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THE AFRO-ALPINE GREY DUIKER OF KILIMANJARO

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ABSTRACT

Between September 1967 and September 1969, the Grey Duiker, *Sylvicapra grimmia* Linn, was studied in the Afro-alpine zone of Mount Kilimanjaro. Three specimens were collected which are described and compared to Grey Duikers living in other East Africa alpine areas and on nearby lowlands. Data on habitat relationships, density, and distribution are presented along with observations on reproduction, behaviour, and feeding habits.

Older records suggested that at least 4 species of small antelope lived on upper Kilimanjaro but evidence collected in this study indicates that only the Grey Duiker is present. This duiker may represent an undescribed race of *Sylvicapra grimmia* for the following reasons: a) geographical isolation, b) ears more squarely tipped than neighbouring races, c) very short tail compared to other races, and d) very short nasal bone compared to other races. However, additional specimens are needed before a final conclusion is made.

The duiker on upper Kilimanjaro is most abundant between 3,300 and 3,800 m in areas that are relatively level, open, and well dissected by drainage lines. A density of not less than 1.80 per km² occurred in a good habitat while an estimated 0.5 per km² or less occurred in a poor habitat. Succulent shrubs and herbs such as *Alchemilla* and *Ranunculus* spp. appear to be the most important foods. Evidence suggested breeding occurs throughout the year and that juvenile mortality was probably very high.

INTRODUCTION

The purpose of this paper is to describe the Grey Duiker *Sylvicapra grimmia* Linn. found on upper Kilimanjaro; to compare it to those found in other East African Afro-alpine areas; and to give details of its biology, behaviour, abundance, and distribution. Within East Africa, the fauna and flora of Kilimanjaro is perhaps as well known as that of any other area due to intense interest in the mountain by geographers, explorers, botanists, ornithologists, museum collectors, and others from the earliest days of European entry into the area. It is, therefore, surprising that the presence of the Grey Duiker on upper Kilimanjaro was not realized until 1948 (Swynnerton 1949). Moreover, it is surprising that a specimen was not collected and made known to science until now.

The Grey Duiker has been known to science for more than two centuries but it was not until the early years of the 20th century that its presence in Kenya and Tanzania was recognized. The first review of the races in northern Tanzania and Kenya was probably provided by Roosevelt and Heller (1914). They recognized *deserti* Heller, *altivallis* Heller, *hindei* Wroughton, and *nyansae* Neumann. A fifth race, *lobeliarum* Lönnberg was described by Lönnberg (1919). Haltenorth (1963) lumped *hindei* with *nyansae* which Ansell (1968) followed in the recent review of African mammals by the Smithsonian

Institute. Briefly, the races can be divided into those that live in the sub-alpine and alpine zones—*lobeliarum* and *altivallis*—and the remainder which live in the bushlands of lower elevations. *Nyansae (hindei)* is the lowland race found near Mount Kilimanjaro and probably occurs to the north, west and south (Roosevelt and Heller 1914; Haltenorth 1963). The mountain races are characterized by very long shaggy hair and shorter ears while those from the lowlands have fine short hair and relatively long ears. The Grey Duiker of Kilimanjaro clearly belongs to the former group.

The specimens and observations of the Grey Duiker of Kilimanjaro used in this paper were collected between September 1967 and September 1969 when I was on the staff at the College of African Wildlife Management at Mweka, Tanzania. Approximately 20 trips were made to the moorlands above the forest with all slopes of the mountain being visited at least once. Grey Duiker were seen regularly and three specimens were collected. The first was taken November 8, 1968, by F. Poppleton and the other two by the author on July 4, 1969. All came from the west shoulder of Kilimanjaro, the Shira Plateau, at approximately 3,600 m. One was a male and two were pregnant females. An animal upon collection was weighed, measured, and then skinned. The skin was removed with feet and head attached and later tanned at the Wildlife College. The stomach contents, the skull and, in the case of the females, the reproductive tract were removed for later processing. Also included are observations provided by the staff and students of the Wildlife College from visits to upper Kilimanjaro in 1970, 1971, and 1972; and the results of a census carried out in February 1970, on the Shira Plateau.

