SUDAN DESERT

Synonyms. Sudanese Desert.
Origins. Savanna type, similar to West African Long-Legged.
Sub-types and races. Possibly allied to the Shukria goat of western Eritrea, although the latter is probably a much better milk producer, more closely related to the Nubian. It is probable that the so-called Zaghawa goat is a black colour variant of the Sudan Desert type.
Distribution. Dry areas of the Republic of Sudan, generally to the north of 12°N but north of 10°N in Darfur and western Kordofan. Also in parts of Eritrea and westwards into Chad. At its southern limit in Sudan, intermediate types with small forest goats are seen. Numbers ere estimated at 1.0 million in early 1950s but certainly much more numerous than this in 1970s and 1980s. Population figures based on tax returns were 571 000 in Southern Darfur Province alone in 1972.
Ecological zones. Semi-arid, arid and, during transhumance and nomadic migration, extending into hyper-arid.
Management systems. Traditional agro-pastoral and pastoral. Probably originally owned only by nomadic pastoralists but now owned in large numbers by agro-pastoralists. Common and shared use makes it difficult to define ownership patterns and flock sizes: about 20 goats per household in Southern Kordofan. Most goats in agro-pastoral system are "owned" by women. Flock structures related to milk and meat production are dominated by females, especially in age groups over 6 months. In Southern Darfur 46.5 per cent of flock < 6 months (25.7 per cent females, 20.7 per cent males); 12.4 per cent 6-15 months (9.4 per cent females, 3.0 per cent males); 41.1 per cent > 15 months (40.8 per cent females, 0.3 per cent males); total females 75.9 per cent (49.8 breeding > 10 months). In Southern Kordofan agro-pastoral sedentary system 38.0 per cent < 6 months; 15.7 per cent 6-12 months (females 11.6 per cent, males 4.1 per cent); 32.7 per cent 13-24 months (females 30.6 per cent, males 2.5 per cent); 13.2 per cent > 24 months (no males); 55.4 per cent breeding females.
Physical characteristics. Large size 65-85 cm. Weight: male 40-60 kg; female 32.7 ± 5.22 kg.
Head fine, forehead flat, profile straight or slightly dished.
Horns in 95 per cent of both sexes: large and flattened in cross-section in males, homonymously twisted, up to 35 cm long, projecting outwards or backwards; females finer and curving upwards and backwards, up to 30 cm in length. Ears medium to *very* long (12-20 cm), lopped. Toggles in 15 per cent of both sexes. Beards in both sexes, *very* bushy in males. Males may have a mane to the shoulders or extending the whole length of the back, mane occasionally present in females.
Neck rather short. Chest shallow and often pinched. Withers prominent (male 69-83 cm; female 65.5 ± 3.73 (s.d.) cm (n=397)). Back short and straight. Croup very weak and sharply sloping with tail set low. Legs long and poorly boned.
Colour variable from white to black, greys common (Figure 33) but many mixed colours: black back stripe in dark colours and grey in light colours. Coat usually short and fine except for mane: some animals (particularly

Zaghawa) have longer hair which may be general over the whole body or confined to hindquarters and legs.

Figure 33 Sudan desert goats on migration in Southern Darfur

Products. Meat; milk.

Productivity.

REPRODUCTION. *First kidding:* 290 days (n=4) in Southern Darfur; most females kid before eruption of first pair of permanent incisors. *Kidding interval:* 238 ± 41 days (n=44) in Southern Darfur traditional system; 9 months in Kordofan. *Multiple births:* common; 69.8 per cent single, 30.2 per cent twin (n=63) in first kidders and 39.0 per cent single, 54.5 per cent twin, 6.5 per cent triplet in multiparous females (n=154) in Southern Darfur sedentary agro-pastoral system. *Litter size:* 1.57; 1.30 in primiparous does and 1.68 in multiparous ones. *Annual reproductive rate:* 2.41. *Lifetime production:* 9-10 kids in Southern Darfur; 4-7 in Kordofan.

