

THE BREEDING OF SOME LARGER MAMMALS IN NORTHERN RHODESIA

BY

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(With 11 figures in the text)

Details are given of a standard manner of recording breeding data of large mammals by game department officers, which is considered a great improvement on previous casual reporting. Information on the breeding in Northern Rhodesia of several ungulates and large Carnivora is summarised, and comparisons made with published data from other territories. It is stressed that much more study is needed, but certain points emerge from consideration of present information. Many species have their young at any time of year, and only a few have a really sharply defined birth season. The wart hog (*Phacochoerus aethiopicus*) seems markedly seasonal in the south of its range, but not in the northern parts. There is at present no data on the fluctuations in frequency of births among non-seasonal breeders. In the seasonally breeding species the actual birth months vary somewhat from north to south, and in the wildebeest (*Connochactes taurinus*) there may be variation in the calving time due apparently to purely local differences of environment. The wild dog (*Lycan pictus*) appears to be monoestrous, but data on the larger felids, though incomplete, seems to indicate that young may be born at any time of the year. Limiting factors in the study of breeding in African large mammals are pointed out, but it is suggested that further work on the lines of that carried out in Northern Rhodesia would be profitable.

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INTRODUCTION

Our knowledge of the breeding biology of African wild mammals is very incomplete, even among the better known species, while virtually nothing is known of many others. In the records of the Northern Rhodesia Game &

Fisheries Department a fair amount of information has been accumulated, and this has been available to me in addition to my own notes. Several game animals have, however, had to be omitted due to lack of sufficient data.

I am indebted to Messrs R. I. G. Attwell, B. L. Mitchell and J. C. Uys of my department, who have supplied much further information, and to Mr G. Hellam of the Livingstone Game Park, for useful records of births there, as well as notes on breeding of some species in the wild state.

SOURCES OF DATA

Information has been drawn largely from unpublished records of the Game & Fisheries Department, which are quoted as "dep.rec". Game reports, which were introduced in 1957 with the object of enabling officers to record data from field observations in a standard and concise manner, have been particularly useful. These reports are made on printed forms (see Appendix) and filed under individual species. One line is allotted to "Number of juveniles definitely under one month old" and from this it has been possible to obtain many more definite records of births than previously available. The advantage of such data from several different parts of the country is obvious, even though there is inevitably a subjective element in that observers may differ somewhat in their assessment of the ages of young animals seen. However, it has been particularly stressed that accuracy is of prime importance, and that in cases of doubt records of "under one month" should not be made. In the following I have guarded as far as possible against the inclusion of possibly unreliable data.

Additional notes may be included on the report forms, e.g. when a young animal still wet from birth is found, or "not under one month, but definitely under two months", this latter being useful for species which hide their newly born young for a time, and of which there are consequently few or no "under one month" reports.

I have back-dated the records to arrive as nearly as possible at the actual birth months, having regard for all relevant factors, and though it may be objected that an additional subjective element is thereby introduced it is considered that these "calculated" times of birth are as accurate as can be obtained, and they are in any case an advance on previously available data.

One thing, however, must be pointed out in connection with the records compiled as above, which, unless guarded against, might introduce serious bias. This is that most game reports are made in the dry season, from about April to October or November. This is because game is widely dispersed during the remainder of the year, and opportunity for observation is further limited by the tall grass, while routine patrolling by game staff is at a minimum during the rains. The main result of the scarcity of wet season reports is to leave gaps in the information on species believed to have young throughout the year. With those markedly seasonal it may not matter, because numerous observations of the herds without young prior to the appearance of the first calves of the year may leave no doubt as to the periodic nature of their breeding.

Records of births of certain species in the Livingstone Game Park have been made available by Mr G. Hellam. This Game Park is not a National

Park in the accepted sense, with animals in the wild state, but an enclosed area of about 1000 acres into which local ungulates are imported and kept as a local attraction. Several animals have bred therein, and it is assumed that for the most part they would do so about the same time as in the wild. Livingstone Park records are quoted therefore only where particularly necessary, no special mention being made where they completely accord with observations in other parts of the territory. Births in the London Zoological Gardens have been summarised by Zuckerman (1953), and I have in some instances referred to this. But it seems advisable to exercise caution in applying data from captive animals to wild ones. In London the animals are, of course, more closely confined than in Livingstone Game Park, and in a quite different and more artificial environment.

In addition to records from Northern Rhodesia I have noted information from certain other territories, principally from published works, especially Shortridge (1934, including his quotations from other authors), Stevenson-Hamilton (1947), Verheyen (1951), Verschuren (1958), and Roosevelt & Heller (1922). Comparisons have been made where possible between these different areas in respect of the seasonally breeding species.

TEXT FIGURES

For some species I have shown recorded births in Northern Rhodesia, up to and including 1958, as histograms, and where there is marked periodicity I have given charts which show the seasons in Northern Rhodesia in comparison with other territories. In these charts peak periods are shown where possible as solid rectangles, and other months cross-hatched, but this has not been possible in all cases due to lack of sufficient data. Out-of-season births are indicated by crosses. It should be remembered that the extent and validity of the information available may vary, and the older records may often be based on general impressions and isolated cases rather than extensive detailed observations.

TERMS USED

From the literature it is obvious that the term "breeding season" is used in two different senses. It may indicate the time when the young are born, or may stand for the time of mating. To avoid ambiguity it seems best to drop the expression "breeding season" in either particular sense, and to use "season of birth" for the time the young are born (with "calving", "lambing", "foaling", "farrowing" or "whelping" for special groups if desired), and "mating season" or "rut" for the other time. Such usage can cause no possible confusion.

In Northern Rhodesia certain differences in the birth times among the seasonal breeders have been found between the Luangwa Valley and the middle Zambesi Valley (below Victoria Falls to Feira) on one hand and the northwestern and western plateau areas on the other. The latter are herein termed the "northwestern plateau", and it is from this area that most of the records come.

BREEDING RECORDS OF SPECIES

PROBOSCIDEA

Elephantidae

LOXODONTA AFRICANA Blumenbach (African Elephant)

Verheyen (1951) thought April to June was the calving time for elephant in the Upemba area, while Wilhelm (cited by Shortridge, 1934) gave October to December for the Okovango and the Caprivi. But Perry (1952), from post mortem examination of many females in Uganda, concluded that breeding might take place at any time of year, without any marked season, though perhaps somewhat more frequently in the dry period, which is about December to February in Uganda. Data from N. Rhodesia shows that small calves have been seen at practically all times of the year, definite records being absent only for February. Even allowing for the fact that in a species with such a long period of infancy individual observers are likely to differ considerably in what they consider newly born young, it seems clear that calves may be born at any time in N. Rhodesia. In the Luanga Valley, where elephants are more numerous and more frequently observed than anywhere else in the territory, there is not known to be any peak calving period in the dry season (Attwell, *in litt.*)

Various authors (e.g. Roosevelt & Heller, 1922, and Verheyen, 1951) have asserted that the newly born calf remains hidden near its birth place for a short time, until able to follow the herd. But this hardly seems borne out by a more recent account of a birth described in detail (Poppleton, 1957).