In order to carry out meaningful comparisons with the sub-species *nyansae* on the plains around Kilimanjaro, a female was collected at Namanga, 70 km northwest of the mountain, and to compare the Kilimanjaro Grey Duiker with the subspecies *altivallis*, the Director of Kenya National Parks, P. Olindo, kindly permitted a female to be collected from the moorlands in the Aberdare National Park. This was done by P. Duncan under the direction of the park warden, W. Woodley. To supplement these specimens, I examined the large collection of Grey Duiker skins and skulls in the National Museums of Kenya which included a specimen of the race *lobeliarum* from Mount Elgon. Wroughton (1910) and Heller (1912) were consulted, respectively, for type descriptions of *hindei* and *altivallis*, and Hollister (1924) for additional sub-species body and skull measurements. Lydekker (1914) also provided useful information.

HISTORICAL NOTES

Small antelope were seen by a large number of visitors to the moorlands of Kilimanjaro (Johnston 1886: 355, Meyer 1890: 118 and 158, Gillman 1923, Guest and Leedal 1954: 45, Miller 1934, Child 1965: 87, Swynnerton 1949: 11, and others). Usually the small antelope were identified as being Klipspringer (*Oreotragus oreotragus* Zimmerman) or Mountain Reedbuck (*Redunca fulvorufula* Afzelius).

Most of the early reports of Klipspringer and Mountain Reedbuck are based on sight records and, except for Swynnerton's (1949), are readily dismissed. Swynnerton, however, noted both Mountain Reedbuck and Grey Duikers in his 1949 paper. Swynnerton was a very competent observer but an examination of his personal diary of the trip (in the library of the Wildlife College), indicates his conclusion that Mountain Reedbuck existed high on Kilimanjaro was based on an indefinite sighting by one of his companions and on one indefinite set of spoor. Swynnerton (1949) also included Bushbuck *Tragelaphus scriptus* Pallas and Harvey's Duiker *Cephalophus harveyi* Thomas in his list of animals for Shira Plateau but his diary shows that he saw no sign of either above 2,700 m., the forest edge. Both of these species, however, do occasionally go above the treeline. (Child 1965, *pers. obs.*).

In researching old records I was able to find only one record of a duiker having been shot at a high elevation on Kilimanjaro. This was by Sir Harry Johnston in 1884 (Johnston 1886) and is of considerable historical interest. Johnston kept neither skin

nor skull of his animal but did make a drawing of its head which appears on page 355 of his book. The drawing is unmistakably that of a Grey Duiker. However, on the basis of this drawing, O. Thomas identified the animal as likely a race of the long snouted Duiker (*Neotragus kirkii*), the animal now known as Kirk's Dikdik *Rhynchotragus kirkii* Gunther. The dikdik had first been recorded only four years earlier in Somaliland. Moreau (1944), on the basis on Johnston's report, included dikdik in his list of mammals for Kilimanjaro, however, it was dropped by Child (1965). It is most unfortunate that Johnston did not retain the skin or skull for this would have been the first record of the species north of Mozambique. Moreover, had the animal been correctly identified, the misidentifications and uncertainty regarding the 'small antelope' of the moorlands of Kilimanjaro would not have persisted to the present day. As a result of the intensive field work on upper Kilimanjaro during 1967-69, additional observations from 1970-72, and examination of old records, I am now convinced that the only small antelope residing at high elevation on Kilimanjaro is the Grey Duiker.

THE KILIMANJARO GREY DUIKER

General appearance and colouration

The most striking feature of the Grey Duiker from upper Kilimanjaro is the heavy course shaggy hair (Plate 1). This feature is shared with *altivallis* and with *lobeliarum* and contrasts sharply with the fine short hair of the lowland races. The hair of the back of the specimens from the three mountains averages about 30 mm length with the guard hairs being 45-50 mm. This is nearly twice the hair length of the *nyansae* specimen from Namanga and others examined. The belly hair is similarly lengthened and is woolly and dirty white rather than straight and white.