GROWTH. *Birth weight:* 2.13 kg; single 2.27 (male 2.30, female 2.25); twin 2.05 (male 2.03, female 2.07); triplet 1.82 (male 1.88, female 1.73). W*eight for age:* 4 weeks-4.8, 8-7.1, 13-9.9, 20-12.6, 26-14.7 kg. *Average daily gain:* birth-13 weeks - 86.9, birth-26 - 67.0 g; on high roughage/sorghum bran diet with 30 mg Monensin per day ADG was 89 g from 26.5 to 33.2 kg at a conversion rate of 10.7 feed/gain and on high concentrate/sorghum grain diet with 30 mg Monensin was 93 g at a conversion rate of 9.0 from 29.9 to 34.0 kg.

MEAT. *Dressing percentage:* entire males 48.2 (44.2-52.8) at live weight of 34.7 kg and castrates 51.2 (46.6-33.1) at live weight of 35.8 kg in Southern Darfur traditional system; 46.0 in central Sudan. *Carcass composition:* 72.7/28.3 per cent meat/bone at 30 kg empty body weight in fattened animals; tail 0.2 kg, head and skin 3.2 kg, abdominal fat 0.2 kg in 20 kg live weight animals.

Research. Field studies in Darfur in early 1970s and in Kordofan in early 1980s. Faculty of Veterinary Science, University of Khartoum, P.O.Box 32, Khartoum North, Sudan.

References. Wilson, 1976b; Bunderson, Cook & Fadlalla, 1984; El-Hag, El-Haj & Gaali, 1984; El-Hag, Kurdi & Maghoub, 1985.

WEST AFRICAN LONG-LEGGED

Synonyms. Arab (Chad); Maure (Mauritania and northern Mali); Sahel; Touareg.
Origins. These goats are part of the Savanna group which includes many Saharan types from Egypt, Libya, Tunisia, Algeria and Morocco.
Sub-types and races. Many local names are given to the West African Long-legged type: Gorane, Peul (Chad); Voltaïque (Burkina); Sahel (Figure 34), Nioro, Niafounké (Mali). Crosses with dwarf goats are also often given names, e.g. Vogan in Togo.

Figure 34 West African Long-legged goats of the Sahel type at Bamako market, Mali

Distribution. North of the 12°N parallel from central Chad in the east to the Atlantic coast in the west, and well into the southern Sahara. In recent years have penetrated farther south, consequent on drought.
Ecological zones. Mainly in the semi-arid but also in the arid zone. A few goats of this type are found in higher rainfall areas but, not being trypanotolerant, they do not survive for long in forest or dense savanna. Many goats of this type are sold in the coastal towns of humid West Africa either having walked or been trucked from the north.
Management systems. Agro-pastoral, pastoral and urban. In the agro-pastoral systems there is very little seasonal movement of stock, when it does take place it is usually of short distance and duration.
CHAD. Sedentary "Arab" flocks in central Chad usually contain 50-70 head of goats and sheep combined (ratio 2:1); in Batha and Chari, Baguirmi goat flocks average 45.0 (+ 43.3 sheep) and 46.3 (no sheep) respectively with an average of 3.8 goats per "taxed person" in the second area. In the Chad long-distance migration pastoral system 85 to 90 per cent of all flocks are mixed goats and sheep, 50 per cent are mixed in short distance migration flocks, and 57 per cent are mixed in agro-pastoral sedentary flocks; flocks of goats only are more common than sheep only. Almost all goats (87.1 per cent of females, 95.3 per cent of males in sedentary flocks; 66.1 per cent of females, 96.0 per cent of males in trans-humant flocks) are born in the flock in which they spend the rest of their lives. Flock structures (Figure 35) are related to meat and milk and comprise about 73 per cent females (51 per cent > 1 year), 27 per cent males (10 per cent > 1 year). Offtake is about 27

per cent per year of which about 30 per cent is for home consumption, 63 per cent is sold (majority males) and 7 per cent is gifts (mainly females).