Mammae : 1 pair, pectoral.

Young per birth : 1. An instance of twins has been reported from Southern Rhodesia. (Anon. 1956).

PERISSODACTYLA

Rhinocerotidae

DICEROS BICORNIS Linn. (Black Rhinoceros)

There is little information on the breeding of this animal either from N. Rhodesia or elsewhere. Pitman (1934) records a 40 lb. foetus in May in the present Lavushi Manda Game Reserve, and may have based his suggestion of a regular calving season in June on this one instance. Very young calves have been seen in the Luangwa Valley from June to October by Attwell, who believes, however, that calving may occur throughout the year. Roosevelt & Heller (1922) record that this is so in East Africa, where the young "may be produced at any season". Wilhelm and Vaughan-Kirby (cited by Shortridge 1934) conflict in that one thought calving occurred generally during the early rains, and the other at the end of the rains, though they were referring to different areas.

It seems that there is no defined calving time, and that the above suggestions that there is may have been made on too few data.

Mammae : 1 pair (Roosevelt & Heller, 1922), inguinal.

Young per birth : 1.

Equidae

EQUUS BURCHELLI Gray (Burchell's Zebra)

Pitman (1934) considered zebra foals were born in N. Rhodesia from July to September. Fig. 1 shows eighty-one births in the northwestern plateau up to and including 1958, and confirms that July to September is indeed the peak period, with early foals a little before and late ones a little after. There are, however, several records of out-of-season births (Fig. 2) and Uys has in

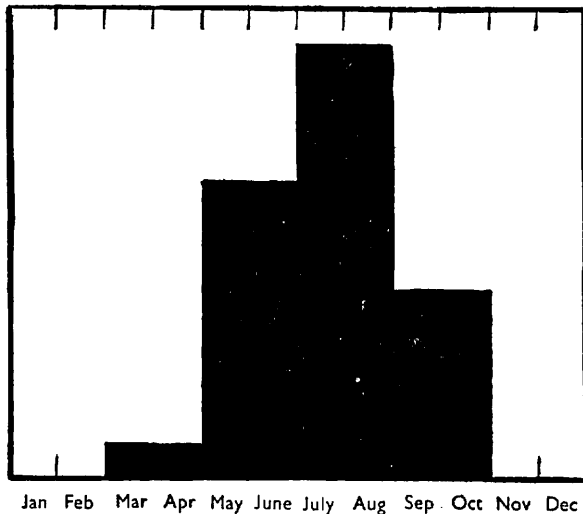


Fig. 1.—*Equus burchelli*. Eighty-one births in the Northwestern plateau areas of N. Rhodesia. From records of foals under one month old. (Combined into two-month periods to minimise possible error in calculating births).

E. Africa (Neumann)					+								
Upemba (Verheyen)		+		+									
N.W. Plateau of N.R. (Dep. Rec.)			+	+	+	+					+		
Luangwa Valley N.R. (Attwell)													
Nyika Plateau (Attwell) (2 foals only)													
Okovango (Wilhelm)													
Kaokoveld (2 cases only) (Shortridge)													
Transvaal (Stev.-Ham)	+	+	+	+									+
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	

Fig. 2.—*Equus burchelli*. Chart of foaling seasons in East, Central and Southern Africa.

N. Rhodesia noted that occasional young foals may be seen at any time. July to September seems to be the main foaling time in most northern parts of the species range, but rather later in the Transvaal, and apparently more prolonged in the Okovango area. In the Luangwa Valley the foaling time corresponds with the northwestern plateau. The April and May records from the Kaoko-

veld may be isolated instances. The November record from the Nyika is of two very young foals in the same herd (Attwell, *in litt.*). 1959 records confirm the previous data for N. Rhodesia.

The newly born young have a mantle of quite long upright hairs on the back, especially over the croup, and the stripes are generally reddish brown, instead of the sepia to black seen in the adults. They run with the herd from birth.

Mammae : 1 pair, inguinal.

Young per birth : 1. (There is circumstantial evidence of an instance of twin foals in the Luangwa Valley).

ARTIODACTYLA

Suidae

POTAMOCHOERUS PORCUS Linn. (Bush Pig)

Records of recently born young from several plateau localities in N. Rhodesia are from October to March. There is one note of a litter estimated to have been born in July in Mazabuka District, but Uys, who recorded this, stated it was quite exceptional. A juvenile in captivity has been seen by C. W. Benson in Samfya District, believed to have been born in mid-September. This would

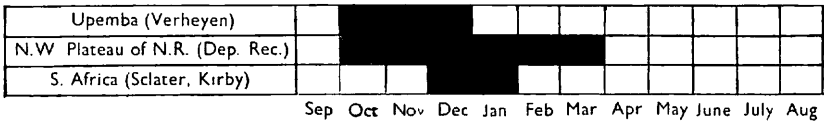


Fig. 3.—*Potamochoerus porcus*. Chart showing farrowing seasons in Central and Southern Africa.

be from an early litter. There are two instances of well developed foetuses in December, and several of sows in lactation during the rains. Other data, not formally recorded, from vermin control operations corroborate that the young are usually farrowed in the rains, as do several observations of sounders without newly born young in the dry season. Fig. 3 shows that Upemba records largely coincide with the N. Rhodesia data, though there appear to be none after December. The South African records are also similar, though perhaps incomplete.

Sows usually make a nest, or bower, for their litters in tall grass. The new born young are marked longitudinally with yellowish stripes on a brown ground, which is later followed by a reddish coat, basically as in the adults. With age the colour gets darker, and old boars may appear black all over, apart from the white dorsal crest.

Mammae : 3 pairs, lower abdominal (Sometimes there may be only 2 pairs).

Young per birth : 2–6 (usually 3 or 4 in N. Rhodesia) Verheyen suggests young sows have 3–4 in the first litter, and subsequently 5–6. The figure of 6–8 given by Asdell (1946) is too high, at least for N. Rhodesia.

PHACOCHOERUS AETHIOPICUS Pallas (Wart Hog)

Fig. 4 shows thirty births in the northwestern plateau recorded up to and including 1958, and indicates a definite peak in July and August, with early litters in June and late ones to October. 1959 figures are in agreement with the previous ones. On several occasions sounders without newly born young have been seen up to June. For example in the Northwestern Province totals of twenty-seven and twenty-eight animals were seen in two successive seasons in May–June without any of the season's new arrivals. In the Kafue National Park, Namwala sector, Uys noted "no young yet" in June 1957, and later

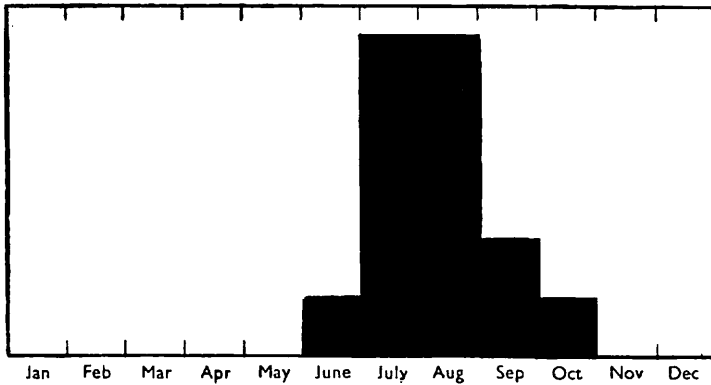


Fig. 4.—*Phacochoerus aethiopicus*. Thirty litters recorded in the Northwestern plateau areas of N. Rhodesia. Birth months calculated from observations of young under one month old.

