

Drinking times and behaviour at waterholes of some game species in the Etosha National Park

by

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A B S T R A C T

In the Etosha National Park some 33 000 observations on drinking patterns and behaviour were made on rhinoceros *Diceros bicornis*, zebra *Equus burchelli*, wildebeest *Connochaetus taurinus*, hartebeest *Alcelaphus buselaphus*, gemsbok *Oryx gazella*, kudu *Tragelaphus strepsiceros*, eland *Taurotragus oryx*, giraffe *Giraffa camelopardalis*, warthog *Phacochoerus aethiopicus*, springbok *Antidorcas marsupialis*, elephant *Loxodonta africana*, lion *Panthera leo*, jackal *Canis mesomelas*, hyaena *Crocuta crocuta* and ostrich *Struthio camelus*. Results were analysed and compared with similar studies elsewhere and suggest that variations may occur regionally.

1 INTRODUCTION

In the Etosha National Park perennial water is found only in fountains and in drinking-troughs supplied by boreholes. Rivers and water-courses are dependent upon rainfall and as such cannot be regarded as important sources. Rain-water pools are much sought after during the rainy season (December—April). Because of the general availability of water during the rainy season animals have no difficulties in obtaining water. This condition is, however of short duration and soon after the last rains have fallen the animals return to the perennial sources, often concentrating in large numbers around such sources. During the rains most ungulates concentrate in large herds on the favoured grazing areas (open flats, often far removed from the nearest perennial water source). When they are forced to return to their perennial sources, these sources become the centre of the animals' "orbit" and together with food, determines range and population units (Leopold, 1933). High density congregations of herds at waterholes have often been reported (Grzimek and Grzimek, 1960, Shortridge, 1934 and others) but the behaviour and ecological consequences thereof had not been investigated prior to the work of Weir and Davidson (1965). They, however, could not determine whether there is any competition for water or, if there is, which species would be involved. They suspected there might also be competition for time and opportunity to drink as distinct from competition for water itself.

2 METHOD

The data presented here were obtained from 19 censuses, each lasting 24 hours and over a full-moon period. Of these 19 censuses, six were conducted between the beginning of August, 1971, and the end of January 1972 at Chudop, a fountain near the Namutoni rest camp. This fountain may be visited by tourists in cars and therefor presents a possible source of disturbance. The other 13 censuses were conducted during the period August 1971 to February 1973 at Gobaub. Here an attempt was made to conduct a census for every month

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of the year but this was not always possible as rains often made the access roads impassable. Gobaub is situated approximately 25 km south of the rest camp Halali and is inaccessible to tourists, hence no disturbance exists here. Over 32 000 animals were counted during these censuses. Numerous visits were made to these waterholes for behavioural studies.

An unrelated project on lions, during the course of which a pride of lions was followed day and night for continuous periods of up to ten days, provided further data on predation and drinking habits of these animals.

3 RESULTS

During the 19 censuses held in the Etosha National Park between August 1971 and February 1973, the following number of observations were made:

Rhinoceros (<i>Diceros bicornis</i> Linn.)	36
Zebra (<i>Equus burchelli</i> Gray)	22 358
Wildebeest (<i>Connochaetes taurinus</i> Burchell)	1 426
Hartebeest (<i>Alcelaphus buselaphus</i> Pallas)	941
Gemsbok (<i>Oryx gazella</i> Linn.)	905
Kudu (<i>Tragelaphus strepsiceros</i> Pallas)	1 937
Eland (<i>Taurotragus oryx</i> Pallas)	376
Giraffe (<i>Giraffa camelopardalis</i> Linn.)	407
Warthog (<i>Phacochoerus aethiopicus</i> Pallas)	203
Springbok (<i>Antidorcas marsupialis</i> Zimmermann)	2 501
Elephant (<i>Loxodonta africana</i> Blumenbach)	436
Lion (<i>Panthera leo</i> Linn.)	133
Jackal (<i>Canis mesomelas</i> Schreber)	676
Hyaena (<i>Crocuta crocuta</i> Erxleben)	115
Ostrich (<i>Struthio camelus</i>)	221
Total	32 892

Peak drinking times

Figure 1 shows the drinking times of 32 671 animals of 15 species as observed at both localities. Ungulates, especially zebra, being the most numerous species, have influenced the histogram to show a peak between 12h00 and 13h00.