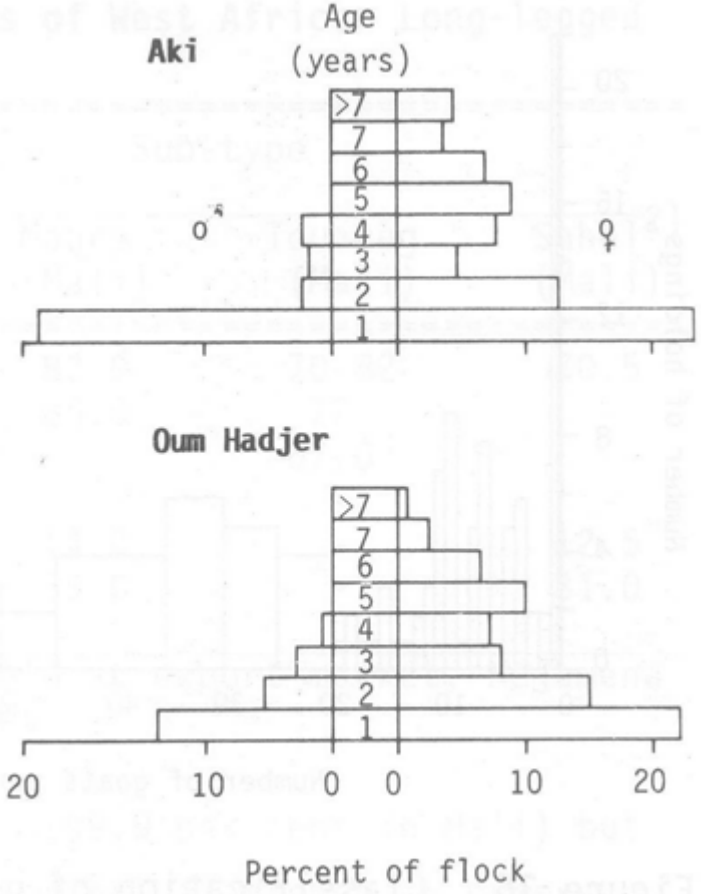

Figure 35 Goat flock structures in different trans-humant ethnic groups in Chad

MALI. In the agro-pastoral system goat flocks in the irrigated rice sub-system average 9.0 ± 6.03 head and in the rainfed millet sub-system 38.2 ± 27.75 head. Flock sizes range from 0-23 in the rice and from 2-91 in the millet areas with more families owning goats in both systems than owning sheep: flock sizes in the transhumant Fulani system in the Gourma average 41. Flock structures are 77.8 per cent females (55.4 per cent > 1 year, 4.0 per cent "broken-mouthed"), 22.2 per cent males (4.2 per > 1 year, 3.9 per cent castrates) in the sedentary systems; in the Gourma transhumant system females are 70 per cent of the flock with a high proportion (67 per cent) of breeding age, males 21 per cent with 6.5 per cent > 14 months of which 3.3 per cent are castrates. Offtake: 26.6 per cent (14.8 per cent females, 53.1 per cent males) in the rice sub-system; about 13.8 per cent (9.0 per cent females, 38.7 per cent males) in the millet sub-system.

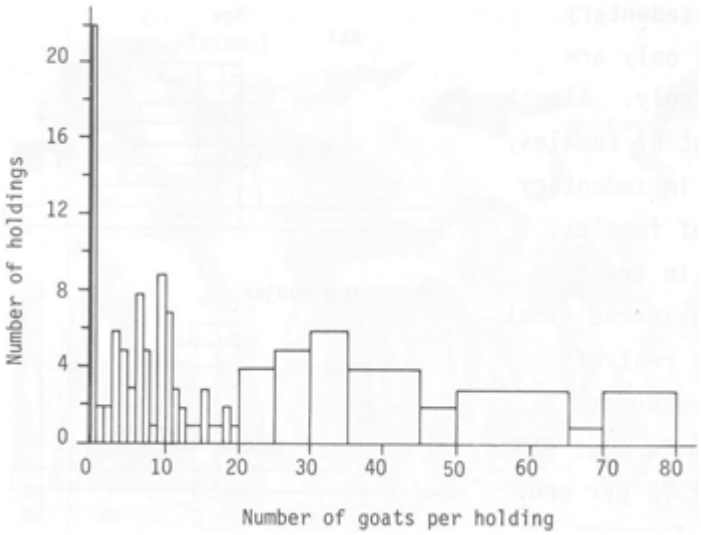

Figure 36 Classification of goat holding sizes in a Mossi agro-pastoral system in northern Burkina Faso

BURKINA FASO. Sedentary flocks in the Mossi agro-pastoral system in Yatenga average 17.1 goats and 16.8 sheep (Figure 36). In the Fulani pastoral system, flocks aver-age 53.7 goats and 23.0 sheep: flocks with only goats are more common than flocks of sheep only and these average 61.9 head (compared with 28.7 head). Fulani flock structures are mainly related to milk and meat production: females 76.3 per cent (approximately 60 per cent > 1 year), males 23.7 per cent (10 per cent > 1 year, 3.1 per cent castrates).