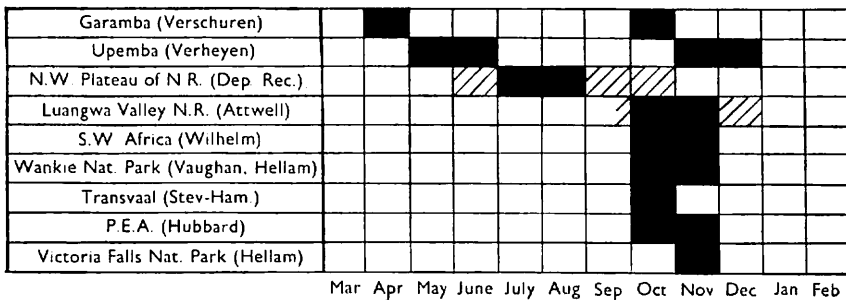


Fig. 5.—*Phacochoerus aethiopicus*. Chart showing farrowing seasons in Central and Southern Africa.

saw the earliest arrivals on 25th July. In 1958, in the same area, he records that the peak of farrowing had been reached by 29th. July when "dozen of females with young" were seen; and in the Kasempa sector of the Park on 3rd August 1959 "most sows now accompanied by young, 2–6 per litter". In the Luangwa Valley the farrowing time is later, from late September to December, with a possible peak October–November (Attwell, *in litt.*) which agrees with areas farther south, both on the east and west of the continent (Fig. 5). In the Luangwa Valley (North) Game Reserve between mid-

November and mid-December 1959, L. D. C. Allen recorded litters estimated six to eight weeks old, which agrees with Attwell's report. Allen has drawn attention to the fact that some sows had older young than this with them, which he estimated aged about nine months, though it seems more probable that they would have been the previous season's litters, thus about a year old. I have sometimes seen sows with the previous litter as well as newly born young, though more information on the growth rate is needed before one can be absolutely sure about their ages.

There is a record from the middle Zambesi Valley, in Gwembe District, of a litter a few weeks old in November (C. W. Benson) ; of two juveniles estimated five months old in March 1959 (Hellam) ; and Uys considers November to be the peak farrowing time in this area, which thus corresponds with the Luangwa Valley.

Farther north the situation apparently changes, and it is recorded that wart hog in the Upemba area and the Garamba National Park in the Belgian Congo have two farrowing times (Verheyen, 1951 ; Verschuren, 1958). In the former locality foetuses have been found during March and April (Frechkop, 1954). In East Africa, the Cameroons, Senegal and the French Sudan the species appears to breed at any time (Roosevelt & Heller, 1922 ; Jeannin, 1936 ; Dekeyser, 1956). These places are nearer the Equator than where marked seasonal breeding has been recorded. It is possible that the occurrence of two farrowing seasons in the Belgian Congo may indicate a transition between seasonal and non-seasonal breeding. Further data is necessary to confirm or refute this.

The young are plain coloured, like the adults, and are normally born below ground in old antbear holes, which is the usual lying up place for wart hogs. According to Verheyen (1951), they remain there for about two weeks, which may be so, though very tiny juveniles are often seen out with their parents.

Mammæ : no data.

Young per birth : 2-7, usually 3-4 from most N. Rhodesian data.

Verheyen suggests three in younger sows and four or more with older ones. Allen (dep. rec.) has noted in the Luangwa Valley that new born litters usually number 4-7 while older ones are usually reduced to 3 or less.

Hippopotamidae

HIPPOPOTAMUS AMPHIBIUS Linn. (Hippopotamus)

Departmental records of newly born young are from April to December ; and mating or attempted mating has been seen in June, and September-October. Hubbard (1929) records a foetus estimated within two weeks of birth on the Kafue River in early August, while Stewart (dep. rec.) found one 21 inches long and 22 lb. weight near Mpika on 8th January 1959. In the Luangwa River a birth took place on land during the night of 6th-7th July 1958, and the calf was seen to enter the water with its dam at 8.30 a.m. on 7th July (W. R. Bullock, dep. rec.). Shortridge (1934) records his opinion that there is no fixed season of birth in Southwest Africa. This is also so in Garamba National Park (Verschuren, 1958), and the Cameroons (Jeannin, 1936), and

captivity records are consistent with breeding at any time. (Zuckerman, 1953 ; Asdell, 1946). This is supported by the N. Rhodesia records mentioned above, and Attwell agrees as far as the Luangwa Valley is concerned.

Mammae : 1 pair, inguinal.

Young per birth : 1 (twins may very rarely occur, though there is no confirmed instance in N. Rhodesia).

Bovidae

SYLVICAPRA GRIMMIA Linn. (Common Duiker)

Recently born young have been recorded in July, and November (dep. rec.) and foetuses in Feb. (40 mm.) ; April ("small") ; July (full term) and September (nearly full term). From Upemba Frechkop (1954) notes foetuses in February, May, July and September ; and in Nyasaland a "large" foetus was found in December (Lawrence & Loveridge, 1953). In Livingstone Game Park Hellam (*in litt.*) states that young have been born from August to November during 1953 to 1958. The female containing the 40 mm. foetus noted above was also in lactation. Verheyen (1951) thought that in the Upemba area females may breed three times yearly. Asdell (1936) quotes Fitzsimons as stating that duiker breed all the year round in South Africa, though mainly in early spring and summer ; while Stevenson-Hamilton (1947) also thought that there is no fixed lambing time. The records given in Shortridge (1934) agree. While N. Rhodesian records might be more complete, it seems safe to say that lambing may take place at any time. The newly born lambs must be hidden for a time, though I have no definitely recorded instance of it.

Mammae - 2 pairs, inguinal.

Young per birth : 1 usually, occasionally twins (*vide* Shortridge, and Stevenson-Hamilton), though there is no recorded instance of twins in N. Rhodesia.

REDUNCA ARUNDINUM Boddaert (Reedbuck)

Information on the breeding of reedbuck in N. Rhodesia is scarce, and there are in departmental records only four instances of young below a month old reported, one estimated born in May, one in June and two in October. Other juveniles have, however, been noted from April to October ; and a foetus in October (size not recorded) and one (fully formed) in December. In the Upemba area there is a record of a foetus in January (Frechkop, 1954). Hellam's notes on Livingstone Game Park births show births from January to April. The data given by Shortridge (1934) indicate an extended lambing season. Verheyen (1951) thought that females in the Upemba area might have two young in a year. Uys has noticed that newborn young are left hidden and do not accompany the female until fairly well grown, which doubtless accounts for the few reports of young under a month old. It appears that lambing may take place throughout the year, and from Luangwa Valley observations, Attwell agrees ; while captivity records (Zuckerman, 1953) are consistent with this.

