A close look at a rare African breed — the Kuri cattle of Lake Chad Basin: origin, distribution, production and adaptive characteristics

C.L. Tawah, J.E.O. Rege* and Gertrude S. Aboagye**
International Livestock Research Institute, P.O. Box 5689, Addis Ababa, Ethiopia

Received 8 July 1996; accpeted 18 June 1997

The Kuri is a rare, little known breed of cattle of the Hamitic Longhorn (*Bos taurus longifrons*) type which is found on the islands and shores of Lake Chad Basin in the area covering the common borders of Cameroon, Chad, Niger and Nigeria. It is taller and more massive than its longhorn counterpart, the trypanotolerant N'Dama. The Kuri is trypanosusceptible. It is a dual-purpose milk-and-meat breed which is tolerant of insect bites and has excellent swimming abilities. It has unique bulbous horns which are believed to aid in flotation as it searches for water weeds, its main food. The Kuri is very well adapted to the aquatic conditions of the Lake but is susceptible to heat stress and solar radiation. The breed is quite fertile, with a reported age at first calving as early as 36 months and a calving interval as short as 15 months. Indeed, the Kuri cow can produce as many as 12 calves in her lifetime. The cow is capable of producing as much as 6 kg of milk a day after feeding her calf and fattens well on pasture and in feedlot. Meat quality of the Kuri is considered exceptional. The limited data on its population and distribution suggest that the Kuri can only survive in the environs of the Lake and is rapidly declining in numbers. Possible reasons for the declining trend include drought, protracted civil conflicts in the region, the retreating waters of the Lake and extensive crossbreeding with the zebus when they graze on the shores. The trend is exacerbated by lack of improvement programmes for the breed. The authors suggest immediate action to assess the extent of zebu introgression and the establishment of a breeding/multiplication centre in the Lake area for characterization, enhancement and conservation of the breed.

Keywords: Breed conservation, characterization, Hamitic Longhorn, Kuri cattle, Lake Chad

*To whom correspondence should be addressed

**Current address: Department of Animal Science, University of Ghana, Legon, Accra, Ghana

Introduction

The Kuri is a rare and little known breed. It is believed to be descended from the Hamitic Longhorn (*Bos taurus longifrons*) cattle and settled on the shores and islands of Lake Chad. Also known as the Baharie, Bare, Borrie, Boudouma, Dongolé, Koubouri, Buduma, or White Lake Chad, the Kuri has been herded for many centuries by the Buduma and Kuri tribes who, in ancient times, migrated from what are now Libya and Sudan into Lake Chad. Hardly comparable to other breeds in Africa or elsewhere in its unmistakably characteristic huge horns, the Kuri is much bigger and taller than the N'Dama and the average zebu (Stewart, 1937). The importance of the Kuri lies not only in its unmistakable characteristic features — its gigantic size and immense horns — but also its meat and milk production potentials. They are so acclimatized to the environs of Lake Chad that they are unable to survive elsewhere.

This rare gene pool which is unique to Africa is unfortunately threatened (FAO, 1975; Adeniji, 1985). The Kuri population is declining and body size is becoming smaller. The major causes of the declining trend include the retreating waters of the Lake and the resulting reduction in the sole habitat of the Kuri. The rangelands resulting therefrom have become populated with zebu cattle, notably Arab Shuwa and M'Bororo zebus, thereby providing greater opportunity for interbreeding. As a result, the Kuri is in the process of being absorbed by the zebu (Queval *et al.*, 1971). Kuri owners have developed preference for the Kuri × zebu type cattle primarily because of the reputation of the crosses for higher milk yield and greater fertility. Zebu-owning tribes in mixed crop farming areas prefer the crossbred because of its large size and, hence, enhanced abilities as a draught animal. Additionally, the population is threatened by protracted civil wars (Ngere, 1990) and drought and rinderpest (Adeniji, 1985). As a large human population in the region depends on the Kuri, its extinction could pose a potential threat to the region's animal agriculture. The objective of this publication is to compile available conventional and 'grey' information on the origin, distribution, population, habitat, production systems, phenotypic and genetic characteristics of the Kuri. In making the information known, gaps and inadequacies that need to be addressed can be identified and an awareness created for the establishment of utilization, enhancement and conservation programmes for this rare breed.

Origin and classification

The origin of the Kuri is obscure and uncertain. One theory considers the Kuri as a pure Hamitic Longhorn which descended from the ancient Egyptian or Hamitic Longhorn as depicted in the Egyptian drawings (Stewart, 1937; Ross, 1944; Gates, 1952; Rouse, 1970; Renard, 1972). The Kuri probably branched off the stream of the Hamitic Longhorn on its north-westerly passage from Egypt and migrated southwestward through the Sahara desert (Esperandieu, 1952), possibly via the Sahelian corridor to Lake Chad. The huge and unique bulbous (pear-shaped) horns of this breed render it possible to identify its presence in rock paintings which are estimated to be approximately 5000 years old (Baker & Manwell, 1980). Epstein & Mason (1984) reportedly found rock engravings of the Hamitic Longhorn in northern Nigeria

which date to about 4000 BC. Kuri traces have also been found in the Saharan rock paintings (Fricke, 1979). Early rock paintings and engravings in Ethiopia and Somalia depict cattle of the Hamitic Longhorn type (Clark, 1954; Epstein & Mason, 1984). Additionally, Epstein (1971) reported the ubiquity of the Hamitic Longhorn in North Africa, Ethiopia, Kenya and Uganda.

Another theory considers the Kuri to be of the sanga (*Bos indicus* × *Bos taurus*) type (Curson, 1936; Curson & Thornton, 1936; Anonymous, 1950; Gates, 1952) which originated from the intermixture of the Lateral-horned zebu and the Hamitic Longhorn in Upper Egypt and Abyssinia (present-day Ethiopia). According to Curson & Thornton (1936) western nomadic tribes carried this breed and passed through the southern part of Sudan, skirted the tsetse fly belt of French Equatorial Africa, and settled in Lake Chad. Gates (1952) and Renard (1972) hold similar views: that the Kuri was established in southern Egypt from where it was subsequently introduced into Lake Chad by the Yemenites during their westward migration about the beginning of the Christian era. The presence of a rudimentary muscular hump on the cervico-thoracic vertebrae in the breed has been used to support its sanga ancestry (Renard, 1972). However, Gates (1952) contended that this hump is cervical. Moreover, Renard (1972) alluded to the fact that the extremities of the dorsal vertebrae, which are simple in taurine and bifid in zebu, are fused in the Kuri, their bifid character notwithstanding. Queval & Petit (1973) observed that the gene frequencies of the antigenic FV locus of the Kuri is similar to that of the Afrikaner, a sanga breed. However, these frequencies are also similar to those of the Brown Swiss, a European *Bos taurus* breed.

Other speculations about the origin of the Kuri also exist. For example, in Gates' (1952) paper, the Kuri is described as a *Bos gaurus* because of its similarity to the Asiatic wild gaur and the Banteng found in India and Malaysia. Stewart (1937) described the Kuri as the closest living relative of the ancient African Urus, *Bos primigenius Hahni*, probably because of similar features and suggested that the Hamitic Longhorn probably interbred with this old African Urus in its passage from Asia to Africa via Egypt. Petit & Queval (1973) alluded to the fact that the karyotype of the Kuri is similar to that of the *Bos taurus typicus* which is a breed of European origin. Malbrant *et al.* (1947a) described the cattle of Lake Chad as *Bos taurus Bolensis* which are said to closely resemble the Grey Steppe cattle of the Balkans, thought to have originated from Africa.