NIGER. In the Touareg system in the Aïr goats are not usually herded but feed in the vicinity of the camp in a loose flock, returning to their kids and to be milked at night. Milking is done by women and children. Flock sizes average about 60 head. Flock structure related mainly to milk production: females 86 per cent (67 per cent breeding); males 14 per cent (1.2 per cent > 14 months)

Physical characteristics. Large size 70-85 cm (male 80-85 cm; female 70-75 cm). Weight: male 40 kg; female 27 kg (Table 24).

Head small, fine and triangular in shape, forehead flat and narrow (Chad), slightly concave (Maure) or convex and narrow (Touareg), profile straight or slightly dished (Voltaïque), narrow nostrils, fine lips, large or less large supraorbital processes.

Table 24 Morphological characteristics of West African Long-legged goats

Character	Sub-type			
	Arab [1](Chad)	Maure (Mali)	Touareg (Mali)	Sahel [2](Mali)
Withers height (cm)	80.5	82.0	70-82	70.5
Girth (cm)	82.0	85.0	72	-
Scapulo-ischial length (cm)	69.6	-	67.0	-
Horn length (cm)	21.0	-	-	-
Ear length (cm)	21.6	14.0	-	12.5

Weight (kg)	37.3	3.0	-	31.0

Notes: 1) 8 male sheep about 3 years old at export market, Ndjamena
2) Mean of 20 full-mouth females

Horns usually present in both sexes (99.9 per cent in Mali) but absent more often in Touareg: strong in males, flattened in crosssection, markedly ribbed, directed straight upwards and backwards diverging more or less then turning inwards at the tips, homonymously twisted with slow spiral, up to 40 cm in length, sometimes horizontal (Figure 37); female horns are finer and scimitar shaped, or curving out and then in, up to 13 cm long. Ears long (21 cm) and wide or shorter (11 cm), usually pendent or semi-pendulous; vestigial ears occur; in Chad can be longer than face. Toggles common: 45 per cent in Mali. Beards common: present in almost all males from 4 months; about 40 per cent of females in Mali over 3 years carry beards. Manes are common in males, occasionally along the whole length of the back.

Figure 37 Maure goats near Niafounké in northern Mali (note male and female horn types)

Neck long and thin. Chest generally narrow and shallow, with girth circumference about or slightly exceeding withers height. Withers prominent but less so in Arab variety in Chad. Back usually straight with prominent backbone. Croup short and very sharply sloping. Legs long and spindly, lightly boned and with sickle hocks Udder usually elongated, more or less distinctly divided into two halves with large teats. Scrotum longish and usually split.

Colour is very variable and depends on sub-type: in eastern Chad 45 per cent are white or predominantly white, 28 per cent red or red pied, 22 per cent black or black pied; in western Chad 39 per cent white, 27 per cent black or pied, 25 per cent red or pied; Touareg type normally red pied or black pied; Maure are red pied or fawn pied; Volta&ium,;que 49 per cent white or principally so, 7 per cent cream to red, 3 per cent dark brown pied, 26 per cent red pied, 7 per cent black pied and 8 per cent solid black; in Mali, Sahel type colour is predominantly red or red-pied but whites, greys and blacks also common. Coat is usually of short stiff hair, except for mane (which may be 15 cm long) and occasional animals with long breeches or more general long hair.

Products. Meat; milk; skins.

REPRODUCTION. *First kidding:* 485 ± 128.9 (s.d.) days (n=307) in central Mali in range 275-1104 days; 455 ± 86 (s.d.) days (n=10) in transhumant system and 13.1 + 1.3 (s.d.) months to 16.5 ± 1.5 months in sedentary system depending on year in Burkina Faso; 407 + 30 (s.d.) days for