Figure 2 to 16 show the drinking times of 15 species.

Zebra (Figure 2) have a peak drinking time between 12h00 and 13h00 but have been observed to drink during every hour. Wildebeest (Figure 3) have a peak drinking time between 12h00 and 13h00. There is, however, a lesser peak between 10h00 and 11h00. They do not drink during all hours, especially from 20h00 to 24h00. Springbok (Figure 4) have two peak drinking times: between 09h00 and 10h00 and again between 12h00 and 13h00. They have been observed to drink during all hours. Gemsbok (Figure 5) have a peak drinking time between 12h00 and 13h00 and do not drink during all hours. Hartebeest (Figure 6) have a peak drinking time between 11h00 and 12h00 and show a decided preference to drink between 08h00 and 16h00. They do not drink during all hours. Kudu (Fig. 7) are essentially daylight drink-

ers with a peak between 09h00 and 10h00. They do not drink after sunset. Eland (Figure 8) have a peak drinking time between 09h00 and 10h00. Although they do not drink during all hours, they do not appear to be adverse to drink at night.

The small sample of black rhinoceros (Fig. 9) indicates that these animals prefer drinking from late afternoon to late evening, with a peak between 20h00 and 21h00. Giraffe (Figure 11) do not show a very definite peak but seem to prefer drinking between 18h00 and 19h00. They may drink during all hours. Warthog (Fig 12) are strict day drinkers with a peak drinking time between 14h00 and 15h00. Ostrich (Figure 13) are also strict day drinkers with a peak drinking time between 11h00 and 12h00. From the small lion sample (Figure 14) it appears that they do not drink during all hours and appear to prefer drinking between 17h00 and 23h00. Jackal (Figure 15) have two peak drinking times: at sunrise and sunset, with a preference to drink at night. They do not like drinking during the heat of day. The small sample of hyaena (Figure 16) shows a peak drinking time between 00h00 and 01h00. They seldom drink during the day.

The preferential drinking time (day or night) of all 15 species are shown in Figure 17. According to this the animals have been divided into five preference classes as follows:

Class	Preference	Species
A	Exclusively daylight drinkers	Ostrich. (Warthog and kudu intermediate with next class)
B	Predominantly daylight drinkers	Zebra, wildebeest, springbok, gemsbok, hartebeest, kudu, warthog and eland.
C	Day and night drinkers	Giraffe. (Jackal are intermediate between classes C and D)
D	Predominantly night drinkers	Lion, jackal, elephant, rhinoceros.
E	Exclusively night drinkers	None.

Fig. 18 shows the numbers counted at a waterhole (Gobaub) fluctuate through the year.

4 DISCUSSION

4.1 Peak drinking times

Comparing drinking times of species common to both Etosha and Wankie (Rhodesia) produces interesting differences. Weir and Davison (1965), with regards to drinking times, have divided the animals into four groups as follows:

Evening and night drinkers:

buffalo, zebra and giraffe with a pronounced evening peak between 16.00 and 20.00.

Night and morning drinkers:

wildebeest and eland with a peak in the morning between 05.00 and 09.00.

Daytime drinkers:

kudu, sable, roan and warthog which is particularly well marked in the case of warthog, which show a pronounced afternoon peak (between 14.00 and 17.00), are not recorded at all between 18.00 and 05.00 and then show a period of morning activity at the pan from 05.00 at 10.00 with decreased activity during the middle of the day (10.00 to 14.00).

Elephant show a pronounced peak in numbers between 16.00 and 02.00.