Despite the uncertainty about its origin, the Kuri undoubtedly has some Hamitic Longhorn ancestry. The presence of zebu features on the breed suggests some zebu influence starting possibly at the turn of the century.

Distribution and population statistics

The Kuri predominates on the shores and islands of Lake Chad which borders with Cameroon, Chad, Niger and Nigeria (Figure 1). Its main habitat is in southern Chad and north-eastern Nigeria but they are also found in northern Cameroon (ILCA, 1992), in the N'Guigmi province of Niger and, to a limited extent, in the Central African Republic (Payne, 1970). However, recent cattle statistics from the Central African Republic (ILCA, 1992) do not include the Kuri. Alberro & Haile-Mariam (1982) have reported that some Kuri cattle may be present in the lower regions of Illubabor province and around the Baro river in the Djikas district of western Ethiopia. Long-horned cattle with small humps, very similar to the Kuri have been observed around Mizan town in Illubabor (pers. obs., Rege). However, these are also typical characteristics of some East African sanga type cattle (e.g. the Abigar of Ethiopia and Sudan and the Ankole of Burundi, Rwanda, Uganda and Zaire). The major difference is the relative size

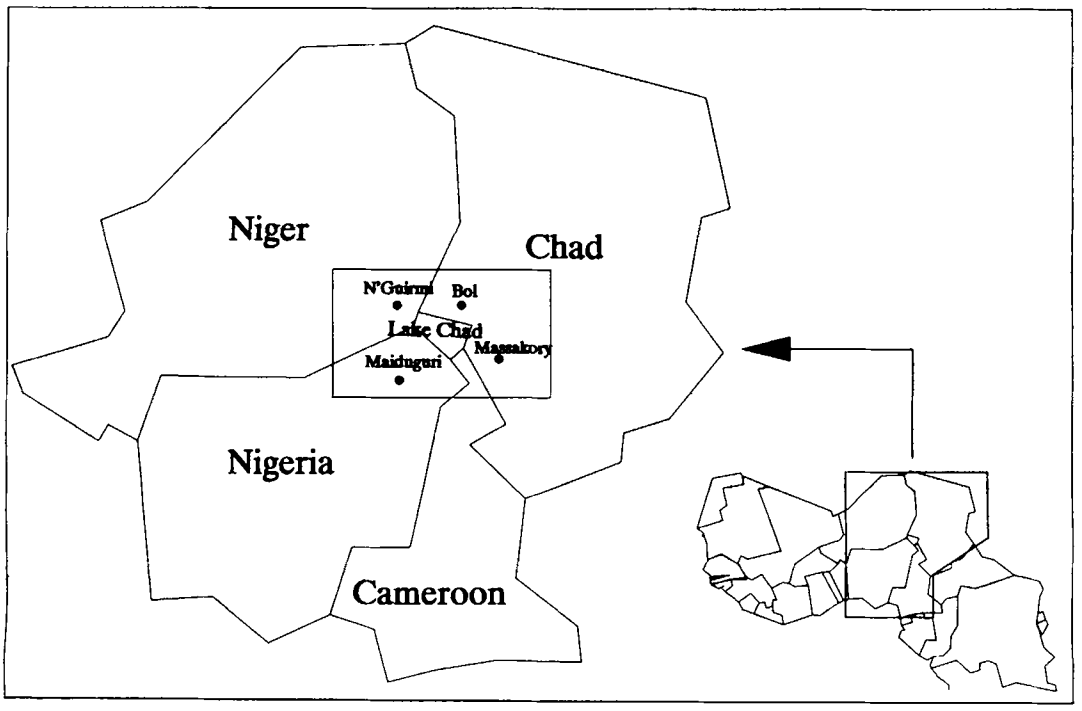

Figure 1 Map of Lake Chad showing distribution of Kuri cattle in the rectangle

of the horns at the base. Most of the pure specimens — which represent about 80 to 90% of the Kuri population in the Lake — are found on the islands of Djibadala, Koremeron, Debala and Bagabol (Malbrant *et al.*, 1947a; Bourzat *et al.*, 1992) and in the region of river Komadugu Yobe, extending into the regions of Manga and Tintouma (Payne, 1970). Some of these animals have been introduced into the shores of Lake Fittri and Lower Chari River in Chad (Adeniji, 1985). In Nigeria, Kuri herds are found mainly in the north-eastern States of Adamawa, Bauchi, Borno and Sardauna (Lamorde & Franti, 1973; Domingo, 1976), while in Cameroon they are present in the northern villages bordering the Lake. Generally, the Kuri is unable to survive outside the environs of Lake Chad Basin. In fact, attempts to introduce the breed in other agro-ecological zones, especially in Nigeria (Maiduguri) and Niger (Tillabery) have been unsuccessful.

Approximate population sizes of the Kuri breed and its distribution (Table 1) suggest that the breed is quite vulnerable, particularly in view of its localized, special but shrinking habitat. Moreover, most of these population estimates are outdated. Furthermore, there are some inconsistencies with the reported figures. Amongst the estimated 45 000 Kuri cattle in 1947/48, 30 000 were in Chad and the rest were in Niger (Renard, 1972). Queval *et al.* (1971) reported a figure of 50 000 for Chad. Renard (1972) reported a figure of 200 000 for the whole Lake Chad Basin. A figure of 7 000 head, including a female population of 3 500, was reported for Nigeria (Adeniji, 1985; Ngere, 1990). This figure is lower than a recently documented estimate of 13 947 (ILCA, 1992). However, the latter figure probably includes the rapidly expanding grade Kuri (Kuri × zebu crosses) population. The Kuri population in Niger is about 39 560 (ILCA, 1992), representing approximately 2% of the cattle herd of Niger, while that of Cameroon is estimated at about 5 800 (ILCA, 1992). The inconsistencies in population estimates in different countries is primarily due to difficulty in differentiating between pure Kuri and its crossbreds, the effects of livestock movements between countries and differences in methods of estimation. A systematic survey is needed to ascertain the population of the breed.

Although the extent to which Kuri is being crossbred with zebu is not known, it is believed that the actual number of pure Kuri is much lower than previously reported. In addition to the effects of crossbreeding, Kuri numbers have suffered from protracted civil wars (Ngere, 1990), drought and rinderpest (Adeniji, 1985). Additionally, the retreating waters of the Lake are reducing the habitat of the breed and providing opportunities for interbreeding with zebu cattle — notably Arab Shuwa and M'Bororo Zebus — as zebu-owning tribes move their cattle to graze the increasingly drying shores of the Lake. Indeed, zebu introgression dates as far back as the 1950s when floods of the Logone and Chari rivers inundated the lower islands and archipelagos of the Lake, causing deficits in pastures and high mortalities in the Kuri herds (Queval *et al.*, 1971). As a result, owners either crossed their Kuri with zebus, or purchased the latter to reconstitute their herds. A deliberate programme of crossbreeding of the Kuri and the zebus is also occurring. These events are responsible for an increasing number of grade Kuri — with slightly larger but less bulky horns than the true Kuri — within the outskirts of the Lake. Coulomb *et al.* (1980) have speculated that the remaining Kuri may be within the range of ten thousand head.