Mammae : 2 pairs, inguinal.

Young per birth : 1. Occasionally twins (Verheyen, 1951).

KOBUS ELLIPSIPRYMNUS Ogilby (Common Waterbuck)

Observations of young estimated below a month old are few, only four, with one other of a calf estimated $1\frac{1}{2}$ to 2 months. These, from the Luangwa Valley, indicate births from May to about August. Matings have been seen in June and August, which, if the gestation period of 240 days given by Kenneth & Ritchie (1953) is correct, would result in births in February and April. In the Transvaal calving is recorded as usually taking place in February, but with irregularity and extending also from August to January (Stevenson-Hamilton, 1947).

While further information is needed, it is probable that there is no fixed calving season. Attwell (*in litt.*) agrees.

Roosevelt & Heller (1922) record that the female stays alone with her calf for a few days after the birth.

Mammae : 2 pairs, inguinal.

Young per birth : 1.

KOBUS DEFASSA Rueppell (Defassa Waterbuck)

Two single foetuses have been recorded by me in the Northwestern Province, one "small" in August, and one 200 mm. in October. As with *K. ellipsiprymnus* the young are hidden for a time after birth (Uys), and this would account for the shortage of "under one month" observations. Most of the departmental records are of animals estimated at two to three months old, and these indicate a prolonged calving season from February to November, and the absence of records for January and February must be due only to the general lack of reports in those months. It seems clear then that calving may take place at any time. Roosevelt & Heller (1922) and Jeannin (1936) agree that this is so in East Africa and the Cameroons respectively, though Jeannin thought there might be a peak in the middle of the dry period. From observations in the southern part of the Kafue National Park B. L. Mitchell (*in litt.*) considers it likely that there is a peak in February and March in that area.

Mammae : 2 pairs, inguinal.

Young per birth : 1 usually, but twins seem fairly frequent, and in the Upemba Frechkop (1954) records an instance of triplets.

KOBUS VARDONI Livingstone (Puku)

In Kabompo District I have found a foetus in November which would have been born within a day or two at most. Pitman (1934) thought lambing was from May to July, and records a number of young under a month old between May and September. P. H. Morris (dep. rec.) found a new-born lamb, not yet on its feet in Kasempa District on 7th September. Uys thinks young may be born at any time of year, but adds that further observation would be needed to confirm this. There is the usual lack of reports from December to April; but in the Luangwa Valley from 11th to 16th November 1957 Major Grimwood (dep. rec.) did not see any really young ones. Some young of un-stated age have been reported in Serenje District in February, none, however,

under a month old. Mating has been seen to take place in July, August and October (dep. rec.).

Selous (quoted by Shortridge, 1934) noted November and December as the birth time, presumably in northern Bechuanaland. Verheyen (1951) thought there were two lambing seasons, June–July and January–February.

Data is therefore inconclusive, but the main lambing time appears to be May to September, with a possible peak from June to August.

The newly born young are hidden for a time, and even after starting to run with the herd they will, on being disturbed, conceal themselves in long grass while the adults make off.

Mammae : 2 pairs, inguinal.

Young per birth : 1.

KOBUS LECHE Gray (Lechwe)

Extensive observations on the Kafue Flats have shown that while most young lechwe are born from mid-July to mid-August, the lambing season is nevertheless prolonged. The earliest recorded births were three in April, noted as "very early", and at the other extreme a decreasing number are born from September through to December. Rutting is mainly from late October to December, which would seem to indicate a gestation period of nearer eight months than seven months as given by Asdell (1946). (B. L. Mitchell and J. C. Uys, unpublished data). Shortridge (1934) records lambing in the Caprivi from July to November, which agrees approximately with the Kafue Flats. In London Zoological Gardens lechwe have bred in most months (Zuckerman, 1953). In fact February is the only month in which no birth has been recorded either in the wild or in captivity.

For the Bangweulu area (*L. leche smithemani* Lydekker) data are less complete, but there too a prolonged lambing season is recorded. W. E. Poles has seen some small juveniles in April and May, rutting in January, and recently formed foetuses in March in this area.

The newly born young are hidden for a time.

Mammae : 2 pairs, inguinal.

Young per birth : 1.

AEPYCEROS MELAMPUS Lichtenstein (Impala)

From many records it is clear that in the northwestern plateau impala have a sharply defined lambing season, most young being born in late September and October. In the Luangwa Valley, though some may be born in October, the peak period is in November, according to Attwell (*in litt.*), and apparently from other dep. rec. may extend into December. There is one Luangwa Valley record of a lamb in April (Schultz, dep. rec.) which is well out of the usual season. In the middle Zambesi Valley, Gwembe District, B. L. Mitchell recorded thirteen young impala estimated about three to four months of age on 26th February. If this estimate is correct the season of birth there must agree with that in the Luangwa Valley, as does that of the wart hog (see above), the only other markedly seasonal breeder common to both areas.

From Fig. 6 it seems that the season in Southwest Africa is the same as in the northwestern plateau of N. Rhodesia, while in Wankie National Park and the Transvaal it is later. The Luangwa and middle Zambesi Valleys are intermediate in this.

Roosevelt & Heller (1922) believed that the doe kept to herself with her young for a short time after giving birth, while Shenton (1954) records some small lambs left on their own in the Luangwa Valley. I have put up a newly born impala from an anthill, where it was lying quite alone. Nevertheless I do not think the time from birth until joining the herd can be very long, as all the season's crop of young can be seen together with the herd when still very tiny. When such a herd is disturbed the young ones often lead the flight, then appearing like a female herd in miniature, as they are remarkably like the adults in everything except size, and in the males lacking horns. While the adults are feeding, the small ones may be left a short distance away resting together in the shade, usually with one or two adult females watching over them.

Mammae : 2 pairs inguinal.

Young per birth : 1, or sometimes twins. (Asdell 1946, and dep. rec.)

There is no data on the frequency of twin births, however.

N.W. Plateau of N.R. (Dep. Rec.)													
S.W. Africa (Wilhelm)													
Wankie Nat. Park (Hellam)													
Luangwa Valley N.R. (Attwell)		+											
Transvaal (Stev.-Ham.)													
	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	

Fig. 6.—*Aepyceros melampus*. Chart showing birth seasons in Central and Southern Africa.

HIPPOTRAGUS EQUINUS Desmarest (Roan Antelope)

Pitman (1934) was uncertain as to the exact calving season, but recorded some calves born in April and May. Uys has noted May as a time when a number of roan are born. Departmental records of young under a month old in the northwestern plateau up to and including 1959, are mostly from April to August, with one in October and one in November. From December to April the lack of data may be due only to the lack of reports for the period, though there are several reports of herds in September and October of which only one includes a small calf. Attwell has noted newly born young in the Luangwa Valley in September, and on the Nyika plateau in November. (Attwell *in litt.*).