Buffalo and sable do not occur in Etosha and roan have only recently been re-introduced, hence no comparative data exist. The other species do occur and can be compared (Figure 17). Because of sunrise and sunset differences only the average times of sunrise and sunset have been shown in all the figures and this accounts for the fact that kudu appear to drink in the pre-dawn darkness while warthog again appear to drink shortly after sunset. If this were to be corrected, Figures 7 and 12 would indicate these animals to be exclusively daylight drinkers.

While Weir and Davison (1962) have recorded zebra and giraffe to be evening and night drinkers, data presented in Figure 2 shows that roughly 94% of all the zebra observed drink during the hours of daylight, with a peak drinking time at sunset. This agrees with the findings of Weir and Davison (1965) and Young (1970). This places zebra in the class of predominantly daylight drinkers (Table 2). Giraffe, according to the classification qualify for class C, the day and night drinkers as some 57% of them have been observed drinking during daylight. However they fall just short of class B, the predominantly daylight drinkers. Their peak drinking time of just before sundown agrees with the data presented by Weir and Davison (1965).

Weir and Davison (1965) classified wildebeest and eland as night and morning drinkers. Figure 17 shows that nearly 95% wildebeest and eland 83% eland drink by day. Wildebeest and eland fall in class B. Figures 3 and 8 confirm that both species here are predominantly day drinkers with clear peaks during daylight. Young (1970) also found wildebeest to be mainly daylight drinkers with a peak during midday.

Allowing for daylight corrections (different seasonal sunrise and sunset times) both kudu and warthog would be classified as exclusively daylight drinkers. Weir and Davison (1965) have shown clearly that kudu drink at night as well while warthog are more confined to daylight but may drink shortly before sunrise and shortly after dark.

Weir and Davison (1965) have placed elephant in a separate category but according to the data presented here they are mainly night drinkers which agrees with the findings of Young (1970).

Hamilton (pers com.), studying waterhole activities in the Kuiseb river, Namib Desert, noted that gemsbok were exclusive night drinkers (an adaptation to the arid conditions) whereas those of Etosha were found to be mainly day drinkers.

The foregoing has shown that differences in drinking times of the same species exists from place to place. Often major differences can be found in populations of the same species which are only a 100 km or more apart. Thus, for example, the senior author has shown that on farms outside the Etosha National Park, kudu tend to drink at sunrise and sunset, even during the night, but seldom during the day. With the data available it has become possible not only to determine whether the animals are nocturnal or diurnal drinkers, but to indicate which 6-hour period of a day is preferred (Table 4).

Table 4. Preferred six-hour drinking period as shown by percentage of total number of observations during these periods.

Species	00h00	06h00	12h00	18h00	Preferred period
	to 06h00	to 12h00	to 18h00	to 24h00	
	%	%	%	%	
Zebra	2,5	39,4	53,7	4,5	Afternoon
Warthog	0,0	25,1	73,4	1,5	Afternoon
Wildebeest	2,9	47,1	48,5	1,5	Daylight
Springbok	3,1	46,1	45,0	5,6	Daylight
Ostrich	0,0	46,6	49,8	3,6	Daylight
Gemsbok	1,9	43,2	51,8	3,1	Afternoon
Hartebeest	0,9	57,2	40,6	1,6	Morning
Kudu	0,0	71,1	27,7	1,2	Morning
Eland	6,7	57,2	25,0	11,2	Morning
Rhinoceros	22,2	0,0	11,1	66,7	Evening
Elephant	25,7	2,5	0,9	70,9	Evening
Lion	30,1	6,0	18,8	45,1	Evening
Jackal	26,3	24,2	9,5	40,2	Evening
Hyaena	66,1	7,0	0,0	27,0	Pre-dawn
Giraffe	23,6	26,8	21,1	28,5	—

4.2 Behaviour at Waterholes

4.2.1 Daylight drinkers

Daylight drinkers such as wildebeest, springbok, ostrich are all prey species of lion, leopard and cheetah and drinking over a 12 hour daylight period has obvious survival value in so far as predators are easier avoided at waterholes. The peak drinking time is also spread over a greater time, thus assuring that all members have a better opportunity of obtaining water.