Table 1 Estimates of population sizes of Kuri cattle in Chad, Niger, Nigeria and Cameroon

Country/Location	Population size	Year	Source
Chad	30 000	1947–1948	Renard (1972)
	50 000	–	Queval *et al.* (1971)
Cameroon	5 800	–	ILCA (1992)
Niger	15 000	1947–1948	Renard (1972)
	39 560	–	ILCA (1992)
Nigeria	7 000	–	Adeniji (1985)
	13 947	–	ILCA (1992)
Lake Chad Area[1]	200 000	–	Renard (1972)

[1]Includes Chad, Niger, Nigeria and Cameroon

Environment

While the N'Dama, supposedly the closest living relative of the Kuri, is widely distributed throughout West and Central Africa, the Kuri is restricted to the shores and archipelagos of Lake Chad Basin (Figure 1). This area is situated between latitude 12°20' and 14°20'N and longitude 13° and 15°30'E and is considered tsetse free (Chabeuf, 1983). It is hot, humid and tropical around the Lake and semi-arid and tropical away from the Lake (Payne, 1970). Queval *et al.* (1971) provided detailed description of the habitat of the breed in the islands and on the shores of Lake Chad. Temperatures range from a minimum of 14.0°C in January to a maximum of 38.5°C in April and an annual average of 27.8°C. Mean annual rainfall ranges from 92.8 to 520.6 mm, 90% of which occurs between the months of July and September. Mean relative humidity varies from a minimum of 24% in March to a maximum of 76% in August. While water vapour pressure averages from 8.6 mmHg in February to 28.8 mmHg in September, relative insolation varies from 0.58 to 0.94. The total annual evaporation ranges from 2290 to 3778 mm, with a monthly maximum of 367 mm in March.

The climate of waterside regions of the Lake is sahelian. Borders to the north have subdesert climate. During the dry season (October to April), dry harmattan winds, carrying fine particles of dust from the desert, blow from the north and north-east and from the east to produce dry fog. During the wet season (May to September), monsoon winds blow from the south-west and west. Local secondary winds include daytime breeze from the Lake when waterside temperatures are higher than those of the Lake, and night-time breeze from the land when the reverse in temperatures occurs. Winds are generally stronger in the day than at night.

The vegetation of Lake Chad is typically aquatic or semi-aquatic. The best pastures are on the lowest islands which have been levelled by erosion. There are three types of vegetation in the lowlands. Temporarily flooded areas are dominated by such grass species as *Sporobolus helvolus* and *Sporobolus spicatus*, while the sandy bank vegetation is predominantly *Imperata cylindrica, Cynodon dactylon, Paspalidum geminatum* and *Panicum subalbidum*. The floating edge vegetation consists mainly of *Phragmites mauritianus, Typha angustifolia, Cyperus papyrus* and *Pennisetum* spp. The high-

lands (or shores) of the Lake are comprised of sahelian pastures which are made up mostly of *Andropogon* spp. and such annual grasses as *Aristidia mutabilis, Cenchrus biflorus* and *Eragrostis tremula.*

Utility, management and production systems

The Kuri is a reputed good milker (Ross, 1944; Malbrant *et al.*, 1947b; Gates, 1952; Epstein, 1971; Queval *et al.*, 1971; Renard, 1972; FAO, 1979; Adeniji, 1985) and the cows have always been milked by their tribal owners who use these cattle rather sparingly as pack animals. Cows are generally milked once daily in the dry season (December–May) and twice daily in the wet season (July–November). At birth, calves suck their dams *ad libitum* for about 10 days. Calves are weaned at about 7 or 8 months of age by which time the dams are almost completely dry. Before weaning, calves are tethered at home while their mothers are out grazing. Milking is done manually in the presence of the calf and the last portion of milk is left for the calf. Like most indigenous breeds, the Kuri has milk letdown problems. Thus, the calf is usually allowed to suck briefly at the start of milking to stimulate milk letdown. Weaners join the rest of the herd at grazing.

Traditionally, the Kuri cattle are owned and reared by the Buduma and Kuri tribes. The sedentary Kanembous and Keleouas people around the Lake keep mostly grade Kuri. The Kuri tribal owners only consume its meat on such occasions as religious festivals and funerals and illnesses of loved ones. The Kuri animals are dull (Malbrant *et al.*, 1947b), lethargic (Malbrant *et al.*, 1947b; Queval *et al.*, 1971; Renard, 1972) and temperamental (Anonymous, 1950). They are also highly sensitive to heat and sunlight (Felius, 1985). They are, thus, considered as poor work animals (Gates, 1952; Payne, 1970; Epstein, 1971). However, some are used as pack animals (Payne, 1970), especially at younger ages when they are relatively docile. Indeed, most of the villages west of the Lake use pairs of Kuri oxen to pull carts. They are sometimes also used in the valley of Komadugu Yobe to pull ploughs, although ploughing is not common in the region (RIM, 1992).

The Kuri cattle are raised in a unique production system that integrates livestock production with flood-retreat farming and fishing (RIM, 1992). Because of the usual abundance of pastures, little use is made of crop residues despite the extensive farming on the islands and shores of the Lake. The management system on the islands is basically traditional (Adeniji, 1985) and extensive, with a total dependency on range pastures. In the wet season, there is maximum vegetation and animals have surplus pasture. However, flooding in the entire low-lying islands during the rains causes herds to migrate to the highlands and return to the lowlands in the dry season.

The production systems using the Kuri tend to vary with location in the Lake. For example, on the shores of the Lake in the Bol area, including the islands of the districts of Bol, N'Guelea, Liwa, Limboy and Tataverom, a small number of islands or coastal sections are grazed in irregular rotations by various cattle owners (Queval *et al.*, 1971). However, in the Kangallon and Isseirom Centres, there is transhumance in the farmlands of Massakory where cattle owners also own croplands. Unlike the M'Bororo nomads who accompany their cattle, the Buduma and Kuri tribes are usually pre-occupied with crop farming or fishing and, thus, allow their cattle to forage freely and return to the village on their own at sunset. In the dry season, the animals in herds of 30 to 35 head follow their herdsmen in swimming through the waters from island to island in search of water weeds as feed. This practice has been described as 'aqueous transhumance'. The Yedina tribesmen move their cattle to upland areas during the peak of the wet season (June–September) and return them to the lowlands in the dry season. This practice may be referred to as 'upland transhumance'. Animals are generally split into transhumant and non-transhumant herds. The latter are comprised of lactating cows (and their calves) which are left to provide milk to the children and older people who stay behind to fish and farm. Transhumance is, however, limited to the environs of the Lake, probably because of the susceptibility of the Kuri to sunlight and heat and its limited ability to trek long distances.

