

Civettictis civetta. By Justina C. Ray

Published 23 June 1995 by The American Society of Mammalogists

Civettictis Pocock, 1915

Civettictis, Pocock, 1915:134. Type species *Viverra civetta* Schreber, 1776.

CONTEXT AND CONTENT. Order Carnivora, Superfamily Feloidea, Family Viverridae, Subfamily Viverrinae. The genus *Civettictis* includes one species, *Civettictis civetta*.

Civettictis civetta Schreber, 1776

African Civet

Viverra civetta Schreber, 1776, 3(16):pl. 111 [1776]; Text: 3(24): 418, 3:Index, p. 587 [1777]. Type locality "Guinea, Kongo, das Vorgebirge der guten Hofnung und Aethiopien." Restricted to "Guinea" (=former French Guinea) by Allen (1924:117). *Viverra poortmanni* Pucheran, 1855:304. Type locality "Gabon."

CONTEXT AND CONTENT. Context as above in generic summary. Five subspecies of *C. civetta* have been described, but there is considerable doubt as to their taxonomic validity because of the great variation in coloration exhibited by individuals living in sympatry (Coetzee, 1971; Rosevear, 1974; Skinner and Smithers, 1990):

- C. c. australis* Lundholm, 1955:290. Type locality "Klaserie, Olifants River, N.E. Transvaal," South Africa.
- C. c. civetta* Schreber, 1776, (see above).
- C. c. congica* Cabrera, 1929:36. Type locality "alto Congo," (=Niapuu, Oriental, Zaire).
- C. c. schwarzi* Cabrera, 1929:36. Renamed from *C. c. orientalis* (Matschie, 1891:352, 353). Type locality "Sansibar, Bagamojo." Restricted to Zanzibar (now in Tanzania) by Schwarz, 1934:261.
- C. c. volkmanni* Lundholm, 1955:290. Type locality "the farm Auros, Otavi Bergen, Otavi, South West Africa." Now in Namibia.

DIAGNOSIS. *Civettictis civetta* is the largest representative of the African Viverridae. It is easily recognizable by its disproportionately large hindquarters, low-headed stance, and erectile dorsal crest (Fig. 1). Most individuals are further identifiable by their dark facial masks and white neck stripes. In both size and general appearance, *Civettictis* is most easily confused with *Viverra zibetha*, the large Indian civet; however, these two species are separated in the wild by a distance of about 4,000 km. In the hand, *V. zibetha* is distinguishable from its African counterpart by a variety of characters. In *V. zibetha*, neither the black mask around the eyes nor the white ear tips, so often characteristic of *Civettictis*, are present. The tail of *V. zibetha* is noticeably longer and more cylindrical than that of *Civettictis*, has distinct and complete white rings, and bears closer resemblance to a genet's (*Genetta* sp.) tail. Furthermore, the underlying spotting pattern on the coat of the African civet is generally distinct, while the spotting on the Indian civet is more diffuse and mottled.

Except for the digital and plantar/palmar pads and the narrow bands of skin connecting them, the soles of *Viverra* are hairy, but those of *Civettictis* are naked anterior to the central pads. The hind foot of *Viverra* lacks a metatarsal pad, present in *Civettictis* (see Pocock, 1915:133, 135, Figs. 1, 2). The claws of *Viverra* are short, semi-retractile, and protected by skin lobes, whereas those of the *Civettictis* are long and non-retractile. The inner faces of each of the two lobes of the perineal gland of *Civettictis* possess an orifice, which connects with the sac that stores the gland's secretion. Such an orifice is not present in *Viverra* (See Pocock, 1915:146, 148, Figs. 6, 7).

The auditory bullae of *Viverra* are smaller and more rounded than those of *Civettictis*, while the paroccipital process is more prominent in the latter (Pocock, 1915). The broader and flatter molars of *Civettictis* may be secondary adaptations for a more crushing and grinding action than the sharper, narrower cheekteeth of *Viverra*. Based on these characters, the African form is accorded generic status separate from the Asian form (Petter, 1969).

GENERAL CHARACTERISTICS. Body mass (in kg) of *Civettictis civetta* averages 14-15 (range, 10-17) in West Africa (Rosevear, 1974), 12 (range, 7-20) in East Africa (Kingdon, 1977), 12.4 in Transvaal (Rautenbach and Nel, 1978), and 10.9 (range, 9.5-13.2) for males and 11.6 (range, 9.7-12.7) for females in Zimbabwe (Smithers and Wilson, 1979). In South Africa, female civets are generally larger and heavier than males, although with a large overlap (Randall, 1977; Smithers and Wilson, 1979). In contrast, Ewer and Wemmer (1974) noted that their captive female African civets were distinctly smaller than males. The ranges of mean external measurements (in mm) from sub-Saharan Africa are: length of head and body, 670-840; length of tail, 340-469; length of hind foot, 123-139; length of ear, 54-58 (Allen, 1924; Kingdon, 1977; Michaelis, 1972; Rosevear, 1974; Smithers and Wilson, 1979; Taylor, 1970). There appears to be no geographical variation in size, judging by data from areas where sample sizes permit comparison (e.g. southern Africa: Smithers and Wilson, 1979; and central Africa: Allen, 1924).

Civettictis appears short-legged for its size, and its hindquarters are disproportionately large (Kingdon, 1977; Rosevear, 1974; Schliemann, 1990). It has a broad head with a short, strong neck, a pointed muzzle, small eyes, and small, somewhat rounded ears (Haltenorth and Diller, 1977; Rosevear, 1974; Skinner and Smithers, 1990; Wozencraft, 1984). The tail is bushy, laterally flattened, pointed at the end, and generally a bit longer than one-half the length of the body (Michaelis, 1972; Rosevear, 1974).

The arrangement of markings in *Civettictis* is highly variable, and no two individuals have the same patterns. The dorsal ground-color of the fur varies from near white to creamy yellow to reddish buff and is covered by deep brown to black spots or blotches. The patterning is irregular, which allows the animal to be cryptic, even in relatively open terrain. The dark markings are not arranged in regular longitudinal lines, as in genets, but are prominent as irregular lines along the back and hind-limbs. Spotting is less evident in the forequarters and fades out to "an intimate mixture of light and dark hairs. . ." (Rosevear, 1974:170). The tail is generally black on the dorsal surface, and is marked by about five partial but diffuse rings of white. The paws and lower limbs are generally black (Dorst and



FIG. 1. Captive African civet, *Civettictis civetta*. Photograph by Chris Wemmer.