Wildebeest and springbok prefer drinking as a group after approaching the water with a fair amount of caution. The presence or absence of other species at the water influences this approach: greater caution is displayed if no other species are present at the water. Both species appear to prefer drinking away from the main "crush" of animals when possible, otherwise wildebeest will form a wedge to get to the water and spread out sideways at the water's edge. They rarely move into the water or show interspecific aggressiveness. Even intra-specific aggression is limited and usually limited to horn presentations. Springbok, being much smaller animals, cannot force their way to the water's edge and have to await an opportunity. Thus it often happens that many

hours may be spent in trying to get to the water. Springbok have been observed to drink at all times of the day and it is suspected by Bigalke (1972) that this activity also proceeds at night. Springbok approach water with extreme caution, moving slowly and with frequent pauses. During this approach displacement activities such as the lowering of the head as if in search of grazing denote tension, as does tail-wagging. They soon depart after slaking their thirst. Similar behaviour has been recorded from the Nossob River by Child *et al.* (1971) and by Bigalke (1972). A marked springbok was observed to drink every day during a four-day observation period.

Ostrich seldom make a direct approach to the water but prefer to appear at the clearing's edge, survey the area and then make a slow and devious approach. Drinking takes place when the opportunity presents itself.

All three species may spend some time near the water, engaged in resting activities before moving off.

4.2.2 Afternoon drinkers

Zebra, gemsbok and warthog are also prey species and the survival value of drinking during daylight is the same. All three species display a determined initial approach to the water but usually halt some distance away to make a short survey of the area. Again, should other animals be drinking this cautionary halt is dispensed with and they will often only stop at the water.

Gemsbok and zebra often walk some distance into the water before drinking. Should drinking space be limited they will stand shoulder to shoulder in the water. Warthog actively seek a space to drink and take care not to approach the larger animals too closely but rarely display any sign of caution when approaching a waterhole, as was also noted by Young (1970).

Both zebra and gemsbok, but especially zebra, are aggressive when drinking and this has great survival value in areas where water is limited. Aggressiveness, as exhibited by these two species, is usually to be found at small waterholes where they are crushed together in order to reach the water. At the large waterholes a minimum distance of about one metre is maintained between individuals and drinking proceeds without aggression. A shortage of water or of drinking space serves to intensify competition at a waterhole and this important point should always be borne in mind when artificial drinking places are created.

When crowded zebra will kick out wildly in an effort to maintain their drinking space. Gemsbok attain the same results by presenting their horns. This warning is often enough to keep females and sub-dominant males at a distance but zebra often misinterpret or ignore this warning and as a result fatal or serious wounds are often inflicted on them.

Upon completion of their drinking activities these species soon depart.

4.2.3 Morning drinkers

Hartebeest, kudu and eland are also prey species subject to the same survival values. When in large herds, eland drink together and, as with the other two species, show a great deal of caution when approaching water. Hartebeest and kudu often form large but temporary aggregations at waterholes. Eland drink and move off soon after drinking and kudu will also move off immediately but very often only as far as the nearest bush where they may spend some time resting. Hartebeest often rest next to the water where they may also engage in mock fights. These three species seldom show serious inter- or intra-specific aggression. On numerous occasions kudu have been observed drinking only some hours after they had arrived: their non-aggressive natures prevent them from competing with other species such as zebra or gemsbok. Because of this lack of aggressive tendencies it is to their advantage to drink earlier than the aggressive species. Direct competition for the water is thus avoided.