Verheyen (1951) thought the species bred all the year round in the Upemba area, but with a peak period of birth from February to May. Jeannin (1936) states that mating takes place in the dry cold season in the Cameroons. Asdell (1946), perhaps combining Shortridge's records and others from farther south-east, stated there was apparently no fixed breeding season.

Data for N. Rhodesia are inconclusive, and more are needed, especially during the rains.

Newly born calves are hidden for a time after birth (Uys, Savory).

Mammae : 2 pairs, inguinal.

Young per birth : 1.

HIPPOTRAGUS NIGER Harris (Sable Antelope)

Uys considers that young sable are born in the Kafue National Park mostly from July to September. Many births calculated from "under one month old" records fall between June and September, but Shenton records calves in the Kafue National Park believed born in January, and there is also a record of a birth in March (locality not recorded) and one in Kalomo District in October. In Livingstone Game Park calving has been from January to March in the years 1953 to 1957, six to eight births taking place annually (Hellam, *in litt.*). In the Caprivi Wilhelm's records (quoted by Shortridge) indicate calving from December to January. As with the roan antelope N. Rhodesian data at present are inconclusive, and not much in accord with records from adjacent territories (Fig. 7). For example Verheyen (1951) gives the rains as the calving time, while, apart from those of the semi-captive animals in the Livingstone Park, N. Rhodesian records are mainly in the dry season, in fact between the peaks in April–May and October–November given by Verheyen.

	June	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Upemba (Verheyen)												
N.W. Plateau of N.R. (Dep. Rec.)												
Caprivi (Wilhelm)												
Mashonaland (? Darling)												
Transvaal (Ste.-Ham.)												
Selous Records (? Area)												
Livingstone Game Park (Hellam)												

Fig. 7.—*Hippotragus niger*. Chart of calving seasons in Central and Southern Africa.

Uys has observed that the calves run with the herd more or less from birth. Newly born young are very light in colour.

Mammae : 2 pairs, inguinal.

Young per birth : 1.

ALCELAPHUS LICHTENSTEINI Peters (Lichtenstein's Hartbeest)

Fig. 8 shows ninety-one births in the northwestern plateau calculated from "under one month" records, up to and including 1958. All other observations confirm that July is undoubtedly the peak calving time and that the young are generally born within a short period, though early calves may make their appearance in June, and late ones in September (possibly even October, though this would be unusual). Uys noted a pair mating in Kasempa District in November, and suggests a gestation period of ± 237 days, which agrees closely with Stevenson-Hamilton's estimate (Kenneth & Ritchie, 1953).

From the Luangwa Valley the only two records of young under a month old are in October and November, but Attwell (*in litt.*) confirms that these months are in fact the main calving time there. From Fig. 9 it can be seen that the Upemba area corresponds with the northwestern plateau of N. Rhodesia while the Luangwa Valley agrees with records from farther south.

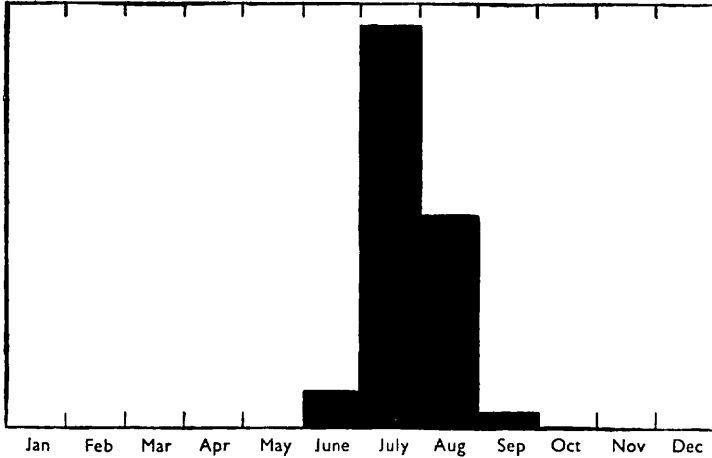


Fig. 8.—*Alcelaphus lichtensteini*. Ninety-one births in the Northwestern plateau areas of N. Rhodesia calculated from observations of young under one month old.

Infant hartebeests are concealed after birth for a short time, the cows often remaining on guard near by. Two or more may be thus hidden, and I believe they may be left on their own at times even after starting to run with the herd, for I have seen quite strong calves together in a little group, as well as herds without calves at times when the cows must have already given

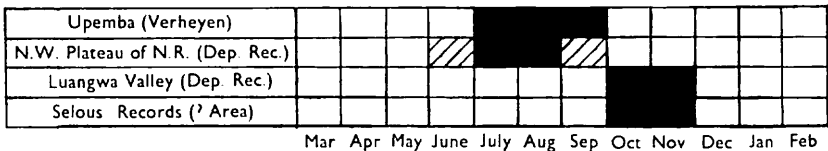


Fig. 9.—*Alcelaphus lichtensteini*. Chart of calving seasons in Central Africa.

birth. By the time they are two to three months of age hartebeest have spike-like horns, without curves, about 4 inches long. I noticed a calf of this age showing the dark smudge behind the shoulder, which is characteristic of the adults, and is believed due to the rubbing of the face gland on the body at this point, leaving a dark sticky deposit. It seems, then, that this gland is functional at an early age. Young hartebeest are much lighter coloured than the adults.

Mammae : 1 pair, inguinal.

Young per birth : 1 usually. There is some evidence that twins may be born occasionally.

CONNOCHAETES TAURINUS Burchell (Blue Wildebeest)

The nominate race inhabits the western parts of the northwestern plateau, and many records indicate calving mainly in September and October, with early births in August and late ones in November. However, B. L. Mitchell believes that in the Southern Province the calving is late August to September in the Isoberlinia and Mopane areas of Kalomo and western Namwala Districts, and October to November on the open flood plains of the Kafue Flats (B. L. Mitchell, *in litt.*). This is interesting because Selous found that in 1879 calving was in September in the Chobe area, but not until November in the Mababe Flats, not far distant (quoted by Shortridge, 1934). In the Transvaal Stevenson-Hamilton has noted that in the Kruger Park young are born from early December to mid-January, but in November 30 miles west of the present boundary, which is presumably because the new grass appears there rather earlier. Eloff (1959) notes irregularity in calving in the Kalahari Gemsbok National Park in 1957, and discusses the question in relation to observations on variation in birth times made by M. H. Cowie in Kenya. It seems then that in many, if not all, parts of its range the species, while strongly seasonal in calving, may show variations due to quite local conditions (Fig. 10). Further investigation of this is desirable.