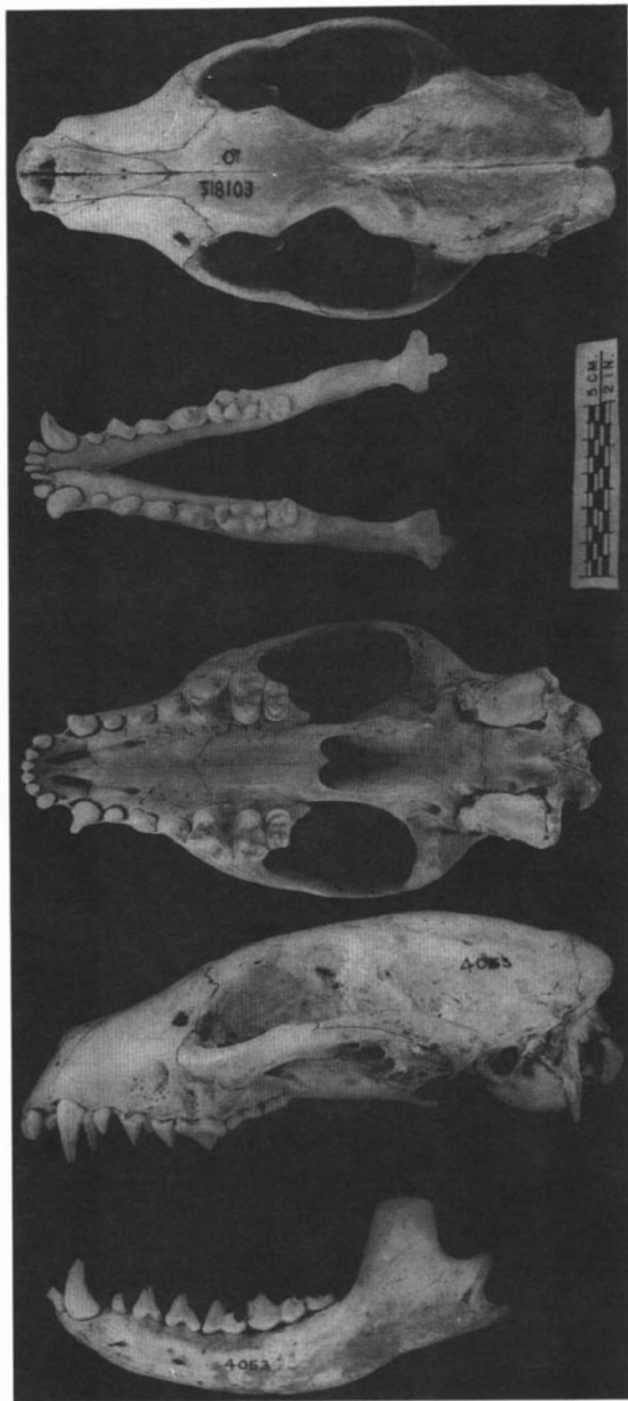


FIG. 2. Dorsal, ventral, and lateral view of cranium, and lateral view of lower jaw of *Civettictis civetta* from male, United States Museum of Natural History No. 318103. Greatest length of cranium is 151.4 mm. Photographs by Victor Kranz.

Dandelot, 1970; Ewer and Wemmer, 1974; Haltenorth and Diller, 1977; Kingdon, 1977; Maberly, 1955; Michaelis, 1972; Roberts, 1951; Rosevear, 1974; Schliemann, 1990; and Skinner and Smithers, 1990).

The head, neck, and ears are clearly marked. There is frequently a black band across the front of the face, and white on the sides of the muzzle and between the eyes and ears. The neck stripe is a "band of white, sloping back from behind the ear to the front of the shoulder—accentuated by black borders above and below" (Ewer and Wemmer, 1974:361). This common marking has also been described as two black neck bands, or a double collar (e.g., Dorst and Dandelot, 1970; Rosevear, 1974). The function of the

mark may be to orient intraspecific bites to a relatively safe part of the body (Ewer, 1973; Ewer and Wemmer, 1974). Such ritualized bites occur when individuals engage in neck fencing play activities, or in preliminaries to mating.

Kingdon (1977) speculated that the facial pattern of *Civettictis* is convergent with that of the American raccoon (*Procyon lotor*) and the Asian tanuki (*Nyctereutes procyonoides*). The fronts and rims of the ears are usually white, while the backs are black. The white muzzle is clearly visible in dim light (Ewer and Wemmer, 1974).

One-third (11 out of 32) of specimens collected in the north-east Congo Basin were melanistic. The ratio of melanistic to normal individuals was equal in each locality, and with respect to both age and sex (Allen, 1924). Melanistic forms have also been reported from West Africa, though not as commonly (Rosevear, 1974), but have never been recorded in the southern African subregion (Skinner and Smithers, 1990).

The dorsal pelage is coarse and wiry, giving the animal a large appearance. The pelage varies in length among individuals. Guard hairs are considerably longer and thicker than the under fur. The tail is also coarse-haired with long bristles. Along the spine from the neck to the tail, a line of shaggy, black hairs form an erectile crest. These hairs are longer than those of the main pelage, and increase in length from the neck to the posterior parts of the back, where they reach a maximum length of 110 to 120 mm (Skinner and Smithers, 1990). A light-colored stripe is situated along the contour of the back and is not visible until the animal erects the spinal crest, allowing it to assume a larger and more threatening posture by causing an apparent increase in lateral body dimensions (Dorst and Dandelot, 1970; Rosevear, 1974; Wemmer, 1977; Wemmer and Wilson, 1983). The lateral aspect is increased by up to 30% during piloerection, and the size of the stripe by as much as six times (Wemmer and Wilson, 1983).

There are five digits on each foot, although the first toes are set back from the other four and are not visible in the tracks. The claws are fairly long, somewhat curved, only slightly retractile, and generally appear in the spoor (Pocock, 1915; Rosevear, 1974; Skinner and Smithers, 1990). The soles of the feet anterior and lateral to the central pads are naked. The metacarpal pads of the forefeet are bilobed and are usually connected to the palmar pad by one or two narrow strips of skin; the hind foot possesses a metatarsal pad (see Allen, 1924:116, Fig. 15; and Pocock, 1915: 135, Fig. 2).

The upper surface of the rhinarium is evenly convex, appearing straight in profile. The anterior median sulcus divides a narrow labial portion and does not reach into the internarial area (see Pocock, 1915:141, Fig. 4).

