7 Sudanese pounds, equivalent to 0.27 USD by market exchange rates (1987).

³ In one incident, an Anafi 4-years old racer camel was bought immediately after a race show by one of the agents of a Gulf prince. The camel was transported by plane from Kassala airport to the Gulf (July 26, 1987, Mastura, Kassala). The price was 120,000 Sudanese pounds.

⁴ The price for a 1,000 hectare post-harvest scheme was 60,000 Sudanese pounds in 1987, and 75,000 in 1990, approximately the price of 12–15 camels.

References

- Abbas, B. and B. E. Musa 1986, "A Rapid Field Survey of Camel Husbandry in the Northern Butana". Group document No. SRC 12:1–13. Addis Ababa: ILCA (International Livestock Centre for Africa).
- 1987, "Some Aspects of Camel Ecology in Northern Butana, Sudan", in M. A. Mohamed Salih and B. E. Musa (eds.), *Camel Production as a Food System*. Mogadisho and Uppsala: SOMAC/SIAS (Somali Academy of Sciences and Arts/Scandinavian Institute of African Studies).
- Abdalla, A. J. and F. Akasha 1987, "Camel Pastoralists of Kordofan Region: problems of survival and adaptation 1983–1985", in M. A. Mohamed Salih and B. E. Musa (eds.), *Camel Production as a Food System*. Mogadisho and Uppsala: SOMAC/SIAS.
- Abdel-Raouf, M., E. M. R. Fateh and M. M. Owaida 1975, "Studies on Reproduction in the Camel (*Camelus Dromedarius*). V. Morphology of the testis in relation to age and season", *J. Reprod. Fert.* 43:109–116.
- Abu-Sin, M. E. 1982, "A Change in Strategy of Animal Rearing Among the Nomads of the Butana, Eastern Sudan. A case study in adaptive responses and change in the semi-arid areas of the Sudan", in G. Heinnitz (ed.), *Problems of Agricultural Development in the Sudan*. Estingea.
- 1986, *Breeding and Marketing of Racing Camels in Eastern Sudan: the case of Butana District*. Mogadisho and Uppsala: SOMAC/SIAS.
- Ahmed, A. M. 1976, *Some Aspects of Pastoral Nomadism in the Sudan*. Khartoum University Press.
- Al-Najim, M. N. 1991, *Changes in the Species Composition of Pastoral Herds in Bay Region, Somalia*. Pastoral Development Network Paper No 316. London: ODI (Overseas Development Institute).
- Clark, N. T. 1985, "The Effect of the 1973/74 Drought in Somalia on Subsequent Exports and Registered Slaughtering of Camels, Sheep, Goats and Cattle", *Nomadic Peoples*, 17:53–57.
- Dahl, G. 1981, "Production in Pastoral Societies", in J. G. Galaty et al. (eds.), *The Future of Pastoral Peoples*. Ottawa: International Development Research Centre.
- Darrag, A. 1989, "Sudan's Experience in Range Rehabilitation and Improvement", in *International Symposium on the Development of Animal Resources in the Sudan*. Khartoum.
- Gebre-Mariam, A. 1987, *Livestock Production and its Socioeconomic Importance among the Afar in North-East Ethiopia*. Mogadisho and Uppsala: SOMAC/SIAS.
- Hailley, P. J. 1980, *Camels in the Horn of Africa*. Proceedings of International Workshop on Camels, Khartoum, Sudan, Dec. 1979. Sweden: International Foundation for Science.
- Hjort, A. and G. Dahl 1984, "A Note on the Camels of the Amarar Beja", in W. R. Cockrill (ed.), *The Camelid: an all-purpose animal*. Uppsala: SIAS.
- Hjort, A. and M. A. Hussein 1986, *Camel Herd Dynamics in Southern Somalia: long term development and milk production implications*. Mogadisho and Uppsala: SOMAC/SIAS.
- Hogg, R. 1990, *An Institutional Approach to Pastoral Development: an example from Ethiopia*. Pastoral Development Network Paper No. 30d. London: ODI.
- Homeida, A. M., B. E. Musa and F. H. A. Mohamed 1986, *Induction of Oestrus in Camels by the Use of Estradiol Benzoate*. Group Document No. SRC 12. Addis Ababa: ILCA.
- Hussein, M. A. 1984, *Comparative Study of the relationship Between Family Size, Herd Size and Management Among Nomadic Pastoralists*. Camel Forum Working Paper No. 4. Mogadisho and Uppsala: SOMAC/SIAS.
- ILO: International Labour Office 1965, *Sudan: Sedentarisation of Nomadic Tribal Population in the Butana Region of Northern Sudan*. Geneva: ILO.
- Khalifa, A. H. 1987, "The Marketing of Sudanese Camels", in M. A. Mohamed Salih and B. E. Musa (eds.), *Camel Production as a Food System*. Mogadisho and Uppsala: SOMAC/SIAS.
- Knoess, K. H. 1977, "The Camel as a Meat and Milk Animal", *World Animal Review*, 22:39–44.
- Knoess, K. H. et al. 1986, "Milk Potential of the Dromedary, with Special Reference to the Province of Punjab, Pakistan", *World Animal Review*, 57:11–21.
- Little, P. D. 1984, "Critical Socioeconomic Variables in African Pastoral Livestock Development", in J. R. Simpson and P. Evangelou (eds.), *Livestock Development in Sub-Saharan Africa*. Boulder: Westview.
- Monod, T. 1975, *Pastoralism in Tropical Africa*. International African Institute London: Oxford University Press.
- Morton, J. 1987, *The Decline of Lahawine Pastoralism*. Pastoral Development Network Paper No. 18c. London: ODI.
- Musa, B. E. and M. E. Abusineina 1978, "The Oestrous Cycle of the Camel (*Camelus Dromedarius*)", *Veterinary Record*, 103:556–557.
- Niamir, M. 1991, *Traditional African Range Management Techniques: implications for rangeland management*. Pastoral Development Network Paper No. 31d. London: ODI.