Females are rarely sold and represent the dominant part (up to 63%) of the herds (RIM, 1992). A typical herd is composed of about 30 cows and a bull. The Kuri owners seem to have a general preference for white breeding bulls which are usually selected on the basis of own physical conformation or milking qualities of their daughters (Queval *et al.*, 1971). In the latter case, breeding bulls tend to be quite old. Bulls run with the cows year-round. Castration of males is a common practice and is accomplished by lacerating the spermatic cord. In Nigeria, predominant Kuri herds are usually found in both nomadic and settled production systems (Lamorde & Franti, 1973). In both systems, cattle are grazed almost exclusively on pastures and receive very little or no supplementary feeding. In general, husbandry practices around Lake Chad Basin are quite similar, although there is general lack of information on the management of the Kuri in Cameroon and Niger.

Physical characteristics

Standing 15.2 cm taller than the average Nigerian zebu (Ross, 1944), the Kuri is taller than most indigenous African cattle. The height at withers can reach 180 cm in the bulls (Malbrant *et al.*, 1947b; Anonymous, 1950; Mason, 1951; Oyenuga, 1967; Epstein, 1971; Queval *et al.*, 1971; Hall, 1991). Its cannonbone length measures, on average, 24.8 cm in bulls and 24.5 cm in cows (Malbrant *et al.*, 1947b). Linear body measurements of mature animals (Table 2) show a wide variation which may be partly attributed to the differences in the definition of maturity. Higher figures have been reported for body length in bulls (152–165 cm) and cows (145 cm) by Kone (1948), Oyenuga (1967) and Queval *et al.* (1971).

As in most breeds, there is clear sexual dimorphism in the Kuri (Table 2). The females have much smaller bodies than the males. Additionally, the head, tail, ear and horn measurements of the cows are much smaller than those of the bulls. Both bulls and oxen are taller and broader at the chest and have longer bodies than cows. On the other hand, girth to height ratios suggest that cows are wider-bodied than bulls. This structural conformation may be considered as an adaptation for mating which enables the cow to withstand the heavy weight of the bull at mounting. Mature weights range between 360 and 750 kg (Malbrant *et al.*, 1947b; Anonymous, 1950; Mason, 1951; Faulkner & Brown, 1953; Epstein, 1971; Queval *et al.*, 1971; Renard, 1972; Adeniji, 1985) with

Table 2 Adult body measurements (cm) of Kuri cattle[1]

	Body					Head		Tail		Horn		
	BL	HW	HG	HG:HW	RL	Length	Thickness	Length	BC	Length	BC	Ear length
Bulls (10)[2]												
Mean	122.3	151.3	195.0	1.29	53.7	65.9	32.1	116.2	24.7	71.7	52.3	20.5
S.D.[3]	7.75	6.38	7.47	-	2.79	2.81	2.18	7.16	1.65	7.76	6.09	2.76
Range	110–135	143–163	181–205	-	50–58	62–71	28–35	108–131	23–28	63–83	45–60	18–26
Oxen (6)												
Mean	124.2	152.6	195.0	1.28	53.7	68.0	27.5	117.5	25.0	77.7	56.8	21.5
S.D.	4.79	7.55	7.10	-	3.50	3.22	2.88	10.37	1.55	14.77	10.76	0.84
Range	117–131	144–163	187–208	-	50–58	63–71	23–30	102–133	24–27	61–104	44–72	21–23
Cows (10)												
Mean	116.4	138.1	181.7	1.32	50.0	59.3	24.6	106.8	22.7	70.6	40.2	19.5
S.D.	8.96	5.42	6.62	-	5.16	3.02	1.90	8.77	1.29	6.48	4.10	1.27
Range	108–135	126–144	174–193	-	45–63	54–62	21–28	91–116	21–25	63–85	35–47	18–21

[1]BL = Body length, HW = Height at withers, HG = Heart girth, RL = Rump length, BC = Basal circumference. [2]Figures in brackets indicate number of animals. [3]S.D. = Standard deviation. Source: Adapted from Malbrant *et al.* (1947b).

Table 3 Physical characteristics of Kuri cattle

Attribute	Description
Conformation	Large framed, coarse-boned animal; long back and shallow body, lacking in width; raised withers; sacrum is high; large bony rump with a marked slope; poorly developed hindquarters with thighs narrowing sharply as they descend to the gaskins, limbs are strong, long, straight and thickset, with large strong joints and slarge spreading, thick and very open hooves (widely cleft), which are also light and flaky; tail is long and thick, with a long switch; udders are round and well developed with long teats
Head, horns, ears and neck	Long and straight; forehead is large, broad and hollowed (convexed) by the implantation of the horns, with projecting orbitary arcades (wide interorbital arches); muzzle is high and broad; ears are long and large; neck is short and thick in cows but thin in oxen and bulls, neck length averaged 57 cm in bulls and 55 cm (52–58 cm) in cows; horns are very long and circular in cross-section, averaging about 70–130 cm in length and 35–55 cm in basal circumference, shaped in a very broad curve, they are unmistakably huge and bulbous; horns may be loose or absent (polledness), their alveolar (spongy) internal structure reduces the density, hence, they are light weight; horns are attached laterally to large pedestal-like necks (stalks) covered with skin and hair; they are directed outwards, upwards and slightly backwards, with tips sometimes curving inwards; horns vary considerably in shape and size; the shapes vary from buoyed horns which are swollen like an onion; ear-like horns which are flattened, striated and rugged; squash-like horns which are like gourds; open-cresent, lyre-shaped and thick-based horns; droopy or floating or flexible horns; inflated horns; they may even be reduced to a stump
Coat colour	Predominantly white with pigmented mucous membranes; individuals with red, red pied, light grey, dun, dark or black spots, reddish brown, greyish red or speckled markings are often present; white animals with occasional grey-coloured shoulders and dark spots on the flanks also occur; muzzle and inside of ears are black; skin is fine, supple and smooth, with short hair; horn colour is yellowish white, grey or white with black ends
Hump	Humps are generally absent but rudimentary ones indicating zebu introgression may be present; dewlap is much reduced and free of folds; prepuce and umbilical folds are not unduly marked

bulls weighing between 500 and 650 kg, and oxen and cows from 500 to 750 kg and 360 to 450 kg, respectively.

Physical characteristics (Table 3) of the Kuri have been reported by various workers (Stewart, 1937; Ross, 1944; Malbrant *et al*, 1947b; Anonymous, 1950; Gates, 1952; Payne, 1970; Rouse, 1970; Epstein, 1971; Queval *et al*, 1971; Renard, 1972; FAO, 1975; Adeniji, 1985; Maule, 1990). The Kuri is predominantly white with a profile that is straight, long and disproportionate with its cephalic mass. However, various shades of colours are often present. Its forehead is convex and the interorbital width is wide (Epstein, 1971). Its gait is loose and shambling (Gates, 1952; Faulkner & Brown, 1953).

