

Z. Säugetierkunde 56 (1991) 159–168
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ISSN 0044-3468

Hiding behaviour in wild Gerenuk (*Litocranius walleri*) fawns

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Receipt of Ms. 15. 11. 1989

Acceptance of Ms. 13. 12. 1990

Abstract

Studied the hiding behaviour of wild gerenuk fawns as one important aspect of early development and ecological adaptation. Hiding changes gradually to the anti-predator strategy of the adults and ceases by month 4. Bushes and small trees serve as day hiding sites; night hiding is in heaps of dry branches. Nursing is twice per 24 hrs, and fawns change hiding sites after each nursing period. Both mother and fawn show extraordinary site fidelity; behavioural mechanisms allow for reunion after voluntary or enforced separation. Only during the first 3 weeks of the hiding phase do mothers consume the entire feces and urine of their offspring. Subsequently the fawns defecate and urinate on their own, outside their hiding sites. The investigation was carried out in Samburu National Reserve, Kenya, in 1984 and 1985, and is based on the life histories of 17 females and their 30 known age fawns, all individually identifiable.

Introduction

Although mother-infant behaviour and behavioural development are decisive for a species' ecological adaptation, these aspects have been largely neglected in field studies of African bovids, the exceptions being investigations on hartebeest, *Alcelaphus buselaphus*, (GOSLING 1969), bontebok, *Damaliscus dorcas*, (DAVID 1975), Grant's gazelle, *Gazella granti* (WALTHER 1965) and giraffe, *Giraffa camelopardalis*, (PRATT and ANDERSON 1979). The aim of this work was to investigate and analyse the mother-young relationship, behavioural development and breeding ecology of wild gerenuk.

Gerenuk inhabit semi-arid thorn bush savanna from Eritrea to northern Tanzania; the western limit is the Rift Valley (HALTHENORTH and DILLER 1977). Gerenuk are browsers. Females live in groups of 5–10 within confined areas of 1–2 km², which are congruent with one male's territory (RÄDER 1982). Unattended young show hiding behaviour and reproduction is throughout the year (REIF 1987).

Material and methods

The investigation was carried out from April 1984 to December 1985 in the Samburu National Reserve, Kenya, (0°34'N, 37°E). The study area of 7 km² was chosen for its high density of gerenuk, 10–12 per km² (as opposed to for example 0.56 per km² in Tsavo N.P., Kenya, LEUTHOLD 1978), the habituation of the animals to vehicles and for being motorable.

There are two rainy seasons (October–December and March–April) with an average annual rainfall of 454 mm over the last 25 years (Meteorological Department, Nairobi).

An aerial photograph (scale 1: 11 000, Survey of Kenya, dated 30. 1. 1967) with grids of 110 × 110 and 37 × 37 m was used for mapping.

Observations were made from a Landrover using binoculars 9 × 63 and a telescope 30 × 75. Olympus SLR cameras with 70–210 mm Vivitar and 600 mm Novoflex telelenses were used for photodocumentation. Adults and subadults could be recognised by natural marks: differences in the coat pattern, cuts in the ears, scars on the body and hairless spots. Fawns were identified through their mothers.

The results are based on the observation of 17 adult females and their 30 fawns, whose birthdays

were known. Only 3 fawns survived to weaning (at age 7–8 months; mortality rate in the first 3 months: 70.7 %).

Data on hiding sites and hiding behaviour were collected by direct observation. Activity patterns and movements were assessed by observing mother–young units continuously from sunrise to sunset and taking the relevant data at 5 min intervals.

Results

Duration of hiding and behaviour in the hiding place

In the first 4 weeks of life gerenuk fawns, except for the two nursing periods, stay on average 9–9.5 hrs hidden and separated from their mothers during the day. The mothers feed and rest out of sight, up to 1.5 km away. Nursing from day 2 until weaning is from 0700–0900 (82.7 %; $n = 99$) and from 1700–1900 (91.8 %; $n = 110$). In their day hiding sites 2–21 days old fawns spend on average 90 % of their time lying ($n = 7$, $\delta_{n-1} = 4.7$ %), 25.4 % thereof with closed eyes. Every $\frac{1}{2}$ to 2 hrs they stand for 1–15 min and stretch. Occasionally they chew dry grass, dark or other objects and rarely they autogroom.