4.2.4 Evening drinkers

Evening drinkers are rhinoceros, elephant, lion and jackal. Rhino and elephant cannot be regarded as normal prey animals and their bulk allows them to ignore lions under most circumstances. Both these species are highly aggressive towards other species at waterholes of small dimensions and by drinking in the evening interspecific competition with the numerically larger other game species, confrontations are avoided. Whereas both Young (1970) and Mitchell (1963) noted that elephant approach water with much caution, the same cannot be said to be true for the elephants of the Etosha National Park. Here elephant have often been seen to approach water at a fast walk or run, completely ignoring tourist vehicles near the waterhole. This may be the result of these elephants having been completely undisturbed for many years within the reserve. It has, however, been seen that the elephants in the western area of the reserve are more prone to leave a waterhole at the approach of a vehicle, but these elephants are not as accustomed to vehicles as those in the eastern part of the reserve as this part of the reserve is at present not open to tourists. It has also been seen that when faced with a choice of drinking from cement troughs or muddy pools, elephant show a preference for drinking from the troughs. Young (1970) showed that elephant preferred cement dams to earthen dams and avoided cement troughs. Confrontations often occur when elephant and rhino arrive at the water at the same time. On one occasion a rhino was observed to chase away a few elephant; on another occasion elephant were seen to chase a rhino away.

Lion, which spend most of the day resting, only become active towards sunset and their first action is to drink. They show no caution when elephant or rhino are drinking and in fact, have often been seen to be chased away from water by these pachyderms. Jackal follow roughly the same pattern as

lions but have to show a certain amount of caution when any of the other animals are drinking. Of these species, lions are the most likely to rest for long periods next to the water.

It would be expected that waterholes would be of great importance to lion in obtaining prey. Predation does take place at waterholes but it more often occurs away from the immediate vicinity as most prey animals do not approach waterholes at night.

The presence of lions at a waterhole may cause a congestion in the normal flow of animals, as was also noted by Young (1970).

Little seems to be known about the drinking habits of lions. Hunters claim that lions invariably drink after feeding and this is often the case if they are feeding close to water. In Etosha, however, kills are usually some distance from water with the result that the lions cannot easily slake their thirst. Schaller (1972) found it difficult to determine the frequency with which lions drank water was easily obtained. Moreover, he found only two cases out of 25 where lions drank within an hour of feeding. He could not determine a specific drinking time.

4.2.5 Pre-dawn drinkers

Hyaenas becomes active at sunset and drinking is one of their last activities after having searched for food. After drinking they quickly disappear from the waterhole.

4.2.6 Indiscriminate drinkers

Giraffe show no clear period during which they drink, hence they often become the prey of lions when they drink during the night. Young (1970) also noted the cautionary habit of giraffe when approaching water: a great deal of time is spent browsing in the vicinity of the water during which time they make a careful reconnaissance of the area. Before actually drinking, a few false at-

tempts may be made and any sudden disturbance, such as birds flying off, may be sufficient to abort the drinking attempt for some time. Being so cautious is of high survival value as they are extremely vulnerable while drinking.

5. ACKNOWLEDGEMENTS

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Fig 1 Drinking times of 32671 animals, comprised of 15 species, in the E.N.P

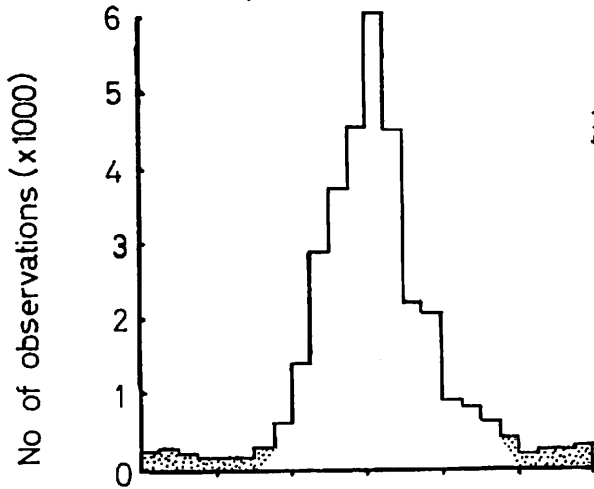


Fig 2 - 16 Drinking times

Fig 2 ZEBRA
(n = 22358)