- Novoa, C. 1970, "Reproduction in the Camelidae: a review", *J. Repr. Fert.* 22:3-20.
- Osman, D. I. O. 1986, *Factors Possibly Associated with Seasonality of Breeding in Male Camels*. Group Document No. SRC 12. Addis Ababa: ILCA.
- Osman D. I. O. and L. Ploen 1986, "Spermatogenesis in the Camel (*Camelus Dromedarius*)", *Anim. Repr. Sci.*, 10:23-36.
- Putman, D. B. 1984, "Agropastoral Production Strategies and Development in the Bay Region", in T. Labahn (ed.), *Proceedings of 2nd International Congress of Somali Studies*, Vol. 3. Hamburg: University of Hamburg Verlag.
- Ramous, A. S. and M. D. Tingari 1983, "Morphology of the Camel Testis in Relation to Reproductive Activity", *Anat. Rec.*, 205:106-110.
- Reusse, E. 1982, "Somalia's Nomadic Livestock Economy: its response to profitable export opportunity", *World Animal Review*, 43:2-11.
- Saint-Martin, G. 1990, *Evaluation de la Recherche Cameline au Soudan pour le FIDA*. Unite de Coordination Pour l'Elevage Camelin. Maisons-Alfort: I.E.M.V.T.
- Sallh, M. A. Mohamed 1990, "Government Policy and Options in Pastoral Development in the Sudan", *Nomadic Peoples*, 25-27:65-78.
- Tingari, M. D., B. A. Rahama and A. H. M. Saad 1984, "Studies on the Poll Glands of the One-Humped Camel in Relation to Reproductive Activity. I. Seasonal morphological and historichemical changes", *J. Anatomy*, 138:193-205.
- Volcani, R. 1954, "Seasonal Variation in Spermatogenesis of Some Farm Animals under the Climatic Conditions of Israel", *Refuah Veterinarian*, 11:169-174.
- Western, D. 1982, "The Environment and Ecology of Pastoralists in Arid Savannas", *Development and Change*, 13:(2)183-211.
- Wilson, R. T. 1984, *The Camel*. London: Longman Group.
- 1989, "Reproductive Performance of the One-Humped Camel. The empirical base", *Rev. Elev. Med. Vet. Pays. Trop.*, 42:117-125.
- Wilson, R. T., A. Araya and A. Melaku 1990, *The One-Humped Camel: an analytical and annotated bibliography*. Technical Paper Series No. 3. New York: United Nations Sudano-Sahelian Office.
- Yagil, R. and Z. Etzion 1980, "Hormonal and Behavioral Patterns in the Male Camel (*Camelus Dromedarius*)", *J. Repr. Fert.*, 58:61-65.
- 1984, "Enhanced Reproduction in Camels", *Comp. Biochem. Physiol.*, 79:201-204.

Acknowledgements

We would like to thank Mr. El Hadi Saleh for expert assistance with maps and figures, and Mr. Zein El Abdeen Osman for typing the manuscript. The cooperation of the field veterinarians Dr. Y.E. Sheikh, N.M. Nayel, and Dia E/Din is greatly appreciated. This work was supported by grants from the University of Khartoum (Sudan) and I.E.M.V.T. (France).