The skull is heavily-built (Fig. 2) and is the longest of any viverrid (Wozencraft, 1984). The zygomatic arch is robust and projects outward; the sagittal and occipital crests are moderate to well-developed. The sagittal crest tends to be more pronounced in males than in females (Wozencraft, 1984). The postorbital processes are usually broad and blunt; there is never an orbital ring. The degree of postorbital constriction varies; in some skulls, it is quite pronounced, giving the mid-section a narrow appearance. The interorbital constriction is generally slight, while the paroccipital process is always noticeable and extends beyond the bullae. The coronoid processes of the mandible are high and strong. The auditory bullae are long and ovoid. Mean skull measurements (in mm) from West African specimens (no *n* or *SE* reported) were: condylobasal length, 145; basilar length, 134; length of palatal, 73.6; zygomatic breadth, 77.1; breadth of upper cheekteeth, 47.4; interorbital breadth, 29.2; postorbital constriction 24; breadth of braincase, 43; length of tooth-row, 57.7; length of P4, 13; breadth of M1, 13.7; length of M1, 13.5; and length of M2, 8.2 (Rosevear, 1974). Mean measurements from Central Africa (*n* = 7, no *SE* reported) were condylobasal length, 149.4; length of palatal, 80; zygomatic breadth, 79.1; interorbital breadth, 29.6; and postorbital constriction, 22 (Allen, 1924). Measurements of skulls from other parts of the range suggest an absence of subspecific variation (Gregory and Hellman, 1939; Wozencraft, 1984).

DISTRIBUTION. *C. civetta* occurs in sub-Saharan Africa from 15°N to 24°S latitude (Fig. 3). The east-west range extends from Senegal to the east coast. African civets are present on the island of Zanzibar, but absent from other islands, such as Madagascar (Haltenorth and Diller, 1977; Kingdon, 1977; Rosevear, 1974;

Skinner and Smithers, 1990). In Somalia, African civets are found in the extreme south, between the Jubba river and the Kenya border (Funaioli and Simonetta, 1966; Skinner and Smithers, 1990).

In southern Africa, the distribution of *C. civetta* is more restricted. It is found throughout Zimbabwe and Mozambique, but in Botswana, is confined to the eastern part of the country, near the borders with South Africa and Zimbabwe. Almost all specimens and sightings from South Africa have been from the northeastern region of Transvaal; those from Namibia have been in the extreme northern and eastern regions (Haltenorth and Diller, 1977; Maberly, 1955; Skinner and Smithers, 1990). African civets have been recorded on very rare occasions from the coastal region of northeastern Natal in South Africa (Rowe-Rowe, 1978).

FOSSIL RECORD. *Civettictis* first appears in the mid- to late-Pleistocene, and another fossil discovered in the Olduvai Bed, *Pseudocivetta ingens*, may be an early representative of the modern African civet (Hendey, 1974; Petter, 1967). African civets became progressively smaller, with those from the Pliocene and Pleistocene having been considerably larger than the modern *Civettictis* (Hendey, 1974).

The Pliocene fossil record provides clues to the origins of *Civettictis*. Cheekteeth of *Viverra leakeyi* from the late Pliocene Olduvai Gorge, Tanzania, may be an intermediate step between those of *V. zibetha*, adapted more for slicing and shearing, and the thickened cheekteeth of *Civettictis*, more suitable for pounding and grinding (Petter, 1963). *V. leakeyi* has also been found in the late Pliocene beds of Langebaanweg, Southwest Cape Province (Hendey, 1974). The finding of another intermediate form (*V. bakerii*; Siwaliks Hill, India) suggests that there may have been a phylogenetic series that began with *V. zibetha* and led to *Civettictis* (Petter, 1963). Two offshoots probably stemmed from *Viverra* during the Pliocene: an Asian lineage and an African lineage (*V. leakeyi*), the latter including another Asian offshoot (*V. bakerii*), which did not persist (Hendey, 1974).

FORM AND FUNCTION. The heavy zygomatic arch provides a strong base for attachment of the masseter muscles, and the temporalis muscles have a broad area of attachment on the brain case, sagittal crest, and high coronoid process (Rosevear, 1974; Skinner and Smithers, 1990). This musculature, combined with a heavy lower jaw, gives *Civettictis* a powerful bite, thus equipping the animal for an omnivorous diet (Rosevear, 1974; Skinner and Smithers, 1990).

The dental formula is $i\ 3/3$, $c\ 1/1$, $p\ 4/4$, $m\ 2/2$, total 40. The outer upper incisors, which are set apart from the other incisors, assist the canines in holding prey (Skinner and Smithers, 1990). The canines project slightly outwards, a condition most noticeable in the shorter canines of the lower jaw. The fourth upper molar and the first lower molar, which form the carnassials, are not particularly well-suited for slicing (Ewer and Wemmer, 1974; Petter, 1969; Rosevear, 1974; Schliemann, 1990; Skinner and Smithers, 1990). The upper carnassial is triangular with an enlarged protocone. The lower carnassial has a narrow trigonid, a talonid that is only slightly lower and smaller, and many cusps. The first and second upper molars are uncharacteristically large and broad for the subfamily (Pocock, 1915); likewise, the second lower molar is quite well-developed with a flat surface. Hence, the broad, blunt cheekteeth are ideally suited for grinding and crushing (Ewer and Wemmer, 1974; Petter, 1969; Rosevear, 1974; Skinner and Smithers, 1990). Patterns of tooth microwear are associated with diet (Taylor and Hannam, 1987).

The African civet is well-known for its perineal gland secretion, a waxy substance known as civet, which was exploited commercially for centuries as the basic ingredient for many perfumes and is still exported, though to a lesser extent, from Ethiopia (Dannenfeldt, 1985). Both sexes possess perineal and anal glands, the secretions of which are used for scent-marking. The perineal glands of male African civets are slightly larger than those of females (Ewer and Wemmer, 1974), and males produce a stronger and better quality secretion (Vandenput, 1937:142).