nomadic Touareg and 387 ± 32 days for Fulani in Niger; 13.7 ± 16.5 months in Chad. *Kidding interval:* 291 ± 105.2 (s.d.) days (n=1111) in central Mali; 291 ± 73.4 (s.d.) days (n=51) in Burkina agro-pastoral system and 328 ± 85.8 days (n=88) in the pastoral system; 234 ± 9 (s.e.) days (n=177) in Chad; 258 ± 10 (s.e.) days in Niger; births occur all the year round but in all studies there are more parturitions during cold dry season (conceptions in late hot dry season) than at other times of year. *Multiple births:* fairly common (Table 25); of 1955 parturitions in Mali agro-pastoral system, 1593 (81.5 per cent of parturitions, 68.5 per cent of young) are single, 350 (17.9 and 30.1 per cent) are twin, and 12 (0.6 and 1.5 per cent) are triplet; in Burkina in Fulani flocks 72.1, 27.8 and 0.1 per cent of parturitions are single, twin or triplet; in Niger in Touareg flocks the figures are 74.5, 24.8 and 0.7 per cent and in Fulani flocks are 54.6, 44.1 and 1.3 per cent; in Chad 53.8 per cent of parturitions are of only a single young, 43.7 per cent are twin and 2.5 per cent are triplet. *Litter size:* 1.24 in single round retro-spective survey in central Mali in 1978 (Table 25); 1.19 ± 0.41 (s.d.) (n=1955) in long term study in Mali agro-pastoral system where there were differences due to season of parturition (1.08 in rains related to conception in dry season and 1.25 in cold dry season related to conception in rains) and parity of dam (1.03 in primiparous does and 1.34 in does of fourth and higher parities); 1.21 + 0.41 (s.d.) , (n=126) in Burkina agro-pastoral and 1.05 ± 0.24 (n=461) in the pastoral system where season again had significant effects on number of young born at each parturition; 1.01 to 1.50 in Chad, ranging from 1.12 for primiparous females to 1.74 for multiparous females on station; 1.26 in Niger Touareg flocks and 1.47 in Niger Fulani flocks. *Annual reproductive rate:* 1.49 in Mali, increasing with parity; 1.51 in Burkina agro-pastoral and 1.17 in pastoral system. *Lifetime production:* most goats do not exceed 5 parturitions (Table 26). *Oestrus cycle:* first return to heat 68 days after parturition on station in Chad; heat lasts 24-48 hours. *Gestation period:* 148 days on station in Niger.

Table 25 Owners' recall data of litter sizes of Sahel goats in central Mali

Parameter	Physiological age of goat					Overall
	Pairs permanent incisors				Temporary incisors	
	4	3	2	1		
Number in sample	180	77	61	111	444	873
Type of birth						
single	457	139	81	77	5	759
twin	203	11	4	1	0	219
triplet	8	0	0	0	0	8
Total births	668	150	85	78	5	986
Total young born	887	161	89	79	5	1221
Litter size	1.33	1.07	1.05	1.01	1.00	1.24

Table 26 Age (months) and reproductive history of Fulani (Voltaïque) goats in Burkina Faso

Age class	Number of parturitions												Number of females	Mean births at age
	0	1	2	3	4	5	6	7	8	9	10	11		
10-14	14												14	0.00
15-19	29	45											74	0.60
20-24	8	21	9	2									40	1.12
25-30	2	40	26	12	0	1							81	1.64
>30	2	22	42	88	49	32	11	7	1	0	2	1	257	3.42

GROWTH. *Birth weight:* 2.2 ± 0.64 (s.d.) kg (n=581) in Mali agropastoral system, male 2.3, female 2.1, single 2.4, twin 2.0, young of primiparous does 2.0 and of fourth parity and above 2.3; 2.7-3.2 kg on station in Niger. *Weight for age:* 10 days-3.0, 30-4.3, 90-7.7, 150-10.9, 240-15.2, 365-20.2, 550-25.2, 730-29.8, 1095-33.6 kg in Mali agro-pastoral system, main environmental influences being system, sex, parity, type of birth, season (Table 27) and year; 10 days-4.4, 30-5.5, 90-9.9, 150-12.8, 240-15.5, 365-19.9 kg in Burkina pastoral system, affected by sex, parity, season and year; similar weights in Chad. *Average daily gain:* in Mali, birth-150 days - 58.0, birth-365 -49.3, birth-1095 - 28.7 g; in Burkina pastoral system, birth-150 -70.6, 150-365 - 39.7, birth-365 - 49.0 g; in Chad pastoral system, 1 week-weaning - males 80.4 females 67.9, weaning-18 months - males 32.8 females 27.9, 18 months-5 years - males 14.5 females 8.1 g. *Post-partum weights:* 26.0 ± 5.16 (s.d.) kg (n=1729) in Mali, varying by system, parity, birth type, season, year and flock; primiparous does weigh 21.2 kg and those of fourth parity and upwards 29.4 kg.