B. Abbas, Ph.D. in Veterinary Medicine, Associate Professor, Director of Camel Research Unit, University of Khartoum.

Hamed Beshir, Veterinarian, Graduate Student, University of Khartoum.

Pascal Bonnet, Veterinarian, Graduate Student, I.E.M.V.T., France.

Noel Chabeuf, Ph.D., Animal Science, former Deputy Director, I.E.M.V.T., France.

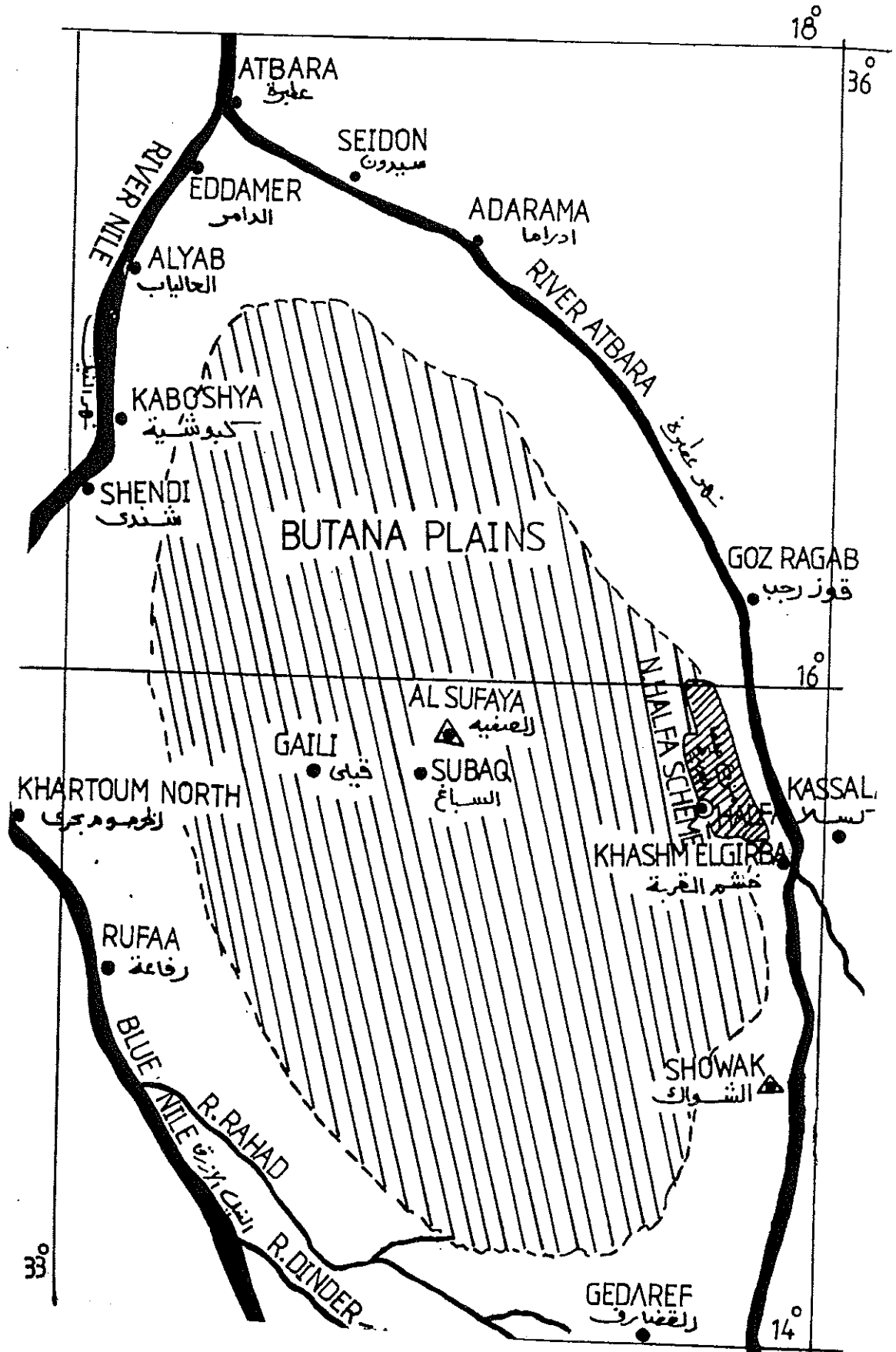
Antoine Millaird, Veterinarian, Graduate Student, I.E.M.V.T. France.