The perineal glands are located between the scrotum and the prepuce in the male, and between the anus and the vulva in the female. They form a double-pocketed invagination, and are visible externally as paired swellings, each averaging 30 mm long and 19 mm wide. An oblong opening between them, about 25 mm in length, is kept closed by a pair of labia that are everted when the secretion is being applied. Inside each gland is a large hair-lined pouch. The

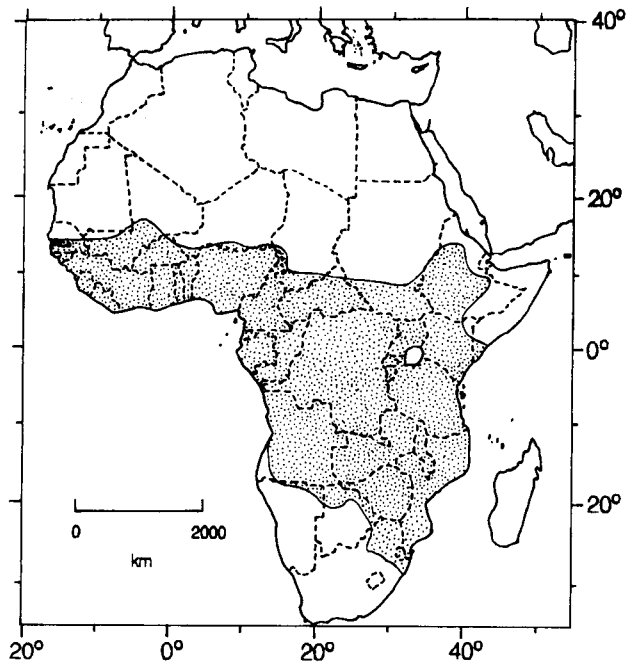


FIG. 3. Map of Africa showing the distribution of the African civet (adapted from Skinner and Smithers, 1990).

secretory portion of the glands is surrounded by striated muscle that compresses the glands, expelling a thick whitish or yellowish substance. The contents of the two pouches then enter the intervening space, which functions as a storage reservoir. When captive civets were kept for their secretions, perfume manufacturers were able to collect 3–4 g of civet each week (Michaelis, 1972).

The principal component of the perineal gland secretion is civetone, a macrocyclic compound (9-cis cycloheptadecanone) that, in 1926, was one of the first chemicals to be isolated from a mammalian scent gland (Van Dorp et al., 1973). The substance hardens with age, but retains a strong odor for >3 months and is resistant to rain and insects (Randall, 1979). The characteristic strong, musky odor is due to an array of saturated and unsaturated cyclic ketones and alcohols (Van Dorp et al., 1973).

The anal glands are situated in the wall of the rectum, and appear to have a different function from the perineal glands (Ewer, 1973). The anal sacs are located under the skin of the anal region and open directly into the rectum (Ewer, 1973). They are composed of an epithelial lining, connective tissue, smooth muscle fibers, and a thick layer of muscle. The lamina propria contains about ten complexes of sebaceous glands, each of which is associated with apocrine glands (Von Saldern et al., 1987). The entire epithelial lining may actively produce the secretion (Jacob and Schliemann, 1983). Because African civets cannot mark objects directly with anal glands, secretions are added to the feces (Ewer and Wemmer, 1974; Jacob and Schliemann, 1983; Pocock, 1915).

The yellowish secretion of the anal glands has no commercial value and does not have the characteristic odor of the perineal gland secretions (Jacob and Schliemann, 1983). In fact, the odor from African civet scats is more dependent on the food consumed than on the anal gland secretion (Bearder and Randall, 1978). The secretion does not contain any volatile fatty acids and is composed of a mixture of various lipids, the most important being squalene, cholesterol esters, cholesterol, mono- and diester waxes, triglycerides, free alcohols, free fatty acids, and alkane-1,2-diols (Jacob and Schliemann, 1983; Von Saldern et al., 1987).

The feet are "compact, blunt-clawed, [and] digitigrade" and are unsuitable for climbing or digging (Ewer and Wemmer, 1974: 363). The foot pad of *Civettictis* has less overall surface area than that of its arboreal relatives, *Nandinia* and *Genetta* (Wemmer, 1977). Trotting is the most common form of locomotion. In the forelimb, features are modified in association with the lengthening of the stride. These include an increase in the mobility of the proximal elements, such as the movement of the scapula on the ribcage, and a lengthening of the distal elements, such as the forearm and me-

tapodials. A high humero-radial index and rigid antibrachium are also exhibited (Taylor, 1974). Likewise, the hind limb is characterized by long epipodials and metapodials. The positioning of the ilia and the sacrum provides a rigid conformation for cursorial locomotion. The muscle bellies of the crus are positioned proximally, resulting in a reduction of the muscles and a lengthening of the associated tendons, thereby reducing inertia. The pes retains a long hallux, large digital pads, distal interdigital pads, and a reduction of the metatarsal pad to two vestigial pads. These characters suggest convergent evolution with the white tailed mongoose, *Ichneumia albicauda*, another carnivore adapted for sustained trotting (Taylor, 1976).

Female African civets possess two pairs of teats (Ewer, 1973). The baculum of *C. civetta* lacks distinctive features (Didier, 1948).

ONTOGENY AND REPRODUCTION. There is no favored season for breeding in West Africa (Rosevear, 1974). The breeding season in Kenya and Tanzania apparently occurs from March to October (Haltenorth and Diller, 1977). In southern Africa, breeding occurs in the warm, wet summer months from August to January, when insects are plentiful (Skinner and Smithers, 1990). However, sighting of a juvenile in May suggests that the breeding season may extend later than January (Smithers and Wilson, 1979). Seasonal breeding for *Civettictis* has also been reported in Zambia (Ansell, 1960). Although there was no evidence of seasonality in captive animals from the United States (Front Royal) and West Africa (Ewer and Wemmer, 1974), the majority of births (19/22) at the Jersey Zoo in the Channel Islands occurred between May and October (Mallinson, 1969, 1973).

Captive females attain sexual maturity at 1 year of age, and males possibly a bit earlier, at 9 months to a year (Ewer and Wemmer, 1974; Haltenorth and Diller, 1977). Captive females give birth to first litters at about 14 months of age (Ewer and Wemmer, 1974). Females are polyestrous and are able to have two or three litters in a year (Ewer and Wemmer, 1974; Mallinson, 1973). If a mother loses her litter, she will undergo estrous again within 14 days (Ewer and Wemmer, 1974). The maximum recorded duration of receptivity was 6 nights (Ewer and Wemmer, 1974). Parturition follows a gestation period ranging from 60 to 81 days (Ewer and Wemmer, 1974; Kingdon, 1977). Minimum gestation for civets born in the Jersey Zoo was 73 days (Mallinson, 1973). Gestation appeared to be longer for captive mothers whose previous pregnancy had ended in miscarriage, or whose litter had been lost after birth. This lengthened gestation may reflect delayed implantation under circumstances in which conception occurs immediately following the cessation of pregnancy, but before the uterus is prepared for implantation (Ewer and Wemmer, 1974). Litter size in captivity ranges from one to four young ($n = 27$; Mallinson, 1969, 1973; Ewer and Wemmer, 1974).