Subsequently day hiding time decreases steadily (Figs. 1, 2): In month 2 the fawns still lie hidden at least 5 hrs during the day; in month 3, day hiding behaviour gradually changes

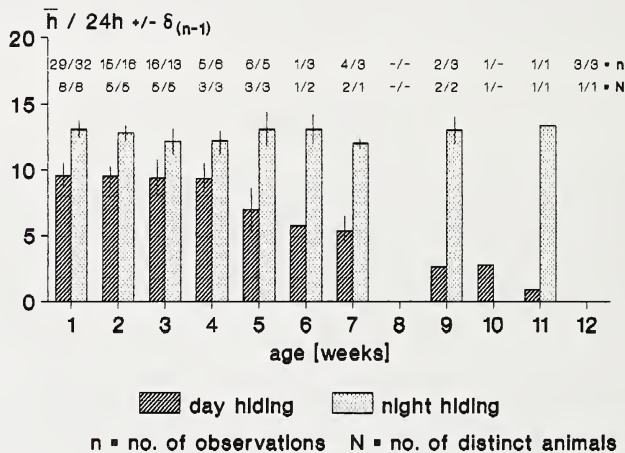


Fig. 1. Average hiding duration (\bar{h}) in 24 h

to the resting behaviour of the adults (Fig. 2). The duration of night hiding in the first 3 months, on average 12–13 hrs, does not change significantly (Fig. 1). Although night observations were not feasible, it can be assumed that fawns which, in the early morning, lay in exactly the same spot that they had lain down in the evening before ($n = 106 = 100$ %), had actually stayed there throughout the night. At the end of month 3/beginning of month 4 the fawns lie down alone between 1800 and 1900 as before, but at dawn are found feeding or resting somewhere else ($n = 15 = 100$ %), either alone, with conspecifics or their mothers. From age 5 months, fawns stay with their mothers at least until complete darkness ($n = 33 = 100$ %).

Beginning and end of a hiding phase, selection of sites

The beginning of a hiding phase is decided by the fawn ($n = 229$). It separates from the mother and approaches a possible hiding site in a determined manner, sniffing at leaves,

branches, soil and so on. A fawn may check several localities before accepting one, and always paws the ground with its front hooves several times before lying down. In the first week the selection might be influenced by the mother. She may lead her young to a potential hiding site, stand right beside it and repeatedly make contact sounds. The young then lies down in the hiding place selected by the mother ($n = 3/75$). If a young of this age has chosen a hiding place by itself and the mother gets disturbed in the vicinity, she walks back to the site, calls her young and leads it away ($n = 19/75$). If the fawn does not get up immediately, the mother repeats the contact sounds and paws the ground with her hooves, in one case even for 15 min, to rouse the fawn.

In the first 6–8 weeks the end of a hiding phase is decided by the mother, who arrives near the hiding site at nursing times and displays special behaviour sequences. In sight of the hiding place, she looks at it, walks determinedly towards it, stopping and sniffing every 15–20 m for 10 sec to 1 min, alert and with head erect. When within 15–20 m she stands still and in an erect position, facing the young and calls. The fawn then walks or runs to the mother. After age 6–8 weeks the fawns end the day hiding phase independently, whereas the end of night hiding is decided by the mother until the age of about 11 weeks.

Characteristics of hiding sites

Day and night hiding sites differ considerably in their characteristics. For a day hiding place gerenuk fawns always select green or dry bushes and small, partly bushy trees ($n = 123$; Tab. 1). During the dry seasons fawns lie right in these bushes (Fig. 3a). In the rainy seasons, when grass and herbs are abundant, preferred sites are in high ground vegetation at the edge of a bush (85.4 %; $n = 48$; Fig. 3b). If later on in the day the place is exposed to the sun the fawn moves to another one, 2–15 m away. At night fawns up to age 9–10 weeks select dead branches (79.3 %) and dry grass whisks (17.0 %) for hiding sites ($n = 106$; Tab. 2). In dry seasons they hide between the branches (Fig. 3c), during the rains they prefer sites next to dead wood in high ground vegetation. From age 9–10 weeks the quality of night hiding places changes and the fawns lie in high grass near small bushes, or just on open grass patches like adults ($n = 15$).