B. E. Musa, Ph.D., Veterinary Surgery, Professor, former Dean and Head of Camel Research Project, University of Khartoum.

G. Saint-Martin, Ph.D., Animal Science, Director, Unité de Coordination pour Elevage Camelin, I.E.M.V.T., France.

Appendix: Maps, Figures and Tables

Map 1. Butana Plains, Sudan



Map 2. Distribution of sampling sites for survey of camel pastoralism in Northeastern Sudan, 1987

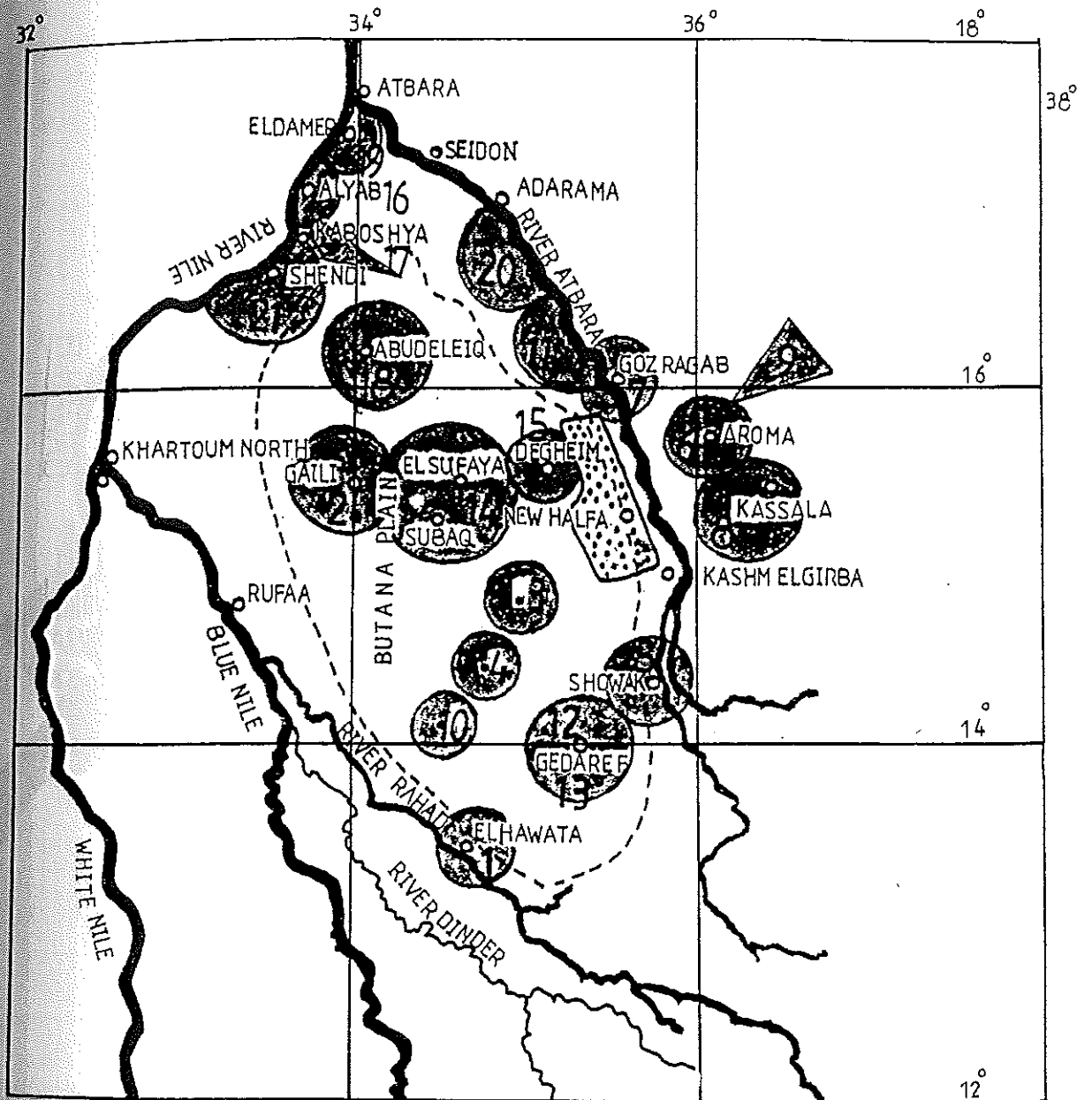