Young are born in an advanced state relative to most carnivores (Ewer and Wemmer, 1974). They are fully furred, although their fur is darker, shorter, and softer than that of an adult, and the coat pattern is poorly defined (Ewer and Wemmer, 1974; Haltenorth and Diller, 1977; Michaelis, 1972). Eyes are open at birth or within a few days. Young are able to crawl at birth, and the hind legs support the body by the 5th day (Ewer and Wemmer, 1974; Kingdon, 1977; Mallinson, 1973). The adult pelage pattern is already clear in the early stages of development (150–200 g; Skinner and Smithers, 1990).

At 17–18 days, the young begin to actively explore outside the nest. The first evidence of play behavior is seen at 14 days. The young are completely dependent on the mother's milk for up to 6 weeks, though they eat solid food before weaning. In the 2nd month of their lives, young begin to catch insects, and are later (42 days after birth) provided with solid food by their mother. Weaning occurs from 14 to 16 weeks (Ewer and Wemmer, 1974). The behavior of mouth suckling (where the young lick their mother's mouth and drink her saliva) is exhibited immediately before the mother provides her young with their first solid food. This behavior is rare in other carnivores, although it is common among rodents (Ewer, 1973). The mother carries the young in her mouth, grasping them by the middle of the back or by the neck (Ewer, 1973). Zoo mothers have been reported to kill and eat their young at birth (Mallinson, 1969).

ECOLOGY AND BEHAVIOR. African civets occupy both forest and open country, but they require cover from stands of long grass or thickets to provide a refuge in the daytime (Ewer and Wemmer, 1974; Kingdon, 1977; Rosevear, 1974; Skinner and

Smithers, 1990). *C. civetta* is absent from the more arid areas of Africa, such as the Sahara, Eritrea, and the southwestern region of the continent, but occurs in the northern parts of the Guinea and Sudan savannas. African civets can be found along river systems that project into otherwise arid areas of Niger, Mali, and Chad (Rosevear, 1974); they are closely associated with riverine and subriverine woodlands in the drier areas of the continent (Rautenbach and Nel, 1978) and are generally more common where there is permanent water, although they are not dependent on it (Skinner and Smithers, 1990). They are apparently able swimmers and do not fear water (Kingdon, 1977; Rosevear, 1974). African civets have been seen at altitudes ranging from sea level to 5,000 m in East Africa (Kilimanjaro; Moreau, 1944); in southern Africa, the highest reported altitude was 1,650 m (Skinner and Smithers, 1990; Smithers and Wilson, 1979).

Civettictis civetta is predominantly nocturnal, but is occasionally seen in the morning or afternoon on overcast days (Kingdon, 1977; Pienaar, 1964; Randall, 1977; Rosevear, 1974; Verheyen, 1951). The peak of activity occurs from 1–2 h before sunset until about midnight. An additional bout of activity can occur just before and shortly following sunrise (Randall, 1977). There is an increased tendency for both sexes to move around when sexually active (Ewer, 1973). The African civet sleeps in dense vegetation during the day, but only mothers with cubs appear to have fixed nests (Verheyen, 1951). Nests consist of holes made by other animals or cavities under tangled roots and are readily vacated if the animal is disturbed (Kingdon, 1977; Rosevear, 1974). The African civet is solitary, except when breeding (Rosevear, 1974; Skinner and Smithers, 1990). African civets are thought to occupy well-defined territories, but their size and the extent of overlap between them is unknown (Bardner and Randall, 1978; Randall, 1977).

C. civetta is omnivorous (Maberly, 1955; Rautenbach and Nel, 1978; Roberts, 1951; Rosevear, 1974; Skinner and Smithers, 1990); 79.3% of the contents of 15 African civet stomachs from southern Africa were composed of three major items: wild fruit, carrion, and rodents. Insects were consistently present in small quantities, the most abundant taxa being crickets, grasshoppers, termites, beetles, and stick insects. Also evident were the remains of birds, reptiles, molluscs, amphibians, arachnids, and vegetation (Bothma, 1971). A sample of 27 stomachs from Zimbabwe (Smithers and Wilson, 1979) revealed the highest percentage occurrence for insects (59%), followed by wild fruit (52%), murids (41%), reptiles (22%), birds (15%), amphibians (11%), and myriapods (11%). Insects consisted primarily of grasshoppers and beetles. Millipedes were common dietary components of Transvaal African civets (Randall, 1977).

The diet in eastern and western Africa appears to be similar to that in southern Africa, but aquatic organisms such as crabs, snails and mudskippers, and the eggs of ground-nesting birds are also eaten (Kingdon, 1977; Rosevear, 1974). Reptiles, amphibians, and insects are less available in the colder and drier months in southern Africa, and insects often have the highest percentage occurrence in scats and stomachs during the warm, wet summer months (Skinner and Smithers, 1990). African civets have been known to subsist almost entirely on fruit for long periods of time, particularly in forested habitats (Kingdon, 1977; Pendje, 1994). Where readily available, carrion was widely used by civets as a food source (Randall, 1977). Grass is commonly found in scats (22% occurrence; Skinner and Smithers, 1990) and, since it tends to be associated with the hair of the civet itself, may prevent hairballs (Ewer and Wemmer, 1974). Grass has a strong tendency to be related to the presence in the diet of snakes, and to a lesser extent, frogs (Randall, 1977). African civets are also notorious for raiding cultivated gardens and chicken coops at night (Kingdon, 1977; Rosevear, 1974).