Table 27 Weight changes (maximum and minimum averaged for 6 years) by sex and age in central Mali goats expressed as percentages of mean annual weight

Sex and age[1)]		Millet sub-system				Rice sub-system			
		n[2)]	[x3)]	Weight (per changes cent)		**n**[2)]	[x3)]	Weight (per changes cent)	
				min	max			min	max
Males:	1	642	25.1	93.0	106.5	167	24.7	91.1	107.9
	2	380	30.3	95.6	104.6	51	30.4	93.5	108.3
	3	309	34.7	87.6	110.5	49	29.8	84.1	104.9
	4	385	40.9	96.8	104.9	14	30.8	90.9	107.1
Females:	1	1342	20.4	91.8	105.0	218	20.9	94.1	109.3
	2	1026	22.5	91.9	106.3	145	23.3	5.4	109.2
	3	1300	24.9	96.2	103.1	179	26.0	96.7	105.4
	4	4257	28.0	94.9	104.3	789	28.8	97.5	107.8

Notes: 1) Age given as pairs of permanent incisors
2) Number of observations in each class of stock
3)Mean annual weight in kg

Weight changes within years in Mali, although significant, are slight and, in contrast to cattle, long term weight changes are not very marked. In Burkina within year variation is considerable, being 88.2-115.8 per cent of the annual mean in the Mossi agro-pastoral system and 87.5-113.4 per cent in

the Fulani pastoral system, in both cases for does with 3 pairs of permanent incisors.

MILK. *Lactation length:* 5-6 months; 134.7 ± 5.6 (s.e.) days (n=173) in range 54 to 155 days on station in Niger, maximum daily yield at 34 days. *Yield:* 1500 g/d for Maure in Mali, 900 g/d on station in Niger, Touareg 600-800 g/d, Voltaïque 900-1000 g/d; total lactation yield of 77.1 litres on station in Niger. *Composition:* density 1.030; DM 12.7 per cent; fat 3.9 per cent; lactose 4.6 per cent.

MEAT. *Dressing percentage:* castrates 49.4 at 26.7 kg live weight, entire males 48.0 at 27.4 kg and females 48.1 at 27.8 kg at central Mali abattoir; 41.9 at 26.8 kg, females 43.3 at 23.3 kg at Farcha (Chad); 45-48 for Voltaique type in Burkina. *Carcass composition:* "carcass" 47.9 per cent in central Mali, stomachs and intestines 5.0, kidneys 0.5, liver 1.9, lungs and heart 2.6, mesenteric fat 4.4, spleen 0.5, head 6.9, feet 3.2, wet skin 6.7, udder 0.8, gut fill 12.7, blood and body fluids 6.8.

Average carcass weights in Mali were 14.2 kg for all ages and *sexes* combined and goat dressing percentages were significantly better than sheep, mainly attributable to lighter gut fill. In 1979 and 1980 at Niono in central Mali, goats contributed 36.3 per cent of all meat produced at the municipal abattoir.

SKINS. Chad exported, through official channels, 1 106 000 skins in 1973 and it was estimated that 176 500 were used locally but this was an exceptional year due to the Sahel drought: in 1976, 820 000 skins were exported of which just over half were goatskins each of about 500 g dry weight.

HAIR. Attempts to produce mohair from Sahel goats in Mali by crossing with Angoras during the 1920s to 1940s achieved only limited success on station and the results were not extended to the traditional producer level.

Research. Mainly systems studies carried out by ILCA, EEC and national organizations, the last particularly in Niger and Chad.

References. Dumas & Raymond, 1975; Dumas, 1977; Gerbaldi, 1978; Dumas, 1980; Bourzat, 1980; Wilson, 1981; Alaku & Moruppa, 1983; Wilson & Durkin, 1983; Wilson & Wagenaar, 1983; Wilson, 1984a; Ouedraogo, 1984; Wilson, 1986; Wilson & Light, 1986; Wilson, 1987; Wilson & Sayers, 1987; Wilson, 1988; Wilson & Durkin, 1988; Bourzat & Wilson, 1989.