Luangwa Valley N.R. (Attwell)																				
Western Namwala & Kalomo (Mitchell)																				
Kafue Flats (Mitchell)																				
1879 Chobe (Selous)																				
1879 Mababe (Selous)																				
S.W. Africa (General) (Shortridge)																				
Kruger Park (Stev.-Ham.)																				
30 miles W. of Kruger Park (S-Ham)																				
	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb								

Fig. 10.—*Connochaetes taurinus*. Chart of calving seasons in Central and Southern Africa.

It is difficult to account for Pitman's belief that the young are dropped "mainly in June and July" (Pitman 1934). All other evidence is against this, and it is easier to note the appearance of the first young in this species than almost any other. There are in fact several notes in the departmental records of new born calves not yet on their feet, as well as numerous herds without small calves in June and July.

Records of births among *C. t. cooksoni* Blaine, which occurs in the Luangwa Valley, are fewer, but such as they are indicate a later season than on the plateau. Attwell (*in litt.*) gives November as the main calving month, and Shenton records "possibly as late as December". Allen (dep. rec.) has reported numerous recently born calves in the Luangwa Valley (North) Game Reserve in November–December 1959.

Wildebeest calves are much lighter coloured than the adults, and they run with the herd from birth. They are very swift even when a few hours old,

and show remarkable endurance. Sherfield (dep. rec.) has noted that with one new born calf the time from its first attempt to stand until it *ran off with the herd* was less than five minutes.

Mammae : 1 pair, inguinal.

Young per birth : 1.

DAMALISCUS LUNATUS Burchell (Tsessebe)

Records for N. Rhodesia are few, but indicate a season of birth just as for the hartebeest, i.e. mostly July, with early calves born a little earlier, and late ones in August or September. Farther southeast and southwest calving is later (Fig. 11).

Mammae : No data, but presumably would be 1 pair, inguinal, as in *Alcelaphus lichtensteini* and *Connochaetes taurinus*.

Young per birth : 1.

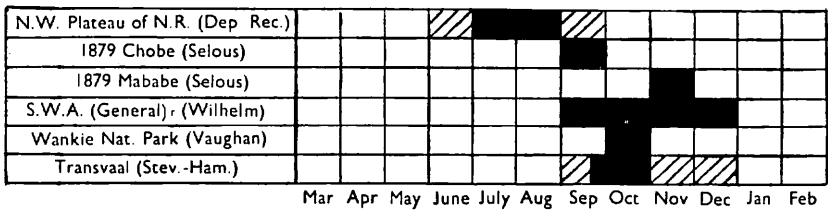


Fig. 11.—*Damaliscus lunatus*. Chart of calving seasons in Central and Southern Africa.

TRAGELAPHUS SCRIPTUS Pallas (Bushbuck)

Records of fetuses and newly born young are few, but indicate lambing from February to October, and absence of data for the other months is probably only due to lack of reports. In the Garamba National Park Verschuren (1958) found there was no fixed lambing season, and Selater (quoted by Shortridge, 1934) stated that the species bred all the year round in the Port Elizabeth, but farther inland the breeding season was mainly in October–February. It is not clear in which sense Selater was using the term “breeding season”. Stevenson-Hamilton (1947) gave September to March as the lambing season in the Transvaal, while Jeannin (1936) considers it to be the dry season in the Cameroons.

While, from published records, there is the probability of a peak lambing period, it seems that the species may lamb in any month. Attwell agrees from Luangwa Valley observations.

I have no definite information on the point, but the lambs are doubtless hidden for a time after birth.

Mammae : 2 pairs, inguinal.

Young per birth : 1.

TRAGELAPHUS SPEKEI Selater (Sitatunga)

I have found nearly full term fetuses in August, October (two instances), and November ; and less developed fetuses in October and November. Davi-

son (1950) records that young are born in the Chobe area in June and July. Mr T. R. Evans, of the Veterinary department, has recorded a young one believed under one month old in Serenje District in March, and also reports that local native information is that young are born at the beginning and end of the rains. Pitman's record of newly born lambs on Nkose Island, Uganda (Pitman, 1928), appears an isolated observation, not necessarily indicating a definite season of birth.

On the whole it seems probable that young may be born at any time of year, but more data are needed to be certain.

The lambs are concealed among reeds for a time after birth (Davison, 1950).

Mammae : 2 pairs inguinal.

Young per birth : 1.

TRAGELAPHUS STREPSICEROS Pallas (Kudu)

Definite dates on which births have been recorded are 26th January in Lusaka District (G. E. Taylor), a calf still wet from birth rescued alive from a honey badger (*Mellivora capensis* Schreber) ; and 21st February, in Lundazi District (O. Charlton), a calf either just born or just about to be, killed together with its parent by a hyaena (*Crocuta crocuta* Erxleben). A foetus collected in Mazabuka District in November (C. W. Benson) would probably have been born in late December or early January. Records of young under one month old include February, March, April, May, June, July, September, October and November, so it is clear that calving may take place at any time. Wilhelm (quoted by Shortridge, 1934), and Stevenson-Hamilton (1947) seem to imply that there may be a definite season for calving, but in the light of the foregoing data this seems doubtful. From Luangwa Valley observations Attwell agrees that young may be born at any time of year.

A newly born calf was seen hidden under a bush (dep. rec.) and I have twice seen a female alone with her recently born young.

Mammae : 2 pairs, inguinal.

Young per birth : 1.

TAUROTRAGUS ORYX Pallas (Eland)

Pitman (1934) was uncertain when elands calved in N. Rhodesia, but noted many small calves in July and August. Uys is inclined to think February to July is the main birth time, while Carr (dep. rec.) has noted " April onward " in the Luangwa Valley. Available information indicates a peak period from June to August, though there are other records in April, September and November, and one in Livingstone Game Park in March. In 1959 in a herd of about eighty animals on Lochinvar Ranch, Mazabuka District, the ranch manager, Mr Van Zyl, reported calves born as follows : nine in January or February, six in March and eleven in April. A single calf under one month old was seen there with a cow during November 1959 (W. P. Crowcroft) but whether from this same herd or not is not known.

Selous' observation (quoted by Shortridge, 1934) that elands calve in S. Rhodesia from June to August agrees, as far as it goes with the N. Rhodesia

time. Stevenson-Hamilton (1947) states that in southeastern Africa elands calve from March to May (mainly in April), and again early August to the beginning of November. In the southern part of its range he believes it unlikely that many calves are born in the cold months of June and July.

In N. Rhodesia it seems likely that calves may be born at any time. Captivity records (Zuckerman, 1953) show that elands can calve at any time of the year.

N. Rhodesian records seem to indicate that, irrespective of the actual month, several cows in a herd may calve about the same time. There are many instances of several young of uniform age seen together. Morris (dep. rec.) reported in the Kasempa sector of the Kafue National Park that one herd in August included ten calves, all estimated about two months old; while just on a month later he saw a herd of forty-seven animals without a single young calf. Further information on this is needed.

In view of the wandering habits of eland it seems probable that the calves accompany the herd almost from birth, though Crowcroft's observation of a very small calf on Lochinvar Ranch with its parent may indicate that at least for a short time the cow remains apart from the herd after giving birth.