Civettictis civetta is not a cunning predator. The paws are not used in prey capture; instead prey is seized by the mouth and secured with the teeth (Ewer and Wemmer, 1974; Kingdon, 1977; Schliepmann, 1990; Skinner and Smithers, 1990). Prey is detected predominantly by smell and sound, rather than by sight (Ewer and Wemmer, 1974). In captivity, attack methods include run-away bite (aimed at any part of the body), bite and throw (where the prey is held long enough to be thrown quickly aside), bite and shake (where the grip is retained and the prey is shaken to break the vertebrae), or killing bite (the grip is retained firmly; Ewer and Wemmer, 1974). An aimed bite at the head is usually administered as a coup-de-grâce. Unlike other carnivores, there is seldom a direct neck bite (Ewer, 1973). Unfamiliar prey is approached cautiously. With large prey items, the first bite is normally directed at the skull;

with small prey, the orientation does not appear to be critical (Ewer and Wemmer, 1974). The paws are used only to extract prey that cannot be reached by the mouth. Insects are rarely dug out of the ground, but they are captured by the mouth (Skinner and Smithers, 1990). The food item is held down with the forepaws and pieces are pulled off by the incisors (Ewer and Wemmer, 1974; Skinner and Smithers, 1990). Tough flesh often must be chewed for long periods with side-to-side chewing motions (Ewer and Wemmer, 1974). Fruit is swallowed with minimal chewing (Kingdon, 1977). African civets attack prey up to the size of a hare, although they are clumsy killers (Maberly, 1955). Aquatic prey is caught under water with the mouth (Ewer and Wemmer, 1974; Skinner and Smithers, 1990). African civets can eat as much as 2 kg in one night, but are able to go without food for as long as 2 weeks (Kingdon, 1977).

Civettictis uses defecation sites (called latrines or civetries; Bearder and Randall, 1978; Ewer, 1973; Gaillard, 1969; Kingdon, 1977; Maberly, 1955; Pendje, 1994; Rosevear, 1974; Verheyen, 1951). African civets invariably deposit their feces in fixed places but do not bury them. Anal gland secretions added to the dung produce a long-lasting odor. Latrines are primarily situated alongside roads or game trails that are also used as routes for movement (Bearder and Randall, 1978). After translocation of the dung piles, African civets still deposited their feces at the original site (Bearder and Randall, 1978). Most latrines are located in clearings, and scats are piled on top of each other in shallow hollows or depressions (Bearder and Randall, 1978; Gaillard, 1969). Captive African civets exhibit a preference for defecating from a height (Ewer and Wemmer, 1974). In southern savannah habitats, individuals visit more than one latrine, and a specific latrine will be used by more than one African civet (Randall, 1977). Latrines may serve as centers of information exchange, given that more animals may visit a given latrine than will defecate there (Randall, 1977; Bearder and Randall, 1978). On the other hand, exclusive use of latrines by African civets has been reported in captivity (Ewer and Wemmer, 1974), and in a rainforest in Zaire (Pendje, 1994). There is some evidence of increased incidence of latrines at territorial boundaries (Bearder and Randall, 1978). These sites may provide a rich microhabitat for seedlings, suggesting that African civets act as seed dispersers (Pendje, 1994; Randall, 1977).

African civets also mark objects along established routes with perineal gland secretions (Kingdon, 1977; Randall, 1977, 1979). Scents are often overlaid by other passing African civets, indicating that the scent may provide olfactory information such as the sexual status of other individuals (Kingdon, 1977). Foreign objects or objects bearing a strange odor are also marked, and unfamiliar areas are marked more extensively than familiar ones (Ewer and Wemmer, 1974; Randall, 1979; Schliemann, 1990). When *Civettictis* marks objects on the ground, it simply squats and presses the gland on the object, often leaving a double mark. Vertical objects such as trees, are marked by backing up, raising the tail, everting the lips of the gland, and pressing them against the object. African civets prefer to mark smooth surfaces (Bearder and Randall, 1978; Ewer, 1973; Ewer and Wemmer, 1974; Randall, 1977, 1979). Unfamiliar or particularly strong-smelling foods are often scent-rubbed by the animal before or during eating (Ewer and Wemmer, 1974). Scent is not emitted in alarm (Ewer and Wemmer, 1974; Kingdon, 1977). Males are also known to direct urine backwards when marking (retromingent urination), a behavior more commonly associated with felids (Ewer, 1973).

Captive African civets are not monogamous (Mallinson, 1973). Sexually active animals increase their movements, with the male exhibiting wider than usual ranging patterns (Ewer, 1973; Ewer and Wemmer, 1974). As estrous approaches, captive females often emit characteristic sex calls, to which the male responds with a contact call that is similar to vocalizations of young individuals (Ewer and Wemmer, 1974). At first, the female actively avoids advances of the male, or even snaps at him (Ewer and Wemmer, 1974; Kingdon, 1977). The female continues to be aggressive following mating and is considered to be the dominant member of the pair (Kingdon, 1977). Matings are usually preceded by courtship chases, which are initiated by the female. Two observed matings of captive African civets lasted 40 and 70 s, respectively (Ewer and Wemmer, 1974). Bonds between the pair in the wild are probably not maintained after courtship (Kingdon, 1977). Indeed, Ewer and Wemmer (1974) recorded overt hostility by captive females towards males immediately after birth of their cubs.

Adult African civets are largely silent. The contact call is the

most frequently heard vocalization in captive animals (Ewer and Wemmer, 1974; Wemmer, 1977). This is a "short repetitive sound, usually delivered three or four times in succession but there may be as many as seven notes in a sequence. It can be imitated by saying 'ha-ha-ha' with the lips closed instead of open" (Ewer and Wemmer, 1974:366). It is most frequently heard when cubs are trying to contact littermates, and produces an automatic answer in the first stages of life. Later in life, the response becomes more facultative; mothers will sometimes use the call to summon their young. This call is sometimes used by adult *Civettictis* to contact conspecifics. Males use it in response to the sex call of an estrous female. African civets are also known to hiss when alarmed, or growl in warning (Rosevear, 1974).

African civets may live near human settlements and are easily tamed (Rosevear, 1974; Schliemann, 1990). They return regularly to a steady source of food from households (Kingdon, 1977). However, they will fall prey to dogs, and are killed by humans, both for their meat and in retaliation for raiding gardens and chicken coops (Carpaneto and Germi, 1989; Kingdon, 1977). In eastern Zaire, the consumption of *Civettictis* by some ethnic groups is governed by food taboos; pregnant women and their husbands cannot eat the flesh of an African civet for fear the baby will be born with abnormalities (Carpaneto and Germi, 1989).

Sporadic cases of rabies in wild *C. civetta* have been recorded in West Africa, and the species may act as a reservoir for the disease (Enurah et al., 1988). African civets have lived for up to 14 years in captivity (Mallinson, 1973). They are protected under the Washington Treaty on the Protection of Species, Appendix III (Schliemann, 1990).