The Kuri horns are immense, of fibrous material and light weight. They have a spongy interior and the external shell is very thin, not much thicker at the base than a human finger nail (Epstein, 1971). It is believed that the backward sweep of the horns may be responsible for the convexity of the forehead (Epstein, 1971). 'normal horns' measure between 60 and 90 cm in length (Anonymous, 1950; Gates, 1952; Epstein, 1971; Queval *et al.*, 1971; Renard, 1972). However, they can even attain a length of 150 cm (Malbrant *et al.*, 1947b). A pair of Kuri horns in the British museum, for example, reportedly measured 105 cm in length and 60 cm in basal circumference and weighed about 1.8 kg (Epstein, 1971). Although the horns are generally very light, approximately 1% of Kuri cattle are said to have such heavy horns that their heads are, to some extent, tipped up by this weight (Payne, 1970). Indeed, it has been suggested (Mason, 1951) that, by tipping the back of the head, the weight of the horns keeps the nostrils out of the water when swimming. The unique bulbous (pear-shaped) horns are the most noticeable characteristic of the Kuri. Prunier (1946) has suggested that the bulbous base and spongy interior of Kuri horns are an

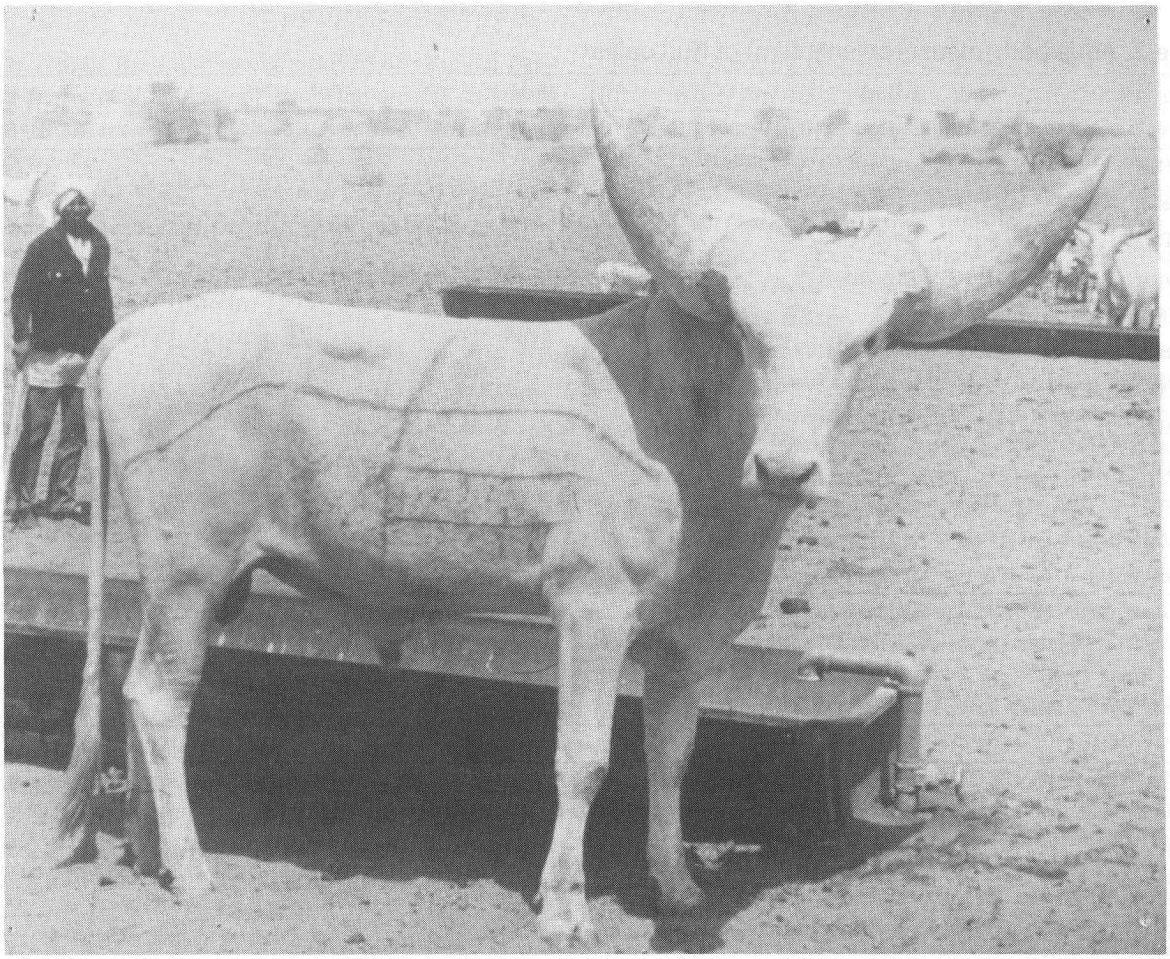

Figure 2 A Kuri male with typical bulbous horns.

adaptation for buoyancy. Some selection within the Kuri has resulted in other horn shapes such as lyre- or cresent-shaped horns. Kuri horns have highly variable length and basal circumference (Table 2), the latter ranging between 20 and 100 cm (Malbrant *et al.*, 1947b; Anonymous, 1950; Gates, 1952; Epstein, 1971; Queval *et al.*, 1971). Horns with much larger basal circumference have also been reported (Gates, 1952). Horn diameter ranges from 20 to 55 cm (Rouse, 1970; Domingo, 1976).

On the basis of thickness of the horn, there are two distinct types of Kuri cattle — those with long horns of moderate to normal width and 20–30 cm basal circumference and those with long, bulbous or conical horns with a large basal circumference that can exceed 60 cm or the spectacular buoy-shaped horns which are only 15–25 cm in length. The first group has horns typical of longhorn cattle (Epstein, 1971); the 'normal horns' being found mainly on those animals living around the shores (Queval *et al.*, 1971). The latter are typical of the majority of the Kuri animals on the islands. They are thought to be some form of adaptation (i.e. for swimming in the aquatic milieu). Some people consider Kuri animals with this type of horns as the only pure Kuri. Although the buoy-shaped horn type is almost completely restricted to the islands, it is rare compared to the long, bulbous type (Queval *et al.*, 1971). The argument that buoy horns are critical in an aquatic milieu is, therefore, not tenable. The 'inflated' horns are also uncommon, perhaps only 5% (FAO, 1975). Some reports suggest that the Buduma and Kuri tribespeople prefer animals with lyre- or crescent-shaped horns over those with 'buoy' or bulbous horns because the latter tend to have least longevity (Queval *et al.*, 1971). There are also anecdotal claims that cows with pointed or floating horns are reputed milkers.

Production characteristics

The figures in Table 4 show that the Kuri has an average (on-station) daily milk yield of about 3–6 kg in a 6–10 month lac-

Table 4 Mean milk yield and lactation length of Kuri cows

Daily yield (kg)	Total yield (kg)	Lactation length (days)	Source
5–8	975–1560[1]	180–210	Malbrant *et al.* (1947b)
3.2	480–576[1]	150–180	Anonymous (1950)
–	1350	–	Gates (1952)
–	2421	314	Gates (1952)
–	1260	–	Epstein (1971)
–	2440	314	Epstein (1971)
3–6	720–1440[1]	180–300	Queval *et al.* (1971)
4–6	840–1260[1]	180–240	Renard (1972)
–	800–1000	180–300	Coulomb *et al.* (1980)
–	1259	280	Adeniji (1985)

[1]Total yields estimated from daily yields and lactation lengths.

tation period. A record yield of 2 400 kg in a 314-day lactation was obtained at the Maiduguri Livestock Centre in Nigeria (Pagot, ined.). The same author also reported an average milk yield of 1 259 kg in a 210–240 day lactation and a calving interval of 445 days in Chad. Lactation milk yield of the Kuri increases progressively from the first lactation to a mid-career point at the fourth lactation and then declines in subsequent lactations (Queval *et al.*, 1971). Reliable estimates of lactation milk yield are limited, while information on milk composition is hard to find. Butterfat, solids-not-fat and lactose content of milk from a single study (Anonymous, 1950) were 4.2, 8.3 and 48.3%, respectively.