Use of sites

A day hiding site is never used for the night nor vice versa, but sites may be used repeatedly. 12 fawns of ages 2–77 days used on average 24 % of their hiding sites more than once ($n = 258$). If at hiding time a fawn is in the vicinity of a previously used hiding place, it will usually walk or run straight towards it, occasionally taking cover, and immediately lie down when reaching it. In order to reach a previously used hiding site fawns aged 2–4 weeks frequently covered distances of 25–40 m, rarely up to 100 m, those of 4–5 weeks often 100 m, but even up to 400 m.

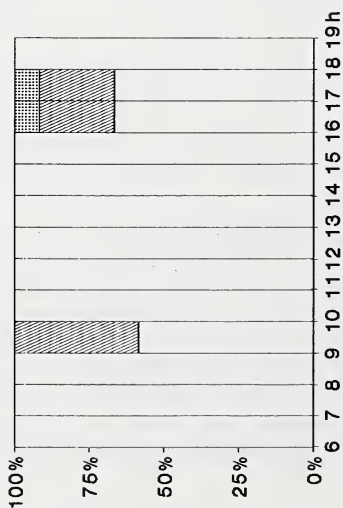
From age 9–10 weeks, young using open sites at night may do so several times, for examples 7 out of 12 nights (observations spaced irregularly from fawn age 76–145 days).

Spacing of hiding sites and movements

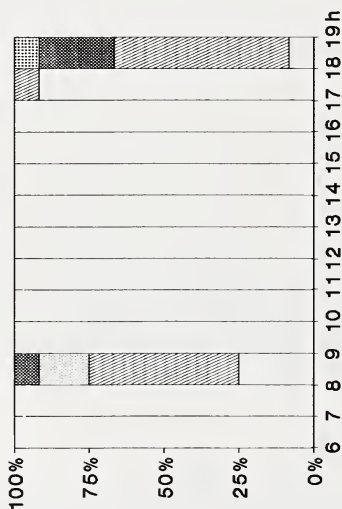
On all observed occasions ($n = 13$) the mother led the newborn 100–400 m to the first hiding site within 1–3 hours after birth. Most mothers ($n = 11/13$) then left their fawns and stayed in the vicinity up to 100 m away, but had no further physical contact with them until the evening nursing session. Some mothers ($n = 2/13$) repeatedly came back to the hiding sites, roused their fawns, nursed them and led them to new hiding places. One of them roused her newborn 4 times in the first 8 hours.

Subsequently, the pattern is quite uniform. In the first and part of the second week of