GENETICS. The karyotype of *C. civetta* has 38 diploid chromosomes, with 72 chromosomal arms (the fundamental number) in a haploid set. It has a single pair of chromosomes with "conspicuous" satellites (Todd, 1967:49), a feature common among the Viverridae. The autosomes are composed of 16 pairs of metacentric or submetacentric and two pairs of acrocentric or subacrocentric elements. The X chromosome is a large metacentric or submetacentric, and the Y is a medium acrocentric or subacrocentric element (Todd, 1967).

REMARKS. Most authors agree with Pocock (1915) in his placement of *Civettictis* in a genus separate from *Viverra* (e.g., Ewer, 1973; Ewer and Wemmer, 1974; Gregory and Hellman, 1939; Hill and Carter, 1941; Kingdon, 1977; Michaelis, 1972; Rosevear, 1974; Skinner and Smithers, 1990). However, Ellerman et al. (1953) argued that the differences did not merit placement above a sub-generic level, and others have likewise retained the original classification (*Viverra*; e.g., Bothma, 1971; Coetzee, 1971; Hapgood, 1987; Rowe-Rowe, 1978).

The perineal gland secretion ("civet") of the African civet is characterized by a pleasant odor when diluted, and is responsible for an extensive perfume industry in the Middle East. African civets and civet became widely available in Europe by the 15th century, concomitant with European exploration of Africa. It was primarily used by physicians to treat a variety of ailments (always topically). Exportation of civet peaked in the 17th and 18th centuries, after which the use of civet in medicine declined. Civet has since been used exclusively by the perfume industry (Dannenfeldt, 1985). Until this century, large numbers of African civets were kept in captivity in Ethiopia and Zanzibar, and constituted a major market for export, along with ivory and slaves. In 1929, one ounce of civet was worth US \$3.75 (Vandenput, 1937), and in 1934, 2,475 kg of civet were produced, at a value approximating US \$200,000 (Michaelis, 1972). Synthetic musk has been developed, but has not fully replaced natural civet, nearly all of which is exported from Ethiopia (Dannenfeldt, 1985).

Civettictis is derived from the French *civette*, first used by Buffon and Daubenton (1763), and the Greek *ictis*, meaning weasel. *Civette* came from the Arabic *zabat* used to describe the scent emitted from the perineal glands (Rosevear, 1974; Wozencraft, 1984). The common use of the name civet cat for *C. civetta* is misleading, as African civets bear little resemblance to felids, and do not even share familial rank with them.

Many thanks to Guy N. Cameron, Alicia V. Linzey, Jay R. Malcolm, Mark E. Taylor, Charles A. Woods, and Chris Wozencraft for their thoughtful editorial comments on various drafts of the manuscript, and to Chris Wemmer and Chris Wozencraft for the photographs of *Civettictis* and the skull, respectively. Jay R. Malcolm

drew the map, and Nicola D. Ray assisted in preparing the manuscript.