Average birth weight was 25 and 22.5 kg for male and female calves, respectively (Queval *et al.*, 1971). Live weight averaged 130 and 125 kg at yearling and 225 and 200 kg at two years of age, respectively for males and females in Nigeria (Pagot, ined.). Data on three dry-season feeding trials have been reported by Tacher (1973) at the Matafo Experiment Station near Bol in Chad. Animals on *ad libitum* supplementary feed — consisting of fresh Napier grass (*Pennisetum* spp.), cotton seed and sodium bicarbonate — had an average daily gain of 0.62–0.65 kg and consumed about 6.9–7.4 kg of feed per kg of weight gain during a 117-day experimental period. The control lot — extensively grazed on natural pastures — gained only 0.17 kg per day.

The Kuri is considered to have great potential as a meat producer (Malbrant *et al.*, 1947b; Queval *et al.*, 1971; Renard, 1972; FAO, 1975; Adeniji, 1985; Maule, 1990) with a remarkable fattening ability (Malbrant *et al.*, 1947b; Renard, 1972; FAO, 1975). It is, however, rarely used as such by its traditional keepers. Steers, for example, readily achieve between 200 and 250 kg of carcass at 5 to 6 years of age on natural pasture alone, and when stall-fed frequently reach more than 700 kg live weight at slaughter (Renard, 1972). Pagot (ined.) has reported a figure of 500 to 600 kg slaughter weight at 5 years of age. The hide is of good quality (Malbrant *et al.*, 1947b; Payne, 1970) and when dry can weigh between 7 and 12 kg (Malbrant *et al.*, 1947b; Pagot, ined.). The meat is tender, juicy and well-marbled (Queval *et al.*, 1971; Renard, 1972). Some workers (e.g. Payne, 1970; Rouse, 1970) have reported poor conformation, while others (e.g. Anonymous, 1950; Renard, 1972) have documented excellent beef conformation in the Kuri. The apparent contradiction may be the consequence of the genetic background (e.g. pure *vs* crossbred) and nutritional environment of the animals that went into the different feeding experiments.

The most comprehensive slaughter information on the breed has been provided by Queval *et al.* (1971) and Renard (1972) from the Fort-Lamy abattoirs in Chad. These are summarized in Table 5. Carcass weights tend to increase with age. About 40% of the carcasses at Fort-Lamy abattoirs weighed over 200 kg (Queval *et al.*, 1971). Malbrant *et al* (1947b) have reported dressing-out percentages of at least 50 and carcass weights of between 250 and 300 kg for castrates. Prime meat has been obtained from 4 to 6-year-old animals in excellent fattening conditions (Queval *et al.*, 1971).

Reproductive traits are the least documented of the performance traits of the Kuri. Available information indicates that females reach puberty early and are very fertile (Renard, 1972). Age at first calving ranges from 36 to 48 months

Table 5 Weighted average carcass weights (kg) of Kuri cattle in Fort-Lamy abbatoirs[1]

	Age (years)						
Sex	4	5	6	7	8	9	Overall
Castrates	149.1	181.3	192.7	204.1	209.6	226.0	181.4
N[2]	2561	2253	554	933	458	143	6902
Males	152.2	176.8	186.3	202.0	210.3	233.3	173.9
N	2288	1006	345	654	319	141	4683
Females	144.0	143.7	146.2	170.3	169.1	160.6	159.3
N	2	4	4	3	10	12	35

[1]Means weighted by number of observations

[2]Number of observations

Source: Adapted from Queval *et al.* (1971) and Renard (1972)

(Queval *et al.*, 1971; Renard, 1972; Coulomb *et al.*, 1980; Adeniji, 1985). The females have an active productive herdlife of 11 to 12 years (Queval *et al.*, 1971) during which they produce an average of 6 to 8 calves (Queval *et al.*, 1971; Renard, 1972), but up to 12 calvings in a productive herdlife are not uncommon (Malbrant *et al.*, 1947b). Queval *et al.* (1971) reported about 80% of cows in Kuri herds with 4 to 9 or more calves in a lifetime. Calving intervals range from 15 to 18 months (Queval *et al.*, 1971; Fricke, 1979; Coulomb *et al.*, 1980; Adeniji, 1985). Coulomb *et al.* (1980) obtained a distribution of monthly calvings from about 289 calving records which showed that 73.4% occurred between October and April (the dry season) which implies that most conceptions occurred during the previous wet season. Sterility rate in the females is reported to be low, about 3% (Queval *et al.*, 1971). The bulls are sexually mature at 3 years of age (Renard, 1972).

Adaptive characteristics

The Kuri has been living in the hot aquatic milieu of Lake Chad for thousands of years and is well adapted to this specific environment. Indeed, breeding herds flourish on the natural rangelands in and around the Lake (Epstein, 1974; FAO, 1975). As has been pointed out, they are excellent swimmers (Ross, 1944; Malbrant *et al.*, 1947b; Payne, 1970; Epstein, 1971), a characteristic they need to survive in their environment. Kuri animals are easily tired, are intolerant to heat and sunlight and are unable to stand extended periods of drought (Malbrant *et al.*, 1947b; Anonymous, 1950). Consequently, they are fond of wallowing in water (Gates, 1952) and usually spend a considerable part of the day immersed in water (Payne, 1970; Epstein, 1971), with only their nostrils lifted above the water surface (Epstein, 1971). Indeed, they will graze in water up to their stomachs. However, they are reputed for tolerance to insect bites and preference for fresh pastures. In the hot humid regions of the Lake, swarms of biting insects are often found during the greater part of the year but the Kuri hardly seems to notice their attacks (Renard, 1972). In contrast, the zebus in Lake Chad Basin are usually moved out before the peak of the biting insects because of their intolerance to these flies.

As has already been indicated, the Kuri is rustic (Malbrant *et al.*, 1947b) and well adapted to its habitat (Adeniji, 1985) but is unable to thrive outside the environs of the Lake

(Epstein, 1971; Olutogun, 1976). For example, between 1953 and 1957 attempts were made to acclimatize a herd of 70 to 90 head of Kuri cattle on a government station at Fianga in the Mayo-Kebbi region of northern Chad. Their inability to adjust to these conditions resulted in the abandonment of a programme to crossbreed N'Dama and Kuri to create a trypanotolerant dairy breed. The grazing habits of the Kuri, especially their selective preference for fresh grasses and aquatic environment as well as their intolerance to continuous dry heat and sunlight account for the inability of the breed to survive beyond the shores of Lake Chad Basin, except around the Yobe river valley where conditions are similar.