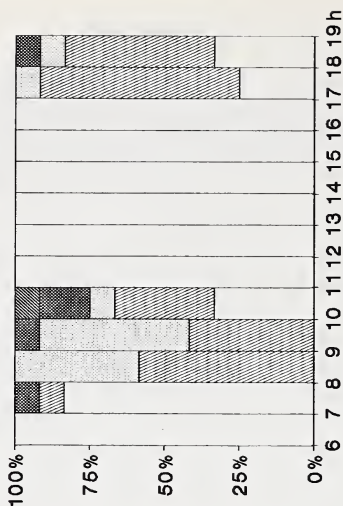
B1: 4 days



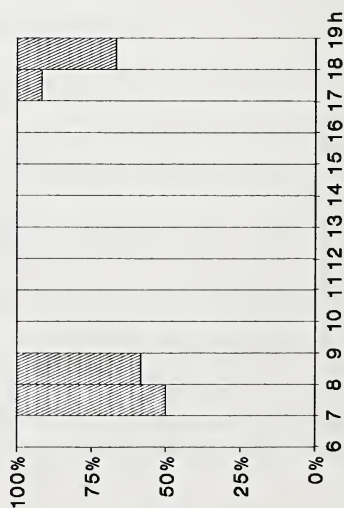
B1: 20 days



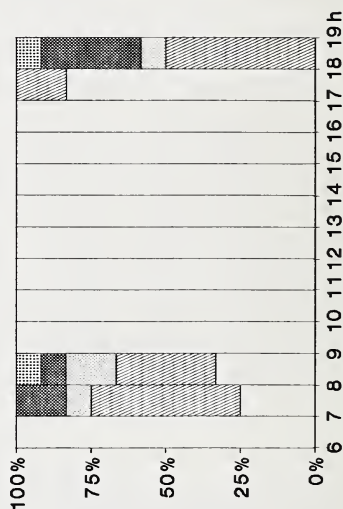
B19: 31 days



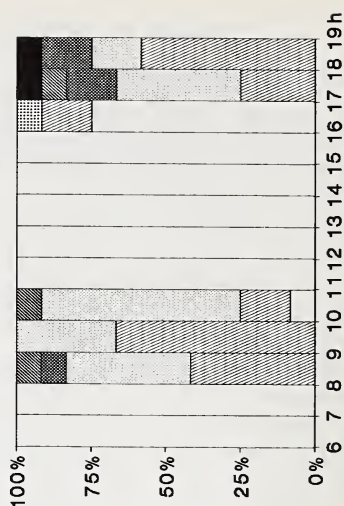
B1: 10 days



B1: 28 days



B19: 43 days



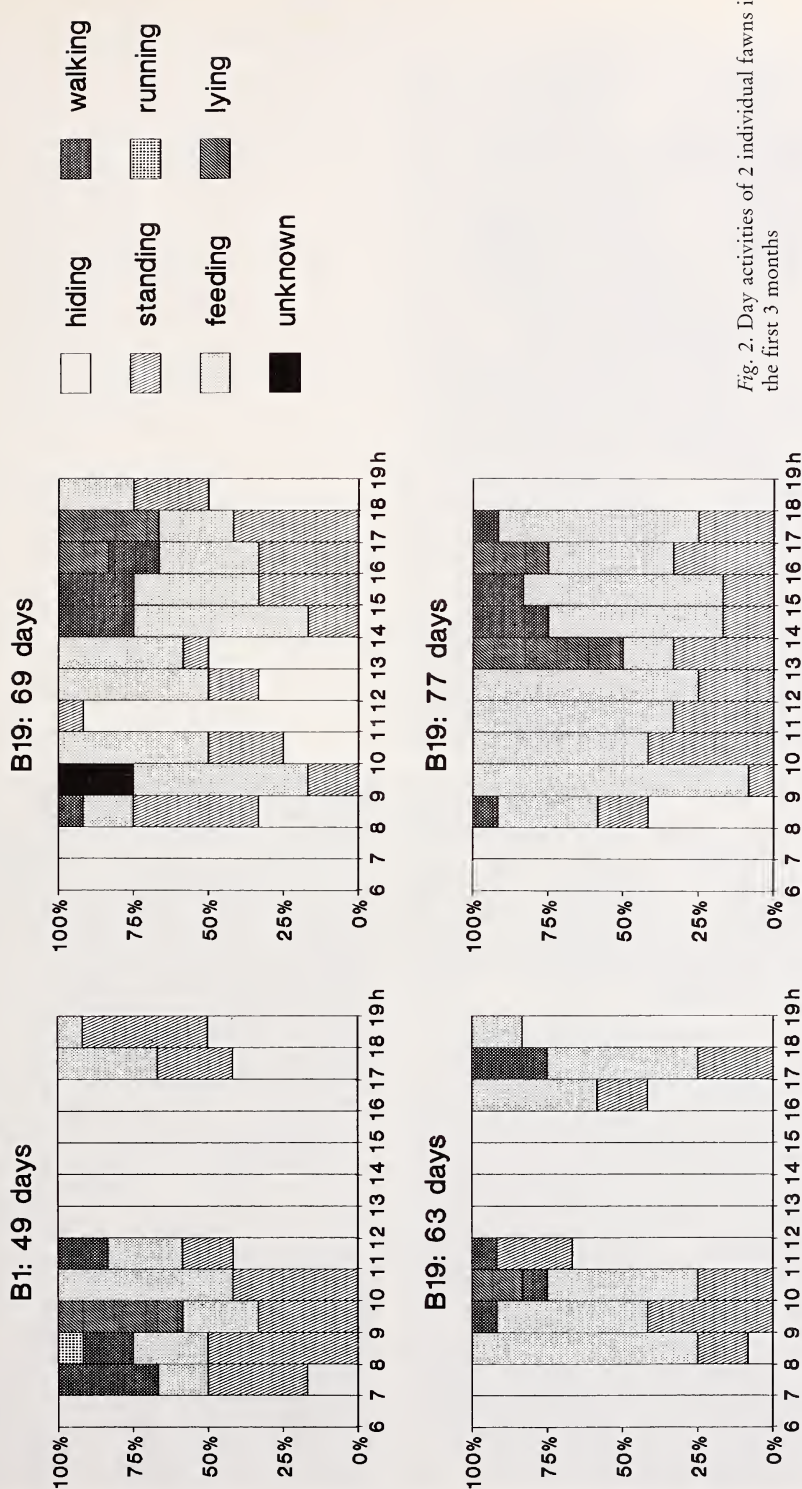


Fig. 2. Day activities of 2 individual fawns in the first 3 months



Fig. 3. Typical hiding sites. a: day hiding site in dry season; b: day hiding site in wet season; c: night hiding site in dry season

Table 1. Specification and relative frequencies of day hiding sites

Specification of hiding site	Dry season n = 75; (%)	Wet season n = 48; (%)
<i>Acacia reficiens</i>	20.0	—
<i>Acacia senegal</i>	10.6	2.1
<i>Acacia tortilis</i> *	9.3	16.7
<i>Boscia coriacea</i>	—	2.1
Bush group (green)	—	14.6
<i>Commiphora</i> spec.	8.0	12.5
<i>Combretum aculeatum</i>	—	4.2
<i>Grewia</i> spec.	5.4	39.6
<i>Maerua</i> spec. ¹	6.7	6.3
<i>Salsola dendroides</i> ¹	2.7	—
<i>Salvadora persica</i> ¹	13.3	2.1
unidentified dry bushes	24.0	—

¹ evergreen; others are deciduous.

Table 2. Specification and relative frequencies of night hiding sites

Specification of hiding site	Dry season n = 63; (%)	Wet season n = 43; (%)
Dead wood with grass	—	53.5
Dead wood without grass	82.5	20.9
Dry, high grass whisks	14.2	20.9
Stones	3.1	—
Green bush	—	4.7

life the fawn uses day and night hiding sites in an area of 2.4–5.6 ha, and mother and fawn, if not disturbed, stay in this area for the nursing periods ($n = 71$; $N = 6$; mean = 3.9 ha, $\delta_{n-1} = 1.2$ ha). In the following weeks the mother enlarges her fawn's range by moving about with it during nursing periods. Consequently, successive hiding places are spaced further apart. At age 8–10 weeks the fawn's range is the same as its mother's.

Fidelity to sites

Gerenuk mothers and fawns demonstrate great familiarity with their home range. No matter how far away a mother is from the hiding place of her young (up to 1.5 km) or in which direction she had fled when disturbed while nursing, she always returns in a straight line. If a fawn has changed sites, the mother calls repeatedly and circles the spot where they were last together. The fawn in turn walks slowly towards the place of separation. In this way mother and young reunite. Mutual searching occurs exclusively at nursing time. After the death of an offspring the mother searches for her fawn at the place of last contact for 2–3 consecutive nursing periods ($n = 22$).