Mammae : 2 pairs, inguinal.

Young per birth : usually 1, but in the London Zoological Gardens twins have been born in about 2 per cent of the total births. (Zuckerman, 1953).

SYNCERUS CAFFER Sparrman (African Buffalo)

Records appear to indicate calving throughout the year, which accords with data from the Garamba National Park and Upemba (Verheyen, 1951; Verschuren, 1958), and the Cameroons (Jeannin, 1936). Information from other areas implying a limited season of birth (e.g. Shortridge, 1934) may therefore be incomplete, though there is probably a peak period of calving. In the Luangwa Valley there may be a peak in June and July (W. E. Poles, dep. rec.); while Verheyen (1951) gives April to June for the Upemba; and Jeannin (1936) considers the end of the dry season the peak period in the Cameroons.

In London African buffalo have calved in all months (Zuckerman, 1953).

The young are believed to accompany the herd more or less from birth (Verschuren, 1958).

Mammae : 2 pairs, inguinal.

Young per birth : 1.

Giraffidae

GIRAFFA CAMELOPARDALIS Linn. (Giraffe)

Giraffe are in N. Rhodesia limited to Barotseland between the Zambesi and Mashi Rivers, and the Luangwa Valley, and data on breeding are few. Attwell and Morris from Luangwa Valley observations believe that calves are born at the beginning of the rains, i.e. about October–November. In the Livingstone Game Park captive animals, believed originally from Barotseland,

have calved in February, July and September; while those at present in the Park were seen to mate in "almost every month" during 1958 (Hellam *in litt.*). Wilhelm, presumably for the Caprivi, thought March onwards was the calving time, July and September being the mating season (quoted by Shortridge, 1934). The gestation period is fourteen to fifteen months (Kenneth & Ritchie, 1953), so Wilhelm's impressions may be incorrect in one respect of the other. Stevenson-Hamilton (1947) states that giraffe are born in the Transvaal from about October onwards for about two or three months. Neumann (quoted by Shortridge, 1934) thought there was no definite calving season, which in view of Hellam's note that mating has been seen almost throughout the year, and the apparent discrepancy in Wilhelm's account, may be correct. In London giraffes have calved in all months from February to October (Zuckerman, 1953).*

Mammæ : 1 pair, inguinal (not 2 pairs) (Shortridge, 1934).

Young per birth : 1 usually. Rarely twins according to Vaughan-Kirby (quoted by Shortridge, 1934).

CARNIVORA

Canidae

LYCAON PICTUS Temminck (Wild Dog)

There are several records of new born cubs in Northern Rhodesia. In Mporokoso District Stokes (dep. rec.) had two litters brought to him in May, estimated two weeks old. I have seen cubs at Mazabuka believed born in the last week of May, 1952, and the next year obtained others there about the same time. In 1959 eight were brought to me at Kabompo which had been born about the third week of June. These were undoubtedly all of one litter. C. W. Benson has seen cubs at Kasama in early July which were under one month old, and in the Mumbwa District he got information of three litters (total 15 cubs), which were in August estimated at two to three weeks of age. In the Southern Province B. L. Mitchell has recorded cubs about four to six weeks old on 23rd June. Three cubs collected by W. E. Poles in the Luangwa Valley on 21st September, and now in the National Museum, Bulawayo, were "certainly not less than two months old" (M. Paterson, *in litt.*). From Mwinilunga District I have seen a cub only two or three days old, which was killed on or about 6th July.

As there are no records at all in any other period of the year, it is apparent that May to July is the usual whelping time for wild dogs in N. Rhodesia.

Stevenson-Hamilton (1947) has remarked on the practice of two or more bitches littering in the same hole. The cubs from Zimba and one group from Mazabuka were in each case believed to comprise two litters. This often makes it difficult to tell the individual litter sizes.

The cubs are born blind; usually, though not always, below ground in old antbear holes. At birth they are black and white, lacking yellow pigment,

* Innis (*Proc. zool. Soc. Lond.* Vol. 131, (1958), 245-278) states that in the Transvaal, giraffe have no fixed season of birth; and she confirms that twin births sometimes occur.

which develops later, in this respect exactly resembling tricolor foxhound puppies.

Mammae : 6 or 7 pairs, abdominal.

Young per birth : 2-8.

Felidae

PANTHERA PARDUS Linn. (Leopard)

Data on breeding in N. Rhodesia is scanty. I have seen cubs from Kasama and Choma Districts estimated born in November, and have found two small fetuses (about 25 mm. long) in a female at Mazabuka on 6th January. Uys, from observations in the Southern Province, is inclined to think there may be a more or less regular whelping season about June-July, while B. L. Mitchell (also in Southern Province) thinks July to September. However, accepting the maximum gestation period of 105 days (Kenneth & Ritchie, 1953) the Mazabuka leopardess mentioned could not have given birth later than April, and in fact would probably have done so before that time. Verheyen (1951) suggests that the female may breed twice in a year, but admits this is based only on native information. Stevenson-Hamilton (1947) considers litters are generally born in South Africa during winter and spring, but notes that no definite rule can be laid down. Jeannin (1936) considers that in the Cameroons mating may take place at any time of year. Shortridge (1934) also suggested there was no fixed season of birth.

While more data is needed the probability is that in N. Rhodesia cubs may be born at any time of the year.

Leopard cubs are born blind (Shortridge, 1934). There are several N. Rhodesian records of single quite young cubs unaccompanied by the parent (Uys).

Mammae : 2 pairs, abdominal.

Young per birth : 3-6, usually 3 (Haagner, 1920). But in N. Rhodesia may be only two, and in London Zoological Gardens only 1-3 has been recorded (Zuckerman, 1953).

PANTHERA LEO Linn. (Lion)

Data from N. Rhodesia confirms published records from elsewhere that litters may be born at any time of year (Shortridge, 1934 ; Stevenson-Hamilton, 1947 ; Asdell, 1946 ; Roosevelt & Heller, 1922 ; Jeannin, 1936 ; Zuckerman, 1953). Actual N. Rhodesia records are of litters estimated born in March, April, June, July and December, and of fetuses (1 × 3, about $\frac{1}{3}$ developed) in April.

Lion cubs open their eyes on the sixth day after birth (Haagner, quoted by Shortridge, 1934).

Mammae : 2 pairs, lower abdominal.

Young per birth : 3-4 usually.

ACINONYX JUBATUS Schreber (Cheetah)

Records of breeding are few. A cub estimated not more than two weeks old from Lusaka District was seen by me in March at Chilanga. C. W. Benson

records cubs which had certainly been born in November in Fort Jameson District. A specimen from Solwezi District, now in the Bulawayo Museum, about four months old when killed, was estimated to have been born in March or April. Stevenson-Hamilton (1947) records litters in the Transvaal from August to November, and Shortridge (1934) cites a record from Wilhelm of a litter in Southwest Africa born in December or January.

Present data is insufficient to indicate whether there is a regular season of birth or not.