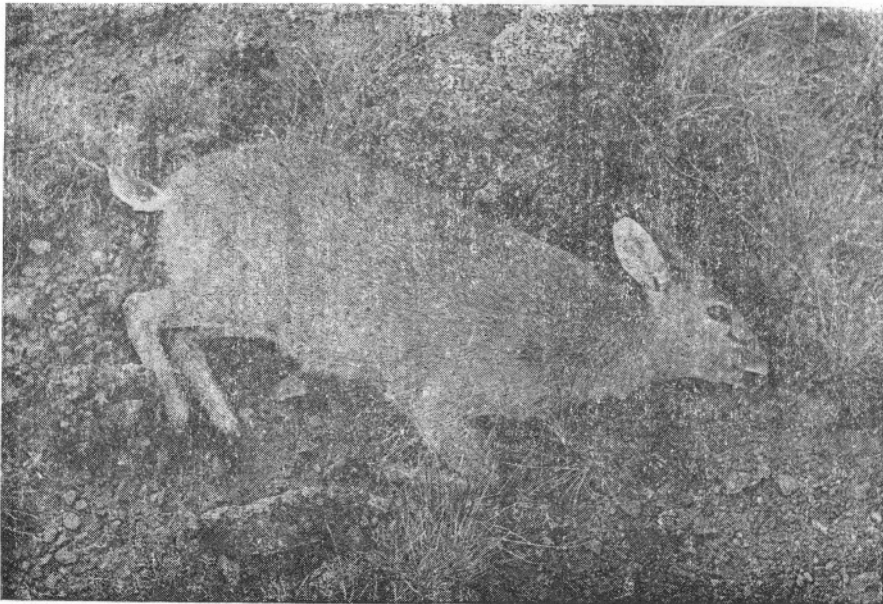


Plate I

The ears of the Grey Duiker from Kilimanjaro are relatively short with the tip 'squared off' (Plate 1). This feature was also noticed by Johnston (1886) and appears

in his drawing. The ear of my Aberdare specimen is blunted, but not to the extent of the Kilimanjaro animals, and that of the Elgon specimen is pointed. Finally, the mountain duikers appear heavier and stockier in relation to body length than the animals from the lowlands. This is discussed more fully in the next section.

There is considerable variation in the colouration of the three specimens from Kilimanjaro. The first female collected is dark grizzly grey above and heavily vermiculate whereas the second female is much more russet and with little speckling. The male is between the two females in general colour. Variation in colour was also observed in the field. The specimens of both *nyansae* and *altivallis* are similar to the Kilimanjaro animals while the skin of *lobeliarum* is more of a tawny russet with almost no speckling. However, the skin of *lobeliarum* may not be typical as Lönnberg in Lydekker (1926) describes the type specimen as being 'greyish buff with a grizzled effect being evident on the back.

The nasal-coronal blaze and the blazes down the forelegs also show considerable variation in extent, from virtually none on the first female collected to full blazes on the second female. The feet and blazes of all three Kilimanjaro Grey Duikers are very dark brown or shiny black. The Aberdare animal is similar in these respects but *lobeliarum* and *hindei* have blazes and feet that are a chocolate brown.

Body measurements

The external body measurements of the Grey Duikers found on Kilimanjaro are basically the same as those of its cousins found on the nearby lowlands and on the Aberdare Mountains. Table 1 compares the measurements of the individuals from the Shira Plateau with those of the Aberdare and Namanga specimens, and with additional measurements of *nyansae* (*hindei*) and *altivallis* taken from Hollister (1924). The only measurement which shows consistent variation between races is tail length. The Kilimanjaro specimens have relatively short tails compared to all others.

TABLE 1

Body measurements of 3 Grey Duikers (*Sylvicapra grimmia*) from Shira, *nyansae* from Namanga, and *altivallis* from the Aberdares; and of additional specimens of *altivallis* and *nyansae* from Hollister 1924. a = from Hollister