Figure 1. A hypothetical diagram and interviewer route through a survey site

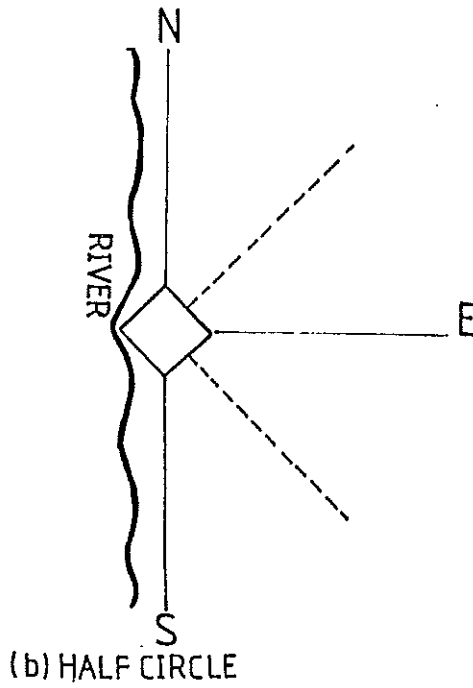
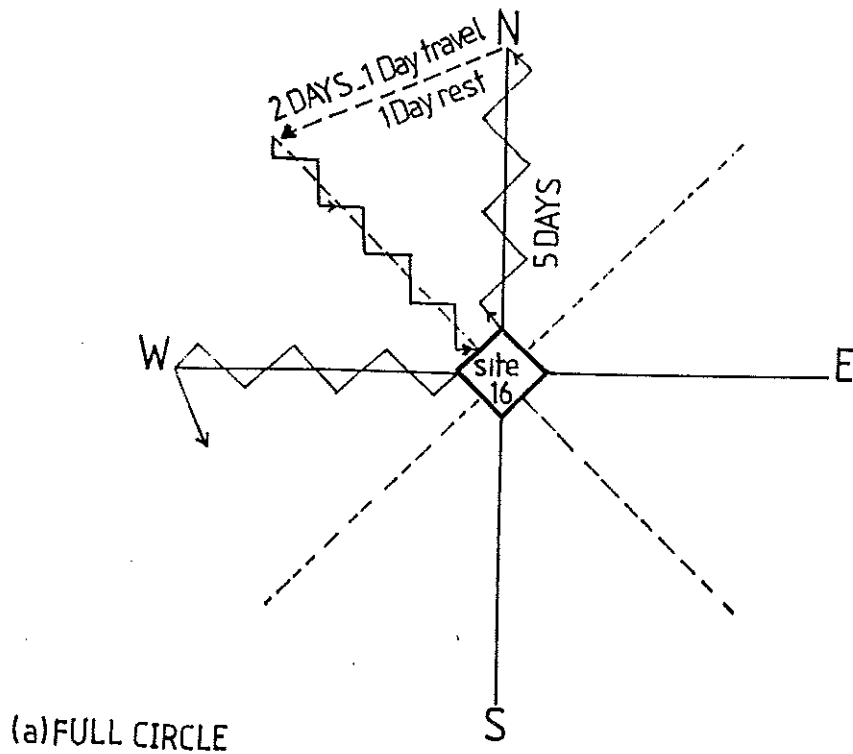
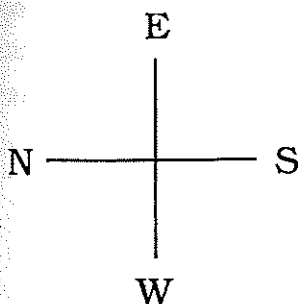
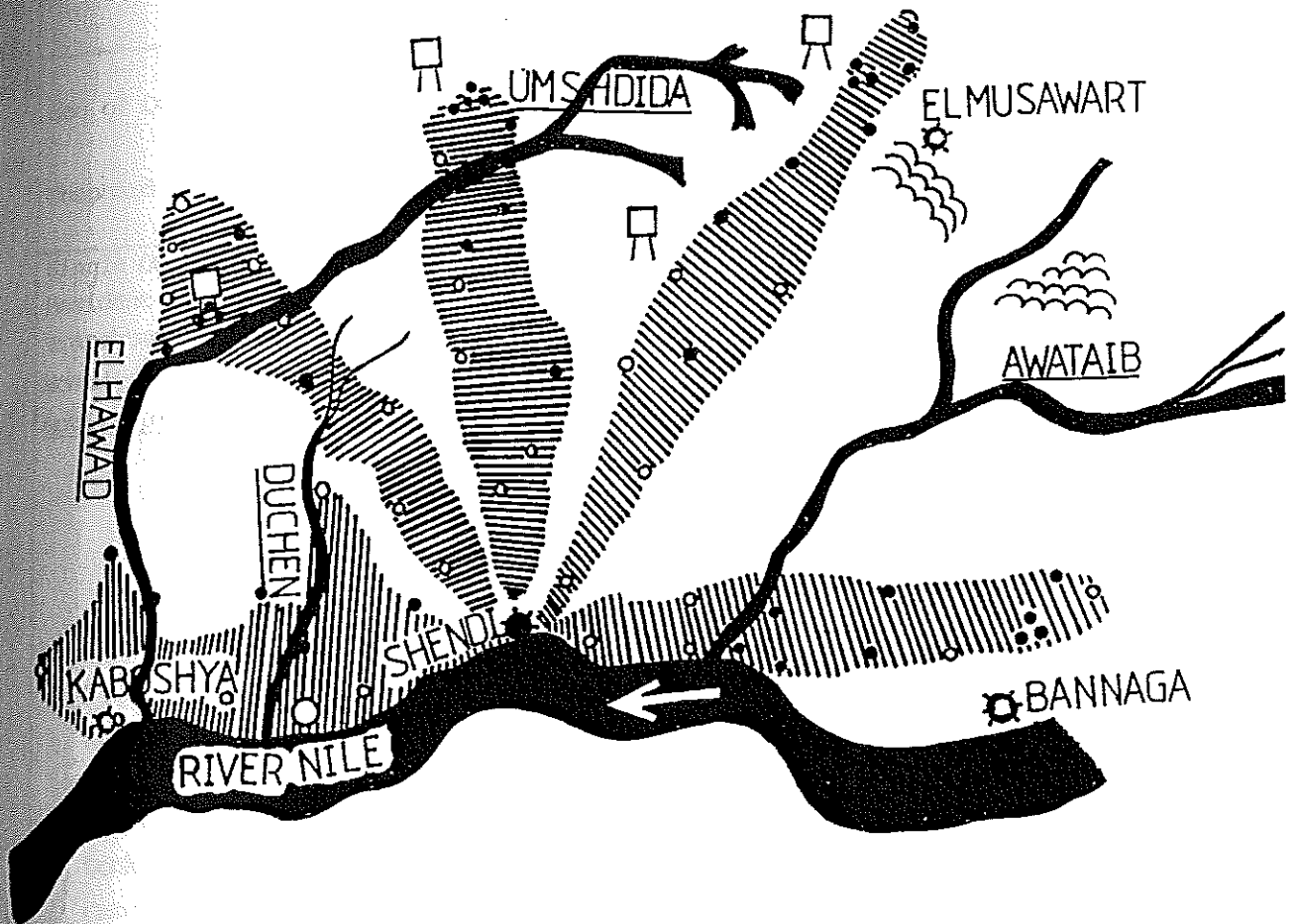