The cubs are born blind (Stevenson-Hamilton, 1947). The long mantle of blue-grey hair along the back of young cheetahs is well known (see especially Webb, 1948, and Holdstock, 1947) but in the very tiny cub examined at Chilanga the mane was absent (Ansell, 1957).

Mammæ : No data.

Young per birth : 2-4 usually (Stevenson-Hamilton, 1934).

DISCUSSION

Much more data is needed on all aspects of the breeding of the species dealt with, but certain provisional conclusions may be reached.

Ungulates.

While the ungulates vary from permanently polyoestrus, breeding at any time of year, to those in which the season of birth is very sharply limited to a definite period, the latter is not usual, only the two species of pigs and four antelopes falling into this category.

The markedly seasonal breeders among the Bovidae are all gregarious, and three of them are closely related, belonging to the same subfamily, where subfamily is used as a taxonomic category, or the same tribe according to Simpson's classification (Simpson, 1945). These are *Alcelaphus lichtensteini*, *Connochaetes taurinus*, and *Damaliscus lunatus*. The other seasonal breeder is *Aepyceros melampus*.

Though the two suids, *Potamochoerus porcus* and *Phacochoerus aethiopicus* are in Northern Rhodesia markedly seasonal in their farrowing, the latter species gives birth farther north at any time, and in parts at least of the Belgian Congo may have two farrowing seasons, which may be a transitional stage.

The very largest land mammals, *Loxodonta africana*, *Diceros bicornis*, and *Hippopotamus amphibius* give birth at any time of the year.

Among the Bovidae the solitary or semi-gregarious antelopes *Sylvicapra grimmia*, *Redunca arundinum*, *Tragelaphus scriptus*, *T. spekei* and *T. strepsiceros* are believed to have their young at any time, and so also do the gregarious waterbucks, *Kobus ellipsiprymnus* and *K. defassa*, and the highly gregarious buffalo, *Syncerus caffer*.

Though the zebra, *Equus burchelli*, may foal in any month it has such a definite peak time (Fig. 1) as to be practically seasonal, though to be accurate it might be better to regard the species as intermediate between the more markedly seasonal and the random breeders.

It seems probable that something similar may apply to those species of antelope on which present information is indefinite, *Kobus leche*, *K. vardoni*,

Hippotragus niger, *H. equinus* and *Taurotragus oryx*. While these possibly calve in any month there may nevertheless be such a marked peak period as to constitute virtually a season.

The phenomenon of several cows of a herd apparently calving about the same time, irrespective of the actual month, appears very definite in the eland, *T. oryx*, and is worth further investigation.

In the wildebeest, *Connochaetes taurinus*, calving, though strictly seasonal, may vary with purely local conditions, and this has been noted in several parts of the species range (Fig. 10).

Variation of the birth months in different parts of the continent among the strictly seasonal breeders seems up to now to have been given insufficient attention. It is however clearly indicated by the data noted above. In general the farther south the later the birth season (in countries south of the Equator). This is brought out in Figs. 3, 5, 6, 9 and 10, and further in the following extract of a letter from Mr L. E. Vaughan who states: "I also notice breeding to be later in the year here (Wankie National Park, Southern Rhodesia) by about two months than at Namwala, curious because it cannot be above 250 miles as the crow flies. For instance wart hogs do not have their young till early October, while up there they litter in mid-August. Also hartebeest there calve in July, and the corresponding tsessebe here not till October".

Regarding seasonal breeding the low-lying Luangwa and middle Zambesi Valleys correspond better with more southern areas than with the north-western plateau. It is not known with which the Eastern Province plateau corresponds, but it may be with the northwestern plateau. It must, however, be stated that these points concern only some of the seasonal breeders, for only the wart hog, *P. aethiopicus* is common to all these localities, as is shown in the following table.

Distribution of strictly seasonal breeders.

Species	N.W. plateau.	E.P. plateau.	Luangwa Valley	Mid-Zambesi Valley.
<i>Phacochoerus aethiopicus</i>	Present	Present	Present	Present
<i>Aepyceros melampus</i>	Present	Virtually absent	Present	Present
<i>Alcelaphus lichtensteini</i>	Present	Present	Present (few)	Absent in valley floor
<i>Connochaetes taurinus</i>	Present	Virtually absent (rare stragglers only)	Present	Absent
<i>Damaliscus lanatus</i>	Present	Absent	Absent	Absent

Present knowledge is insufficient to assess possible correlation of climatic and other factors with birth times in the seasonal breeding species. Even less is known of possible fluctuations in intensity of breeding in the non-seasonal.

As far as is known, the young of all solitary and semi-gregarious bovids are hidden for some time after birth, and so are the young of some gregarious

species. Among the strictly seasonal breeders the hartebeest (*A. lichtensteini*) hide the calves at birth, while the impala (*A. melampus*) may do so. The wildebeest (*C. taurinus*) calves on the other hand run with the herd from birth. It is not known whether or not the young tsessebe (*D. lunatus*) are concealed at birth.

Carnivora

Lycaon pictus, the only canine considered, is seasonal in whelping in N. Rhodesia, and doubtless, as with the others of its family, is monoestrus. Among the larger felids *Panthera leo* and probably *P. pardus* may have their young at any time of year, but data on *Acinonyx jubatus* is insufficient to form any conclusion.

General

It is unfortunate that past observations on the breeding of the larger African mammals have not been more extensive, and that detailed information should be limited to so few areas. It will never be possible to remedy this completely as future studies must necessarily be confined to the relatively small areas where game is still plentiful. Where such investigations can be carried out they must inevitably be largely limited to field observations. It is out of the question to examine large numbers of pregnant females as can be done in breeding studies of plentiful and easily procurable small mammals. It is, however, suggested that more records of young under one month old, as noted in the N. Rhodesia game reports would materially add to existing knowledge; and this should where possible be supplemented by records of foetal material. The following N. Rhodesian Bovidae have been omitted from detailed consideration above due to lack of data. *Cephalophus sylvicultor* Afzelius, *C. monticolus* Thunberg, *Raphicerus campestris* Thunberg, *R. sharpei* Thomas, *Ourebia ourebi* Zimmermann and *Oreotragus oreotragus* Zimmermann. All these are solitary or semi-gregarious, and therefore probably have no fixed season of birth.

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APPENDIX

Form of Game Report as used for recording of data on the larger mammals by Game Officers in Northern Rhodesia.

GAME REPORT

No.

SPECIES..... Date and time seen.....

Exact locality (give altitude also where of interest).....

.....

Composition of herd :

Males..... Females..... Undetermined Sex..... Juveniles..... Total.....

Number of juveniles definitely under one month old.....

In case of elephant, number of tuskless Males.....Females.....Juveniles.....

Indications of mating

Nature of country in which seen.....

.....

Type of vegetation on which browsing or grazing.....

.....

Other species associated with herd.....

Notes on recognition of individuals (relate to previous report), condition, or other points of interest

.....

.....

.....

.....

Date..... Signature..... Designation.....