Subspecies	1-	2-	3-	<i>nyansae</i>	<i>nyansae</i> ^a	<i>altivallis</i>	<i>altivallis</i> ^a
Locality	Shira	Shira	Shira	Namanga	—	Aberdares	—
Altitude (m)	3,500	3,600	3,530	1,300	—	3,050	—
Date Coll.	8-11-68	4-7-69	4-7-69	31-7-69	—	2-9-69	—
Time Coll.	1650	0900	1450	0300	—	day	—
Collector	Poppleton	King	King	King	—	Duncan	—
Sex	female	male	female	female	1 male 4 female	female	2 male 2 female
Age	adult	adult	adult	adult	adults	adult	adults
Weight (gm)	1363	1360	1455	1273	—	1382	—
Foetus wt. (gm)	9	—	143	6	—	23	—
Rumen wt. (gm)	50	50	200	200	—	170	—
H. & B length (mm)	880	810	820	875	905(800-970)	880	890(820-940)
Shoulder ht. (mm)	560	560	540	550	—	560	—
Hindfoot lt. (mm)	260	265	260	264	269(253-287)	280	269(265-270)
Heart girth (mm)	520	540	490	490	—	475	—
Crown rump (mm)	—	650	650	710	—	710	—
Tail length (mm)	95	95	96	125	122(100-153)	125	105(100-110)
Ear length (mm)	110	96	97	102	110(97-130)	100	105(100-109)
Ear width (mm)	55	52	52	53	—	55	—

The body measurements were examined to see if the duikers from higher elevations were, in fact, stockier and heavier than their lowland cousins as they appeared (Table 1). The weight per unit body length is greater in the high elevation specimens but the data are inconclusive as three were females in varying stages of pregnancy. Heart girth relative to head plus body length is largely independent of reproduction condition. This ratio (Table 1) is clearly greatest in the Kilimanjaro individuals at about 0.60 for the two females and 0.67 for the male as opposed to 0.55 for *nyansae* and *altivallis*. Although the differences are not great, these combined with the heavy coat does give credibility to the general impression of a stockier and heavier animal at high elevations on Kilimanjaro.

There were no differences in the size or shape of the hoofs of the different races. Those of *lobelitarum*, *nyansae*, and individuals from Kilimanjaro are, however, much more worn than those of the specimen from the Aberdares. Undoubtedly, this is a result of the different substrates the animals walk on.

Skull measurements

Skull measurements of two of the specimens collected on Kilimanjaro (the skull of the female collected by Poppleton was inadvertently lost) were compared with the skull measurements of *nyansae* and *altivallis* (Table 2). As with the body measurements, those of the Kilimanjaro skulls generally do not vary from those of other races. However, a difference appears to exist in the nasal bones. The nasal bones of the Kilimanjaro specimens are shorter in relation to width (0.61) than those of almost all other Grey Duiker skulls examined. Five *altivallis* (4 from Hollister 1924) averaged 0.53 (0.51-0.56), six *nyansae* (5 from Hollister 1924) averaged 0.54 (0.51-0.57), and six *deserti* and *roosevelti* (Hollister 1924) averaged 0.51 (0.46-0.55). I also examined the width/length ratio of the nasals of 25 skulls in the National Museums of Kenya. They came from various lowland locations. Four of the 25 had ratios greater than 0.57. Three of the four had a nasal wider than average (32 vs 29 mm) but with normal lengths. Only one, an adult male (KNM No. 301) had the greatly shortened nasal of the two Kilimanjaro specimens. The actual difference between the skulls from Kilimanjaro and all others with the one exception is in the length of 'free' nasal, that is, the nasal extending beyond the nasal-premaxillary notch. The 'free' nasal is approximately 5 mm shorter on the Kilimanjaro skulls.

TABLE 2
Skull measurements (mm) of 2 Grey Duikers from Kilimanjaro, *nyansae* from Namanga, and *altivallis* from the Aberdares, and of additional specimens of *nyansae* and *altivallis* from Hollister 1924. a= from Hollister

Subspecies Sex	Shira 2 male	Shira 3 female	<i>nyansae</i> female	<i>nyansae</i> ^a 2 male 3 female	<i>altivallis</i> female	<i>altivallis</i> ^a 2 male 2 female
Greatest length of skull	165	163	161	167(158-174)	160	164(157-168)
Condyllo-basal length	151.5	153.5	151	155(148-162)	157	154(145-159)
Palatal length	81	79	82	79(75-86)	85	79(72-82)
Greatest breadth of skull	76	79	75	—	77	—
Zygomatic breadth	75	75	70	74(72-76)	73	76(74-77)
Mandible length	129	124	131	125(118-133)	134	125(120-130)
Maxillary tooth row length	48	44.5	44	48(45-50)	50	48(45-50.5)
Mandibular tooth row length	52.5	49.5	46	53(49-55)	50	51(48-56)
Nasal breadth	31	29	30	29(28-31)	28	28.5(27-31)
Nasal length	49	49	54	56(53-63)	52	54(50-58)
Ratio of the width to length of the nasal	0.63	0.59	0.55	0.52 (av.)	0.54	0.53(av.)