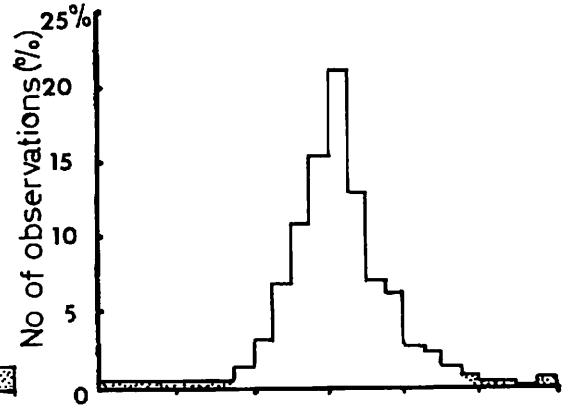


Fig 3 WILDEBEEST
(n = 1426)

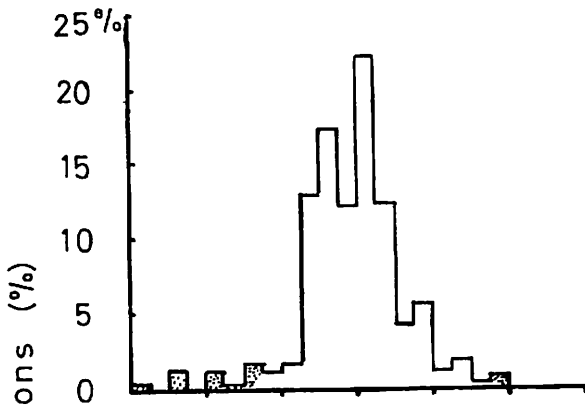


Fig 4 SPRINGBOK
(n = 2501)

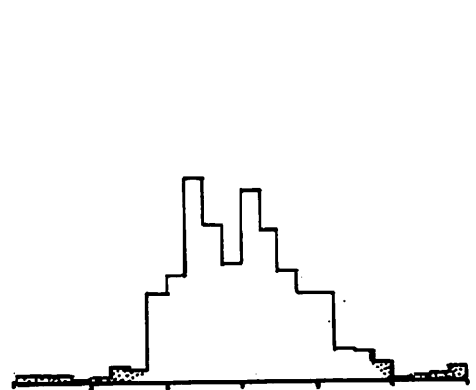


Fig 5 GEMSBOK
(n = 905)

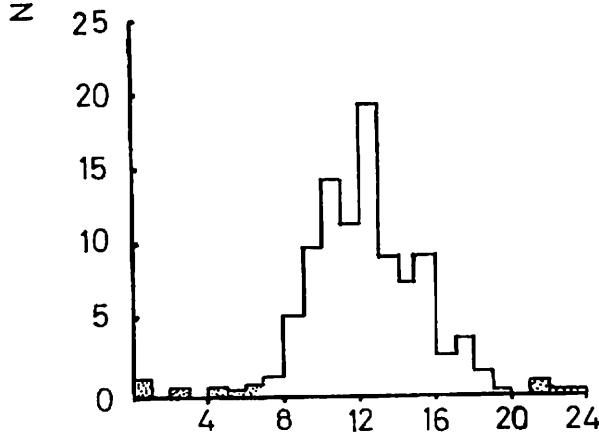
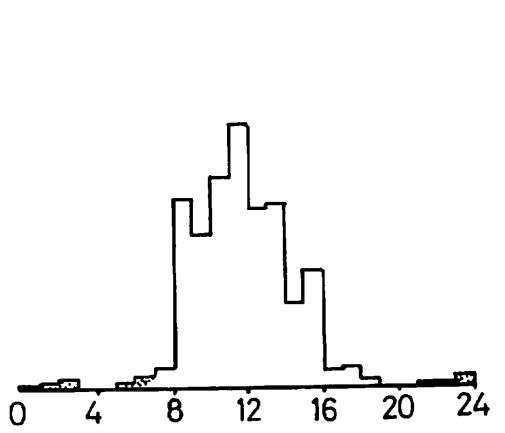


Fig 6 HARTEBEEEST
(n = 941)



TIME

Drinking times (cont.)