The Kuri is relatively immune to indigenous parasitic infections (Queval *et al.*, 1971; Renard 1972; FAO, 1975). However, Lamorde & Franti (1973), in a survey of owners of Kuri animals in northern Nigeria, found trypanosomiasis to be a major constraint to the performance of Kuri herds. Additionally, records from the Livestock Service in Chad have indicated that the major blood-borne parasitic diseases limiting the productivity of the Kuri are trypanosomiasis and piroplasmosis (Queval *et al.*, 1971). Indeed, an outbreak of trypanosomiasis in 1956 at N'Gouri Farm in Chad led to 22.3% deaths in a Kuri herd. In contrast, the N'Dama — its ancestral Longhorn counterpart — has been shown to be highly resistant to trypanosomiasis. This can only be attributed to the absence of tsetse flies in the Lake environment. The Kuri is also reportedly highly susceptible to rinderpest (Adeniji, 1985) and contagious bovine pleuropneumonia (CBPP; locally known as *fufu*). High mortality rates of about 47% have been associated with CBPP and an unidentified anaemic condition (RIM, 1992).

Mortality rates of 14% per year have been reported across age groups (IEMVT, 1973). Mortality rates of between 35 and 55% among less-than-one-year-old Kuri animals have been reported in pastoral herds in Chad (Bourzat *et al.*, 1992). Although no reasons for these high mortalities have been documented, they may be associated with the protracted civil war, drought and the retreating waters of the Lake. RIM (1992) has reported overall mortality rates of 27% in Kuri herds in Nigeria, where high mortalities have been attributed to CBPP epidemic.

Special genetic characteristics

Petit & Queval (1973) have reported Hb gene frequencies of 0.620 and 0.381 for Hb^A and Hb^B, respectively in 364 Kuri animals (Table 6). Such high Hb^B frequencies are commonly found in Indian (e.g. Brahman) and related zebu breeds (Table 6) and in the Channel Island breeds, especially the Jersey (Baker & Manwell, 1980). Gezahegne (1996) has also reported such high values in some zebu breeds of Ethiopia. Thus, haemoglobin frequency in the Kuri may be an indication that they have received Hb^B through zebu introgression. The complete absence of Hb^C in the Kuri may serve as a good indicator of its purity. The Kuri, like *Bos taurus* breeds, differs from the zebu (*Bos indicus*) in their Y-chromosome (Petit & Queval, 1973) which is sub-metacentric in the former but acrocentric in the latter.

Serum characteristics (Table 7) show that total globulins are in greater proportion than the albumins in the Kuri. Relative abundance of globulins may be a major factor in the adaptation of the breed to its aquatic milieu (Petit & Queval, 1973) and may be implicated in the Kuri's immunoresponses. However, the relationship between the immunological response and the adaptive behaviour of the breed is not clear and, therefore, requires further investigation.

Table 6 Haemoglobin gene frequencies from some African breeds

Breed	Hb^A	Hb^B	Hb^C	Hb^D	Source
Kuri	0.62	0.38	–	–	Petit & Queval (1973)
Muturu	0.72	–	–	0.28	Braend & Khanna (1968)
N'Dama	1.00	–	–	–	FAO (1976)
Baoulé	0.96	0.04			Petit & Queval (1973)
Lagune	0.92–1.00	0–0.08	–	–	Domingo (1976), FAO (1976)
Sanga[1]	0.42–0.88	0.06–0.42	0.02–0.17	–	Braend & Khanna (1968)
Abigar	0.49	0.29	0.20	0.02	Gezahegne (1996)
West African Zebu	0.53–0.79	0.21–0.47	0.02–0.08	–	Braend & Khanna (1968), Petit & Queval (1973)
Ethiopian Zebu[2]	0.43–0.53	0.29–0.45	0.11–0.19	–	Gezahegne (1996)
African Zebu[3]	0.35–0.79	0.21–0.42	0.02–0.18	–	Petit & Queval (1973)

[1]Sanga from East and Southern Africa

[2]Ogaden, Arsiand Boran

[3]Zebu from West, East and Southern Africa

Table 7 Serum characteristics of Kuri cattle

	N[1]	Mean value	95% C.I.[2]
Albumin (%)	344	34.89	34.18–35.60
α - globulin (%)	344	14.78	14.36–15.19
β - globulin (%)	167	22.63	21.71–24.15
γ - globulin (%)	167	28.03	26.60–29.46
Total proteins (g/l)	173	71.76	70.35–72.37
Total cholesterol (mg/ml)	169	1.16	1.11–1.21
Na^+ (mg/ml)	173	3.34	3.32–3.37
K^+ (mg/ml)	123	23.47	22.80–24.14
Mg^{++} (mg/ml)	173	0.22	0.22–0.23
Ca^{++} (mg/ml)	165	0.31	0.27–0.36

[1] Number of samples

[2] Confidence interval

Source: Petit & Queval (1973)

Conclusion

The inability of the Kuri to thrive outside its present econiche implies that its rate of decline will accelerate as the level of the water in the Lake continues to retreat. As this breed plays a major role in the livelihood of most tribes in the region, a decline in its population poses a serious threat to the livestock industry in the area. Thus, there is urgent need for immediate action to halt and possibly reverse this trend. The authors recommend, firstly, an investigation into the extent of zebu introgression into the Kuri and, secondly, the setting up of a nucleus breeding scheme on the islands. The breeding scheme

will not only facilitate the characterization and enhancement of the breed but its conservation as well. A parallel action might be to set up multiplication/breeding centres on the islands and/or along the shores of Lake Chad Basin for the benefit of the countries in the region.

References

ADENIJI, K.O. 1985. Review of endangered cattle breeds of Africa. In: Animal Genetic Resources in Africa: High Potential and Endangered Livestock, p. 20. Second OAU Expert Committee Meeting on Animal Genetic Resources in Africa, Bulawayo, Zimbabwe, OAU/IBAR, Nairobi, Kenya.

ALBERRO, U. & HAILE-MARIAM, S. 1982. The indigenous cattle of Ethiopia. *World Anim. Rev.* 41, 2.

ANONYMOUS. 1950. Rapport sur l'élevage en Afrique equatoriale française. *Rev. Elev. Méd. vét. Pays trop.* 4, 185.

BAKER, C.M.A. & MANWELL, C. 1980. Chemical classification of cattle. I. Breed groups. *Anim. Blood Grps biochem. Genet.* 11, 127.

BOURZAT, D., IDRISS, A. & ZEUH, V. 1992. La race Kouri: Une population en danger d'absorption. *Anim. Genet. Resources Information Bull.* 9, 15. FAO, Rome.

BRAEND, M. & KHANNA, N.D. 1968. Haemoglobin and transferrin types of some West African cattle. *Anim. Prod.* 10(2): 129.

CHABEUF, N. 1983. Trypanotolerant cattle in West and Central Africa. *J. S. Afr. vet. Assoc.* 54(3), 165.

CLARK, J.D. 1954. The Prehistoric Cultures of the Horn of Africa, Cambridge University Press.

COULOMB, J., SERRES, H. & TACHER, G. 1980. L'Elevage en pays sahéliens. Agence de Coopération Culturelle et Technique, Presses Universitaires de France. 192 pp.

CURSON, H.H. 1936. A comparison of two of the so-called Zebus. Anatomical studies No. 61. *Onderstepoort J. vet. Sci. Anim. Ind.* 7, 371.