Only males possess horns. The horns of the adult male from Kilimanjaro lay at an angle of 170 degrees to the face. The lengths of the horns along the front curve were 117 (left) and 114 mm. An old skull found by Swynnerton (1949) had horns approximately $5\frac{3}{4}$ inches (145 mm) long. Other individuals seen in the field appeared to have horns longer than those which Swynnerton found.

Evolution

Lydekker (1926: 150) suggests that *altivallis* has arisen from *hindei* (*nyansae*). In reviewing the similarities in colouration and other characteristics that the Grey Duiker of Kilimanjaro shares with *nyansae* and *altivallis*, it would appear that it, too, has probably evolved from *nyansae*. However, as Kilimanjaro is separated from the range of *altivallis* by nearly 400 km, which includes bands of dense forest and open grasslands, *altivallis* and the Kilimanjaro Bush Duiker likely arose independently. This independent evolution is supported by the apparently consistent differences between *altivallis* and the Kilimanjaro animals in length of the nasal and the tail and in the shape of the ear. Based on these differences, the Grey Duiker from upper Kilimanjaro may represent an undescribed race, but more specimens are necessary to confirm this hypothesis.

BIOLOGY

Habitat and distribution

The Grey Duiker of Kilimanjaro is resident from the treeline at 2,900 m (2,600 on West Kilimanjaro) up to 4,600 m. Remains have been found as high as 5,500 m (Meyer 1890). It is not, however, equally distributed within these altitudes or on adjacent slopes. There are very few animals in the thick heath zone (*Erica*, *Philippia*, *Adenocarpus*, *Hypericum* spp.) from the treeline to 3,300 m. In this zone individuals are rarely seen and signs such as spoor and dung are uncommon. Above 4,100 m the duiker is also uncommon and it is only in favourable areas like the southwest slopes of Kibo and Mawenzi that it regularly occurs over 4,300 m. Thus the preferred altitude range is 3,300 m to 4,100 m. Even within these limits there are areas like the dry north slope of Kibo where the duiker is scarce.

Undoubtedly, the most favourable area on Kilimanjaro for the Grey Duiker is the Shira Plateau. This plateau of some 55 km² between 3,300 and 3,800 m on the west slope of Kilimanjaro abounds in duiker and it is not unusual to see several in a day. The Shira is a relatively level plain dominated by an open heath, everlasting (*Helichrysum* spp.), and grass (*Deschampsia*, *Koeleria* spp.) community except for a large boggy moorland dominated by sedges and tussock grasses. In this open moorland, and in the many damp drainages that dissect the plateau, succulent herbs and shrubs (*Alchemilla*, *Ranunculus*, etc.) are common. Salt (1954) provides a more complete description of the area. Elsewhere on Kilimanjaro, the duiker is most frequently seen in the wide valleys such as those of the Kikafu and Umbwe Rivers. Individuals and signs are rare on the drier ridges and moraines between valleys and on dry open slopes.

Numbers

The Kilimanjaro Bush Duiker appears to be a solitary animal as it is rarely found in pairs. Of nearly 75 records only four times were two individuals seen together. It may be that both males and females occupy territories as I have several records where an animal was seen at the same locality on two or more occasions over a period of months. The animals were unmarked but consistent patterns of behaviour strongly suggest they were the same.

On the Shira Plateau I saw an average of three (1-8) animals per day (11 days). Similar numbers were also seen by other observers in the same area. To get a measure of

density on the plateau, a census was carried out by students and staff of the Wildlife College on February 16, 1970. A modified King Census was used (Hemingway in prep.) and gave an adult population density of 1.80 per km². Interestingly, a similar census done by the Wildlife College in *Pseudolachmostylia* woodland (a Miombo type) at Kingapira in the Selous Game Reserve, September 15, 1969, gave a density of 2.04 per km². Both must be considered minimum densities. The closeness of these results in apparently optimum habitats without exploitation suggests that behaviour may be limiting numbers.