Fig 7 KUDU
(n=1937)

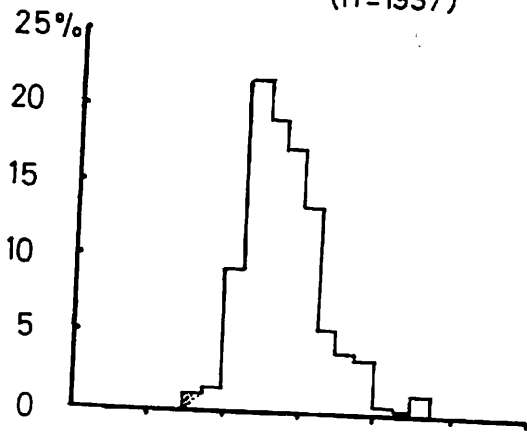


Fig 8 ELAND
(n=376)



Fig 9 BLACK RHINOCEROS
(n=36)

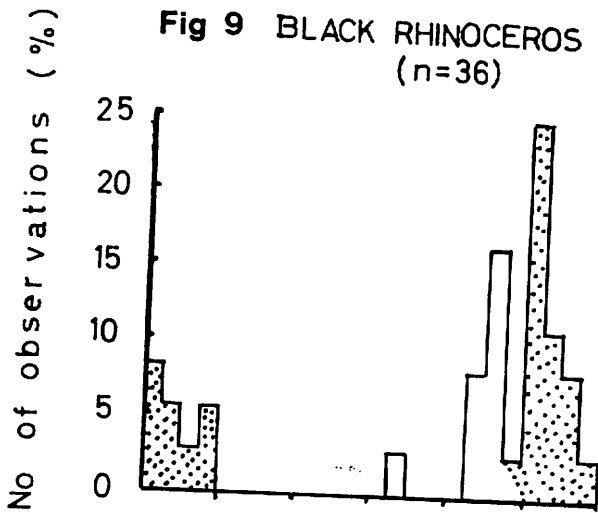


Fig 10 ELEPHANT
(n=436)

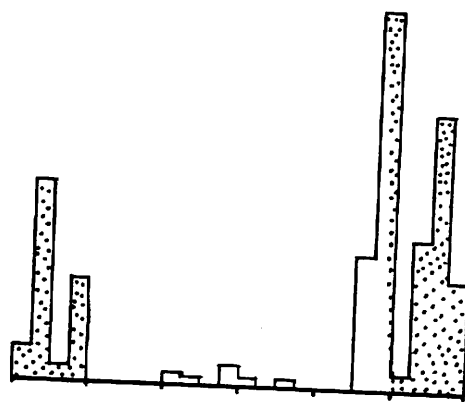


Fig 11 GIRAFFE
(n=407)

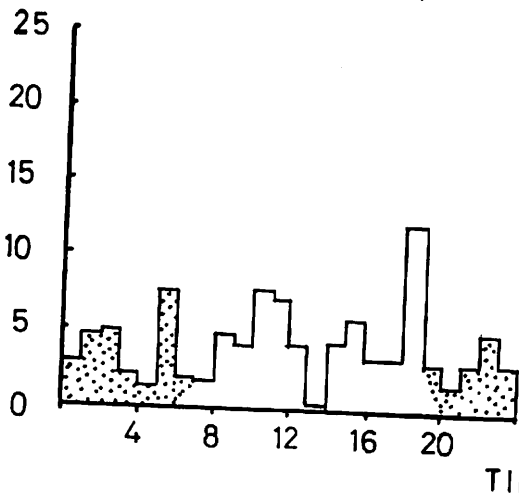


Fig 12 WARTHOG
(n=203)