Figure 2. An example of one surveyor's progress through a site (Nile sector, Shendi site, Aug.8 to Sept.9, 1987)



- ✱ surveyor site
- locations where interviews were made
- locations visited but no camels
- ⌘ tube well
- ⌘ mountains
- ⌘ rural towns
- ELHAWAD: desert stream

Figure 3. Global composition of camel herd (Northeastern Sudan, 1987; 822 herds, 17,865 camels)

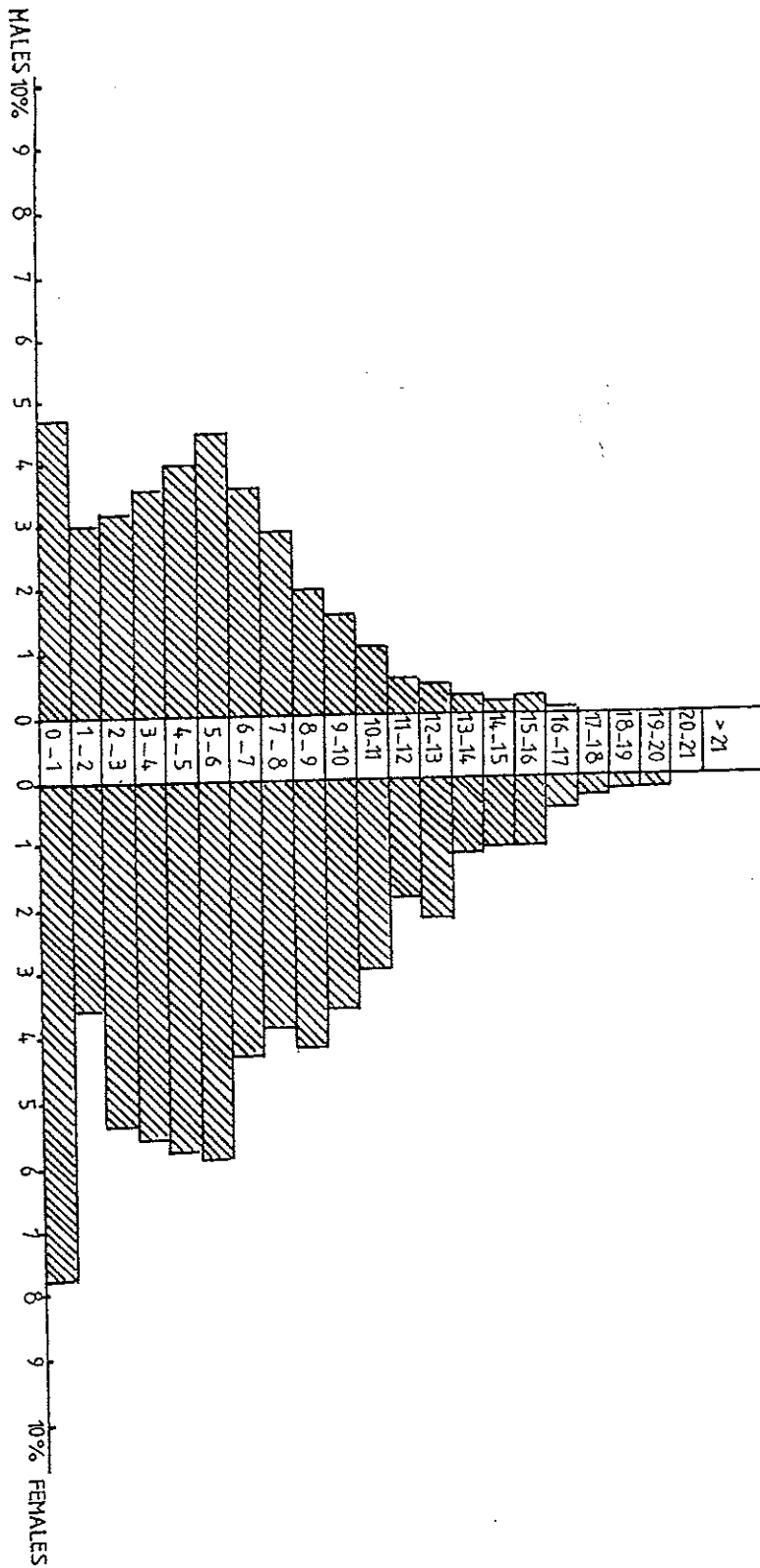


Table 1. Herd Status

DISTRICT _____		PROVINCE _____ village or Camp _____ Tribe/Subtribe _____		Site
Son of Owner <input type="checkbox"/>	Owner <input type="checkbox"/>	INTERVIEWEE		Interviewee
Shephard <input type="checkbox"/>	Relative <input type="checkbox"/>	Wife <input type="checkbox"/>	Age <input type="text"/>	
Single Owner <input type="checkbox"/> Resident <input type="checkbox"/> Transhumant <input type="checkbox"/> Nomadic <input type="checkbox"/> <u>Activities</u> : Livestock <input type="checkbox"/> Breeding <input type="checkbox"/> Agric. <input type="checkbox"/> Trade <input type="checkbox"/> Paid Job <input type="checkbox"/> Other <input type="checkbox"/>	No. Co. Owners Composed of Resident _____ No. _____ Transhumant, _____ Nomadic _____ _____village _____Families Belonging to	Ownership		
Cattle Sheep Goats Horses Donkeys Camels Concen. Fodder Pasture	No. of Livestock	WATERING POINTS a sources Pay Free V R W H <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Summer <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Autumn <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Darat <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Winter ↑ ↑ ↑ ↑ <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	HERD Mobility	
Water <input type="checkbox"/> Capital <input type="checkbox"/> Range <input type="checkbox"/> Calf mor- <input type="checkbox"/> tality <input type="checkbox"/> Securing <input type="checkbox"/> Pneumonia <input type="checkbox"/> Labour <input type="checkbox"/> Stomash <input type="checkbox"/> Diseases <input type="checkbox"/> COMMENTS	CONSTRAINTS/PROBLEMS	Owner <input type="checkbox"/> Wife <input type="checkbox"/> Son <input type="checkbox"/> Relative <input type="checkbox"/> IF PAID Food <input type="checkbox"/> Cash <input type="checkbox"/> Camels <input type="checkbox"/> Milk <input type="checkbox"/> Other <input type="checkbox"/>	HERDER	

Sig.