Over the remainder of Kilimanjaro, the density is almost certainly lower, probably less than one per 2 km², as there are the large tracts of poor habitat. Nonetheless, even at the lowest density, the Grey Duiker is still the most numerous large animal on the upper slopes of Kilimanjaro. The only other resident ungulate, the eland, is unlikely to exceed 50 individuals on the whole mountain (unpublished data). In a personal communication (September 2, 1969) W. Woodley and P. Duncan report seeing four individuals feeding regularly in an area of about 0.75 km² in the Aberdares.

Reproduction and recruitment

The Grey Duiker of Kilimanjaro appears to breed throughout the year as the females collected in both November and July were pregnant. The July foetus was near term as it had a crown-rump length of 33 cm and weighed 3.15 lbs. (1.43 kg), which is close to the 3.2 lbs. (1.45 kg) and 30 cm reported by Wilson and Clarke (1962) for new born. The foetus of the second female from Kilimanjaro and those of the Namanga and Aberdare females were in earlier stages of development.

In all the trips I made to upper Kilimanjaro not once did I see a young duiker either alone or with its mother. Apparently the females keep their young well hidden until well grown. It is also possible that there is a high death rate which tends to reduce the number of visible young. High juvenile mortality could account for the high pregnancy rate (4/4) of the females in this study and the 51 percent (48/94) reported by Wilson and Clarke (1962). On Kilimanjaro there are several predators including the Serval (*Felis serval* Schreber), the Leopard (*Panthera pardus* Linn.), the Lammergeyer (*Gypaetus barbatus* Linn.), and Wild Dog (*Lycaon pictus* Temm.) (Child 1965, Lamprey 1965).

Habits

Most duikers are seen in the early morning or late afternoon. It is unusual to see an animal before it sees you and the majority are only antelope bounding out of sight. They tend to flush at long distances in relatively open habitat. The average distance was 151 m in the census taken in 1970. Once flushed, the duiker rarely stops until out of sight even if it is three to four hundred meters away across an open moor. These behaviour patterns are likely the reason the animal was incorrectly identified by so many people, and why it was not collected more frequently.

Through the day most animals rest in shrubby areas rather than in the open. However, I have five records of duikers being 100 m or more from bushy cover of any kind at midday. In three cases the animal was lying down while in the other two they were moving and feeding. Roosevelt and Heller (1914) say that *altivallis* in the Aberdares leaves the heath bush only at night to feed on areas of open moor but their conclusion was likely the result of insufficient observations. Animals surprised out in the open dashed for cover although not necessarily the nearest.

When feeding, an individual moves without definite direction and stops here and there to take some item. About every 30 seconds the head is suddenly raised probably to look for danger. Yet, one afternoon I was able to stalk within 50 m of a male on open moor by moving only when the animal's head was down. It struck me that a similar approach by a predator could have been successful.

Food

The rumen of the first female collected was the only one that contained plants that were not digested beyond recognition. Her rumen contained the leaves and shoots of *Ranunculus oreophytus* Del., *R. volkensis* Engl. and *Alchemilla johnstonii* Oliv. The rumen contents of the Aberdare female were also highly digested, however, Roosevelt and Heller (1914) note that the chief food of an animal Roosevelt collected in the Aberdares was *Alchemilla argynophylla* Oliv. These very limited data suggest that the Grey Duiker of the mountains prefer the more succulent vegetation to be found in damp areas. The presence or absence of preferred food is probably one of the more important factors affecting the distribution of the Grey Duiker, and perhaps density. It has been pointed out that on Kilimanjaro the duiker is most plentiful on the Shira Plateau and in the broad wet valleys while it is very uncommon on dry slopes and ridges.

The rumen of the Namanga female was filled with the fruits of *Solanum* sp. This fruit was probably the most succulent item of food available in July in that area.