Defecation and urination

Gerenuk fawns defecate and urinate only outside their hiding sites. For the first weeks of life defecation and urination is assisted by the mother. During or immediately after suckling, the mother licks the genital and anal regions of her young and consumes its feces and urine. The average frequency of this nursing behaviour (Fig. 4) drops considerably in

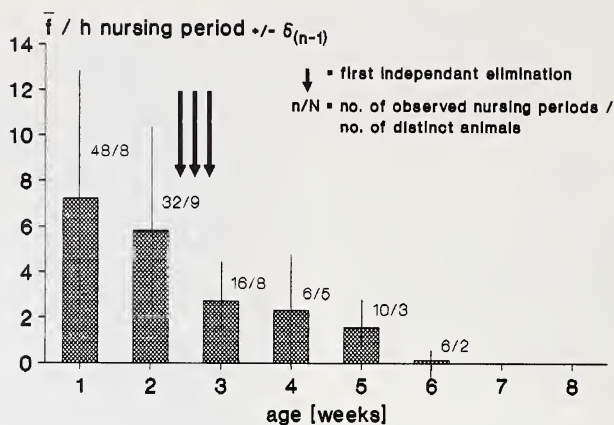


Fig. 4. Average frequency (\bar{f}) of mother assisted elimination per hour (h) nursing period

week 3 and ceases by week 6. The first bout of feces and urine intake by the mother lasts 1–2, in some cases up to 3 min; later bouts in the same nursing period last between 5 and 30 sec.

The change from mother assisted to independent elimination is gradual. At age 18–21 days (Fig. 4) the fawns attempt to defecate on their own for the first time, displaying for 1–5 min the typical stance with tail stretched out, producing not more than one pellet, often none at all. At the same time they start urinating on their own. From age 6–7 weeks the fawns defecate and urinate like adults.

Discussion

In terms of mother-infant relationships, WALTHER (1965, 1966, 1968) distinguishes “Followers” and “Hiders”. Following behaviour is the adequate anti-predator strategy in open habitats (LENT 1974; ESTES 1976) and is often associated with migratory habits. In forest and bush habitats the typical strategy is hiding whose efficiency is enhanced by (a) the young changing hiding sites after every nursing period, (b) the mother avoiding leaving her scent at the hiding place, (c) the mother consuming the fawn’s eliminations and thereby preventing olfactory cues (LENT 1974). Hiding also saves energy and water (LANGMAN 1977).

Although hiding behaviour of several bovid species has been observed in zoos and in the wild (overview WALTHER 1979), data on age-related changes in daily hiding time are only available for captive greater kudu, *Tragelaphus strepsiceros* by (WALTHER 1964). This study presents the first detailed data on this subject for a wild bovid.

The hiding period of gerenuk can be divided into 3 phases:

1. Consistent day and night periods during month 1.
2. Gradual decrease in the duration of day hiding in months 2 and 3 until it vanishes completely. Change of characteristics of night sites during month 3.
3. Progressively shorter night hiding periods during month 4, until they cease altogether. The first changes in the pattern of hiding are during the day, with fawns becoming active on their own in the early afternoon when predator activity is low. At nursing time in the evening, when predators are more active, the fawns reunite with their mothers. Changes in the night hiding pattern occur only 4–6 weeks later.

The changing of hiding sites after every nursing period as in gerenuk has also been described for reedbuck (JUNGUIS 1970) and Grant’s gazelle (WALTHER 1965). The selection

of qualitatively different day and night hiding sites has so far not been observed in other species, however WALTHER (1968), noted the selection of different localities for day and night hiding in captive sitatunga fawns, *Tragelaphus spekei*.

Bushy day hiding places provide shade and visual screening from diurnal avian and terrestrial predators (Martial eagle, *Polemaetus bellicosus*, Verraux's eagle, *Aquila verreauxi*, cheetah, *Acinonyx jubatus*, and wild dog, *Lycaon pictus*). However, the dry wood and grass characteristic of night hiding sites – which would crackle if touched – may provide an audible form of protection from nocturnal predators. Predators hunting at night most probably try to avoid making such noises. Also it was noted that carnivores like wild cat (*Felis silvestris*), bat-eared fox (*Otocyon megalotis*) jackal (*Canis mesomelas*) and leopard (*Panthera pardus*), often were found lying in bushes considered to be suitable day hiding places for gerenuk fawns. Therefore use of a day hiding place at night might carry the risk of being discovered accidentally in the early morning by a retiring predator. This may be important, if one remembers that gerenuk mothers do not guard the hiding places of the young permanently as in the Grant's gazelle (WALTHER 1965).