Date

Survivor

Table 2. Herd Composition

Owner Shepherd		INTERVIEWEE			SERIAL NO. Page No.		
Remarks	Purpose	No. of CALVINGS	Source	Age	Comments		No.
					Sex	Breed	
							1
							2
							3
							4
							5
							6
							7
							8
							9
							10
							11
							12
							13
							14
							15
							16
							17
							18
							19
							20
Sig.		Date			Surveyor		

Table 3. Female Performance

Owner <input type="checkbox"/>	INTERVIEWEE	Serial No. _____
Shepherd <input type="checkbox"/>		Page No. _____
		Breed _____
<input type="checkbox"/> - Born	<input type="checkbox"/> No. of Calvings	Age <input type="checkbox"/> _____
<input type="checkbox"/> - Trist		
<input type="checkbox"/> - SALE		
<input type="checkbox"/> - Gift		Birth date (year/season)

TWINS	(CALF)				Calvings		Age
	Age at Loss	Reason for Loss	Present ?	Sex	Date	Calf No.	
							1
							2
							3
							4
							5
							6
							7
							8
							9
							10
							11
							12
							13
							14
							15
							16

Sign.

Date

Surveyor

Table 4. *The species composition of 822 camel herds (Northeast Sudan, 1987)*

Species	No. of herds	Mean	Standard deviation	Variance
Cattle	208	12.31	16.9738	288.1113
Sheep	429	60.29	154.7769	23955.9154
Goats	482	22.44	70.8881	5025.1288
Horses	6	1.66	1.0327	1.0666
Donkeys	353	3.18	5.7874	33.4951
Camels	822	29.36	32.1376	1032.8311

Table 6. *The breed distribution of 822 surveyed camel herds*

Breed	Male		Female		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Arabi	4,303	24.1	7,484	41.9	11,787	66.0
Bushari	782	4.4	1,336	7.5	2,118	11.9
Anafi	1,187	6.6	2,218	12.4	3,405	19.1
Arabi-Bushari	11	0.1	24	0.2	35	0.3
Arabi-Anafi	12	0.1	25	0.2	36	0.3
Kenana	3	0.0	9	0.1	12	0.1
Anafi-Bushari	6	0.0	8	0.0	14	0.1
Hasab	2	0.0	0	0.0	2	0.0
Arabi-Kenana	15	0.1	7	0.0	22	0.2

Table 7. *Distribution of 17,865 camels according to origin*

Origin	Male		Female		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Born in herd	5,745	32.2	10,720	60.0	16,465	92.2
Purchased	748	4.2	558	3.1	1,306	7.3
Gift	16	0.1	51	0.3	67	0.4
"Trust"	8	0.0	19	0.1	27	0.1

Table 5. The different tribes of camel pastoralists in Northeastern Sudan (1987)

Tribe	Frequency*	Percent
Amar'ar	1	0.1
Araquee	3	0.4
Artega	18	2.2
Batahine	28	3.4
Beni Amer	28	3.4
Busharin	45	5.4
Fadnyia	7	0.8
Fulani	1	0.1
Gaalyin	36	4.3
Hassanyia	4	0.5
Hadendowa	100	12.0
Kababish	2	0.2
Kenana	19	2.3
Kowahla	120	14.4
Lahawine	105	12.6
Manasir	6	0.7
Massalamia	5	0.6
Rashaida	97	11.6
Rufa'a	8	1.0
Shukriya	201	24.1

* Number of herds

Table 8. *Distribution of camels according to use (Northeastern Sudan, 1987)*

Utilization	Male		Female		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Breeding	5,028	28.1	10,382	58.2	15,410	86.3
Pack	168	0.94	86	0.31	254	1.31
Sale	314	1.8	133	1.3	447	3.2
Racing	450	2.5	526	2.9	976	5.4
Riding	318	1.8	89	0.5	407	2.3
Work	129	0.7	59	0.3	188	1.0
Stallion	92	0.5	0	0.0	92	0.5
Unspecified	18	0.1	73	0.4	91	0.5

Table 9. *Frequency of gestations according to age of breeding female camels*

Gestation No.	Percentage of females Age group (years)												
	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15
0	98	90	63	34	21	10	9	4.5	4	3	3	3	4
1	2	10	37	58	54	29	10	5.5	3	2	0	2	2
2	0	0	0	8	23	48	54	45	31	17	8	3	3
3				0	2	12	25	34	31	50	63	54	12
4					0	1	1	10	30	18	18	23	47
5						0	1	1	1	9	7	7	19
6							0	0	0	1	1	8	9
7										0	0	0	2
8													2