SUMMARY

a) Present evidence indicates that the only small antelope of upper Kilimanjaro is the Grey Duiker. This study found no evidence to suggest that either Klipspringer or Mountain Reedbuck occur at high elevations as has been reported in earlier papers (Child 1965, Swynnerton 1949).

b) The Grey Duiker of upper Kilimanjaro may represent a previously undescribed mountain race of *Sylvicapra grimmia* for the following reasons:

- 1) geographical isolation from other mountain races,
- 2) ears more squarely tipped than *altivallis*,
- 3) a short tail compared to neighbouring races, and
- 4) a nasal bone that is shorter in relation to width than in other races.

c) The Kilimanjaro Grey Duiker is most abundant between 3,300 and 3,800 m in areas of relatively open and level terrain dissected with drainage lines.

d) The duiker appear territorial and occur at a density of about 1.80 per km² in good habitat.

e) Breeding occurs throughout the year. There appears to be a high juvenile mortality rate.

f) The chief food appears to be succulent herbs and shrubs with *Ranunculus* and *Alchemilla* spp. being particularly important.

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LITERATURE CITED

- ANSELL, W. F. H. (1968). Artiodactyla (excluding the genus *Gazella*). *A Preliminary Manual for African Animals*. Edited by J. Meester No. 8 Smithsonian Institution.
- CHILD, G. S. (1965). Some Notes on Mammals of Kilimanjaro. *Tanganyika Notes Rec.* No. 64: 77-89.
- GILLMAN, C. (1923). An Ascent of Kilimanjaro. *Geogr. J.* No. 61: 1-27.
- GUEST, N. J. and G. P. LEEDAL (1954). Notes on the fauna of Kilimanjaro. *Tanganyika Notes Rec.* No. 36: 43-49.
- HALTENORTH, T. (1963). Klassifikation de Säugetiere: Artiodactyla 1(18): 1-167 Walter de Gruyter and Co. Berlin.
- HELLER, E. (1912). New genera and races of African ungulates. *Smithson. misc. Coll.* 60, No. 8: 1-16.
- HEMINGWAY, P. (in prep.). A line transect estimator for the case of obstruction to vision.
- HOLLISTER, N. (1924). East African Mammals in the U.S. Nat. Mus. Primates, Artiodactyla, Perissodactyla, Proboscidae, and Hydracoidae. *Bull. U.S. Nat. Mus.* No. 99 Part 3: 82-86.
- JOHNSTON, H. H. (1886). *The Kilimanjaro Expedition*, London.
- LAMPREY, H. F. (1965). Birds of the forest and alpine zones of Kilimanjaro. *Tanganyika Notes Rec.* No. 64: 69-75.
- LONNBERG, E. (1919). *Revue zool. afri.* 7: 181-3.
- LYDEKKER, R. (1914). Cat. of the ungulate mammals in the *Brit. Mus. Nat. Hist.* Vol. 2: Artiodactyla 107-121.
- (1926). (ed) *The Game Animals of Africa*. Rowland Ward Ltd. London.
- MEYER, H. (1890). *Ost-Afrikanische Gletscherfahrten*. Leipzig.
- MILLER, (1934). Report of a Trip up Kilimanjaro. *Ann. Rep. Tang. Game Dept.* 1933.
- MOREAU, R. E. (1944). Kilimanjaro and Mount Kenya: Some comparisons with Special reference to the mammals and birds: and with a note on Mount Meru. *Tanganyika Notes Rec.* No. 18: 28-59.
- ROOSEVELT, T. and E. HELLER (1914). *Life-Histories of African Game Animals*. (2 vols). New York.
- SALT, G. (1954). A contribution to the Ecology of Upper Kilimanjaro. *J. Ecol.* 42: 375-423.
- SWYNNERTON, G. H. (1949). Report of a safari to explore the Shira Plateau, West Kilimanjaro, East Africa. *Ann. Rep. Game Dept.*, 1948: 9-11.
- WILSON, V. J. and J. F. CLARKE (1962). Observations on the Common Duiker, *Sylvicapra grimmia* Linn., based on material collected from a Tsetse Control Game Elimination Scheme. *Proc. Zool. Soc. London* 138: 487-497.
- WROUGHTON, R. C. (1910). Two new duikers related to *Cephalophus abyssinicus* S. Thomas and new *Dendromus* from Mount Elgon. *Ann. Mag. nat. Hist., Ser. 8*, Vol. 5: 273-276.

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