CURSON, H.H. & THORNTON, R.W. 1936. A contribution to the study of African native cattle. *Onderstepoort J. vet. Sci. Anim. Ind.* 7, 613.

DOMINGO, P.M. 1976. Contribution à l'étude de la population bovine des Etats du Golfe du Benin. DVM Thesis, Ecole Inter-Etats des Sciences et de Médecine Vétérinaires de Dakar 148 pp.

EPSTEIN, H. 1971. The origin of the domestic animals of Africa. Vols. 1 and 2. New York. Publ. Africana, 670 pp.

EPSTEIN, H. 1974. Vanishing livestock breeds in Africa and Asia. In: Ist World Congress on Genetics Applied to Livestock Production, Madrid, Spain, 7–11, October. p. 31.

EPSTEIN, H. & MASON, I.L. 1984. Cattle. In: Evolution of Domesticated Animals. Mason, I.L. (ed.), Longman Group Ltd, New York (USA). p. 6.

ESPERANDIEU, G. 1952. Congrès Panafricain de Préhistoire, Alger, Actes de la II^{e} Session, 551 pp.

FAO. 1975. Pilot study on conservation of Animal Genetic Resources. FAO, Rome (Italy); UNEP, Nairobi (Kenya), 60 pp.

FAO. 1976. Rapport de la première consultation d'Experts sur la recherche concernant la trypanotolérance et l'élevage du bétail trypanotolérant tenue à Rome, Italie, 16–19 mars, 42 pp.

FAO. 1979. Expert Consultation on dairy cattle breeding in the humid tropics. Haryana Agricultural Univ. College of Animal Sciences. Hissar, India, 12–17 Feb., 1979. FAO, Rome.

FAULKNER, D.E. & BROWN, J.D. 1953. The improvement of cattle in British Colonial Territories in Africa. HMSO, London, 144 pp.

FELIUS, M. 1985. Genus *Bos*: Cattle breeds of the World. MSDAGVET, Merck & Co. Inc. New Jersey, USA. p. 121.

FRICKE, W. 1979. Cattle husbandry in Nigeria. Heidelberger Geographische Arbeiten. Institutes der Universitat Heidelberg, 330 pp.

GATES, G.M. 1952. Breeds of cattle found in Nigeria. Farm and Forest (Nigeria), 11, 19.

GEZAHEGNE, S. 1996. Characterization of some indigenous cattle breeds of Ethiopia using blood protein polymorphisms. MSc Thesis, Department of Animal Science, University of Alemaya, Ethiopia.

HALL, S.J.G. 1991. Body dimensions of Nigerian cattle, sheep and goats. *Anim. Prod.* 53, 61.

IEMVT. 1973. Région de Recherches vétérinaires et zootechniques d'Afrique Central: Etude du Kouri. N'Djamena, L.R.V.Z., Farcha, Rapport annuel 1973, Tome 2, p. 341.

ILCA. 1992. Domestic Animal Genetic Resources Information Database (DAGRID). International Livestock Centre for Africa (ILCA), Addis Ababa, Ethiopia.

KONE, K. 1948. Le boeuf du lac Tchad de la région de N'Guigmi. *Bull. Ser. Elev. Ind. Anim. (A.O.F.)* 1(2), 47.

LAMORDE, A. & FRANTI, C.E. 1973. Nomadism and Cattle Production in Nigeria. MPVM Thesis, Univ. of California, Davis, USA.

MALBRANT, R., RECEVEUR, P. & SABIN, R. 1947a. Le boeuf du lac Tchad. *Rev. Elev. Méd. vét. Pays trop.* 1, 37.

MALBRANT, R., RECEVEUR, P. & SABIN, R. 1947b. Le boeuf du lac Tchad. *Rev. Elev. Méd. vét. Pays trop.* 1, 109.

MASON, I.L. 1951. Classification of West African livestock. *Tech. Comm. No. 7.* Commonwealth Bureau of Animal Breeding and Genetics. Farnham Royal, Edinburgh.

MAULE, J.P. 1990. The cattle of the Tropics. Centre for Tropical Veterinary Medicine, Univ. Edinburgh. Easter Bush, Roslin, Midlothian, Scotland, 225 pp.

NGERE, L.O. 1990. Endangered Livestock breeds in West Africa. Animal genetic resources. A global programme for sustainable development. *FAO Animal Production and Health Paper, No.* 80, p. 189, FAO, Rome.

OLUTOGUN, S. 1976. Reproductive performance and growth of N'Dama and Keteku cattle under ranching conditions in the Guinea Savanna of Nigeria. Ph.D. Thesis, Department of Animal Science, Univ. of Ibadan, 292pp.

OYENUGA, V.A. 1967. Agriculture in Nigeria. FAO, Rome, 308pp.

PAGOT, J. ined. Ethnologie des Animaux Domestiques. Institut d'Elevage et de Médecine vétérinaire des Pays tropicaux, France. p. 10.

PAYNE, W.J. A. 1970. Cattle production in the tropics. Vol. 1. Breeds and breeding. Longman, London, 336 pp.

PETIT, J.P. & QUEVAL, R. 1973. Le Kouri: race bovine du lac Tchad. II. Etude biochimique: les hemoglobines et les constituants du sérum. *Rev. Elev. Méd. vét. Pays trop.* 26(1), 97.

PRUNIER, R. 1946. Les bovins du Lac Tchad (with annotated English translation). *Farm and Forest* 7(2), 123.

QUEVAL, R., PETIT, J.P., TACHER, G., PROVOST, A. & PAGOT, J. 1971. Le Kouri: race bovine du Lac Tchad. I. Introduction générale a son étude zootechnique et biochimique: Origines et écologie de la race. *Rev. Elev. Méd. vét. Pays trop.* 24(4), 667.

QUEVAL, R. & PETIT, J.P. 1973. Le Kouri: race bovine du lac Tchad. III. Les facteurs érythrocytaires. *Rev. Elev. Méd. vét. Pays trop.* 26(2), 235.

RENARD, P. 1972. Avant project pour la Sauvegarde de la race bovine Kouri et l'extension de son élevage à l'ensemble du perimétre du Lac Tchad. Commission du Bassin du Lac Tchad. No. 04.14. Fort-Lamy (Tchad), p. 2.

RIM. 1992. Nigerian Livestock Resources. Vol II: National Synthesis. Report by Resource Inventory and Management

Limited (RIM) to Federal Department of Livestock and Pest Control Services, Garki, Abuja, Nigeria, 440 pp.

ROSS, S.D. 1944. Nigerian Cattle types. *Farm and Forest* (Nigeria) 5, 52.

ROUSE, J.E. 1970. World Cattle II: Cattle of Africa and Asia. Univ. of Oklahoma Press: Norman, Oklahoma City, USA.

STEWART, J.L. 1937. The Cattle of the Gold Coast. *Vet. Rec.* 49(41), 1289.

TACHER, G. 1973. Note préliminaire sur l'embouche de bovins Kouri dans la région du Lac Tchad. In: L'embouche intensive des bovins en pays tropicaux. Actes du Colloque, Dakar (Sénégal). 4–8 Dec. 1973. p. 171, IEMVT, France.