The consumption of the fawn's feces and urine by the mother has been documented in other bovids of the hider type, such as Grant's gazelle, *Gazella granti* and other gazelles (WALTHER 1966, 1968), waterbuck, *Kobus ellipsiprymnus* (SPINAGE 1969), lesser kudu, *Tragelaphus imberis* (LEUTHOLD 1979), hartebeest, *Alcelaphus buselaphus* (GOSLING 1969), and reedbuck, *Redunca arundinum* (JUNGUS 1970). To what extent this behaviour actually does protect the young as claimed by some authors (for example GOSLING 1968), is difficult to assess. Hiding roe deer fawns (*Capreolus capreolus*), for example, are easily roused by dogs (BUBENIK 1965). In this study also it was determined from tracks that a leopard roused a 10 days old gerenuk from its night hiding place by following its spoor to the hiding site, but failed to make a kill. Supposing that the intake of feces and urine by the mother minimises scent cues as to the whereabouts of the fawn, the questions arise as to why this behaviour is not displayed throughout the entire hiding phase, and why it is not correlated with changes in the hiding pattern. However, the fact that in gerenuk the first independent elimination of feces and urine coincides with the first intake of plant matter (Fig. 2) and with a marked decrease in mother assisted elimination (Fig. 4), indicates a causal relationship between the fecal composition of the fawn and mother assisted elimination.

The possibility that the eliminations of fawns – while they are subsisting on milk – could be a valuable additional source of nutrients for the mother has so far not been discussed. Furthermore, the fact that fawns keep their hiding places clean even after they defecate and urinate independently would seem to be equally important as an antipredator strategy as the intake of the eliminations by the mother.

Acknowledgements

We are grateful to the Office of the President, the National Research Council, the Wildlife Conservation and Management Department and the Samburu Country Council for permission given to U. REIF to work in Samburu; the Kenyatta University College for affiliation and the East African Herbarium for identifying plant specimens. We thank I. and D. BURCHARD, A. und P. CADOT, P. I. M. CHABEDA, E. CHECHE, DR. R. DAVIS, H. KATSIMA, S. KARABILLO, S. KIAMBI, J. KONES, Prof. D. K. MAGON, Dr. G. MARTIN, M. L. MODHA, C. A. MWANGO, N. and Dr. R. OLIVIER, S. RUCINA, M. and Dr. D. SPLETTSTÖSSER for their interest and assistance. W. RÄDER is thanked especially for his valuable advice and untiring efforts with the vehicle, in the camp and in the field.

Zusammenfassung

Abliegeverhalten bei Gerenuk-Kitzen (Litocranius walleri)

Das Abliegeverhalten des Gerenuks ist eine Feindvermeidungsstrategie, die an die unterschiedlichen Such- und Jagdmethoden von Tag- bzw. Nachtfeinden angepaßt ist. Tag-Abliegeplätze befinden sich an bzw. unter Büschen und kleinen Bäumen, Nacht-Abliegeplätze in trockenem Fallholz.

Im ersten Lebensmonat sind Gerenuks streng Ablieger. Danach nimmt die Abliegezeit allmählich ab und das Aktivitätsverhalten geht im 4. Monat in das der Erwachsenen über.

Nach jedem Säugen, 2mal in 24 Stunden, wechseln die Kitze den Abliegeplatz. Abliegeplätze werden auch mehrfach verwendet.

Mutter und Kind zeigen extreme Ortstreue und Ortskenntnis, die ihnen das Wiederfinden nach freiwilliger oder erzwungener Trennung ermöglichen.

Mütter nehmen Kot und Harn ihrer Jungen in den ersten 3 Wochen vollständig auf. Danach koten und harnen die Kitze zunehmend selbständig, immer aber außerhalb ihrer Abliegeplätze.

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Zeitschrift/Journal: [Mammalian Biology \(früher Zeitschrift für Säugetierkunde\)](#)

Jahr/Year: 1991

Band/Volume: [56](#)

Autor(en)/Author(s): Klingel Hans, Reif Ursula

Artikel/Article: [Hiding behaviour in wild Gerenuk \(Litocranius wallen\) fawns 159-168](#)