LITERATURE CITED

- ALLEN, J. A. 1924. Carnivora collected by the American Museum Congo Expedition. *Bulletin of the American Museum of Natural History*, 47:73-281.
- ANSELL, W. H. F. 1960. Mammals of northern Rhodesia. The Government Printer, Lusaka, Northern Rhodesia, 155 pp. + 24 pp. (figs.).
- BEARDER, S. K., AND R. M. RANDALL. 1978. The use of fecal marking sites by spotted hyenas and civets. *Carnivore*, 1:32-48.
- BOTHMA, J. DU P. 1971. Food habits of some Carnivora (Mammalia) from Africa. *Annals of the Transvaal Museum*, 27:15-25.
- BUFFON, G. L. L. COMTE DE, AND L. J. M. DAUBENTON. 1763. *Histoire naturelle, générale et particulière avec la description du cabinet du Roi*. L'Imprimerie Royale, Paris, 10 (Quadrupeds):1-6 (unnumbered) + 368 pp.
- CABRERA, A. 1929. Catálogo descriptivo de las mamíferos de la Guinea Española. *Memorias de la Real Sociedad Española de Historia Natural*, 16:5-121.
- CARPANETO, G. M., AND F. P. GERMI. 1989. Mustelidae and Viverridae from north-eastern Zaire: ethnozoological research and conservation. *Mustelid and Viverrid Conservation*, 1:2-6.
- COETZEE, C. G. 1971. Order Carnivora. Part 8. Pp. 1-42, in *The mammals of Africa: an identification manual* (J. Meester and H. W. Setzer, eds.). Smithsonian Institution Press, Washington, D.C., not continuously paginated.
- DANNENFELDT, K. H. 1985. Europe discovers civet cats and civet. *Journal of the History of Biology*, 18:403-431.
- DIDIER, R. 1948. Étude systématique de l'os pénien des mammifères. *Mammalia*, 12:67-93.
- DORST, J., AND P. DANDELLOT. 1970. A field guide to the larger mammals of Africa. Houghton-Mifflin, Boston, 287 pp.
- ELLERMAN, J. R., T. C. S. MORRISON-SCOTT, AND R. W. HAYMAN. 1953. Southern African mammals 1758-1951: a reclassification. *Trustees of the British Museum of Natural History*, London, 363 pp.
- ENURAH, L. U., R. A. OCHOLI, K. D. ADENIYI, AND M. C. EKWONU. 1988. Rabies in a civet cat (*Civettictis civetta*) in the Jos Zoo, Nigeria. *British Veterinary Journal*, 144:515-516.
- EWER, R. F. 1973. The carnivores. Cornell University Press, Ithaca, 494 pp.
- EWER, R. F., AND C. WEMMER. 1974. The behaviour in captivity of the African civet, *Civettictis civetta* (Schreber). *Zeitschrift für Tierphysiologie*, 34:359-394.
- FUNAIOLI, U., AND A. M. SIMONETTA. 1966. The mammalian fauna of the Somali Republic: status and conservation problems. *Monitore Zoologico Italiano*, 74(Supplemento):285-347.
- GAILLARD, D. 1969. Sur un trait de biologie de la civette (*Civettictis civetta* Schreber). *Mammalia*, 33:352.
- GREGORY, W. K., AND M. HELLMAN. 1939. On the evolution and major classification of the civets (Viverridae) and allied fossil and recent Carnivora: a phylogenetic study of the skull and dentition. *Proceedings of the American Philosophical Society*, 81:309-392.
- HALTENORTH, T., AND H. DILLER. 1977. A field guide to the mammals of Africa including Madagascar. Translation from German by R. W. Hayman for Collins, London, 1980. 400 pp.
- HAPPOLD, D. C. D. 1987. The mammals of Nigeria. Clarendon Press, Oxford, 402 pp.
- HENDEY, Q. B. 1974. Late Cenozoic Carnivora of south-western Cape Province. *Annals of the South African Museum*, 63:1-369.
- HILL, J. E., AND T. D. CARTER. 1941. The mammals of Angola, Africa. *Bulletin of the American Museum of Natural History*, 78:1-209.
- JACOB, J., AND H. SCHLIEMANN. 1983. Chemical composition of the secretion from the anal sacs of *Civettictis civetta* (Schreber, 1776). *Zeitschrift für Naturforschung*, 38c:497-500.
- KINGDON, J. 1977. East African mammals: an atlas of evolution in Africa. Academic Press, New York, IIIA:476 pp.
- LUNDHOLM, B. G. 1955. Description of new mammals. *Annals of the Transvaal Museum*, 22:279-304.
- MABERLY, C. T. A. 1955. The African civet. *African Wildlife*, 9:55-58.
- MALLINSON, J. J. C. 1969. Notes on breeding the African civet *Viverra civetta* at Jersey Zoo. *International Zoo Yearbook*, 9:92-93.
- . 1973. The reproduction of the African civet *Viverra civetta* at Jersey Zoo. *International Zoo Yearbook*, 13:147-150.
- MATSCHIE, P. 1891. Über einige säugetiere von Kamerun und dessen hinterlands. *Archiv für Naturgeschichte*, 1:351-356.
- MICHAELIS, B. 1972. Die schleickatzen (Viverriden) Afrikas. *Säugetierkundliche Mitteilungen*, 20:1-110.
- MOREAU, R. E. 1944. Kilimanjaro and Mount Kenya: some comparisons with special reference to mammals and birds. *Tanganyika Notes Record*, 18:28-68.
- PENDIE, G. 1994. La frugivorie de *Civettictis civetta* (Schreber), et son rôle dans la dispersion des graines au Mayombe. *Revue d'Ecologie (la Terre et Vie)*, 49:107-116.
- PETTER, G. 1963. Étude de quelques viverridés (Mammifères, Carnivores) du Pleistocene inférieur du Tanganyika (Afrique orientale). *Bulletin de la Société Géologique de France*, 5:265-274.
- . 1967. Petits carnivores villafranchiens du Bed I d'Oldoway (Tanzanie). *Colloque International du Centre National de la Recherche sur "Problèmes actuels de paléontologie (évolution des vertébrés)"*, Paris, 163:529-538.
- . 1969. Interprétation évolutive des caractères de la denture des viverridés Africains. *Mammalia*, 33:607-625.
- PIENAAR, D. DE V. 1964. The small mammals of the Kruger National Park—a systematic list and zoogeography. *Koedoe*, 7:1-24.
- POCOCK, R. I. 1915. On the feet and glands and other external characters of the Viverrinae, with the description of a new genus. *Proceedings of the Zoological Society of London*, 1915: 131-149.
- PUCHERAN, J. 1855. [D'une espèce nouvelle de carnassier]. *Revue et Magasin de Zoologie*, 7:304.
- RANDALL, R. M. 1977. Aspects of the ecology of the civet *Civettictis civetta* (Schreber, 1778). M.Sc. thesis, University of Pretoria, Republic of South Africa, 250 pp.
- . 1979. Perineal gland marking by free-ranging African civets, *Civettictis civetta*. *Journal of Mammalogy*, 60:622-627.
- RAUTENBACH, I. L., AND J. A. J. NEL. 1978. Co-existence in Transvaal Carnivora. *Bulletin of Carnegie Museum of Natural History*, 6:138-145.
- ROBERTS, A. 1951. The mammals of South Africa. The Trustees of "The Mammals of South Africa Book Fund," Johannesburg, 700 pp.
- ROSEVEAR, D. R. 1974. The carnivores of West Africa. *British Museum of Natural History*, London, 548 pp.
- ROWE-ROWE, D. T. 1978. The small carnivores of Natal. *Lammergeyer*, 25:1-48.
- SCHLIEMANN, H. 1990. Viverrids. Pp. 510-556 in *Grzimek's encyclopedia of mammals*. Volume 3. Translation from German (S. P. Parker, ed.). McGraw-Hill, New York, 643 pp.
- SCHREBER, J. C. D. [1774]-[1810]. *Die säugthiere in abbildungen nach der natur mit beschreibungen*. Walther, Erlangen. [Dates of publication on cover 1775-1792], 5 volumes, 347 plates.
- SCHWARZ, E. 1934. Notes on the nomenclature and systematic position of some African mammals. *Annals and Magazine of Natural History*, 14:258-261.
- SKINNER, J. D., AND R. H. N. SMITHERS. 1990. The mammals of the southern African subregion. University of Pretoria, Pretoria, South Africa, 771 pp.
- SMITHERS, R. H. N., AND V. J. WILSON. 1979. Checklist and atlas of the mammals of Zimbabwe Rhodesia. *Museum Memoir (National Museums and Monuments of Rhodesia)*, 9:1-147.
- TAYLOR, M. E. 1970. Locomotion in some east African viverrids. *Journal of Mammalogy*, 51:42-51.
- . 1974. The functional anatomy of the forelimb of some African Viverridae. *Journal of Morphology*, 143:307-336.
- . 1976. The functional anatomy of the hindlimb of some African Viverridae. *Journal of Morphology*, 148:227-254.
- TAYLOR, M. E., AND A. G. HANNAM. 1987. Tooth microwear and diet in the African Viverridae. *Canadian Journal of Zoology*, 65:1696-1702.

- TODD, N. B. 1967. The karyotypes and diploid numbers of the African civet (*Civettictis civetta*) and the African palm civet (*Nandinia binotata*) with remarks on satellite chromosomes and taxonomy of the Feloidea. *Carnivore Genetics Newsletter*, 3:49-51.
- VAN DORP, D. A., R. KLOK, AND D. H. NUGTEREN. 1973. New macrocyclic compounds from the secretions of the civet cat and the musk rat. *Receuil*, 92:915-928.
- VANDENPUT, R. 1937. La civette. *Bulletin Agricole du Congo Belge*, 28:135-146.
- VERHEYEN, R. 1951. Contributions a l'étude éthologique des mammifères du Parc National de l'Upemba. *Institut des Parcs Nationaux de Congo Belge*, Brussels, 161 pp.
- VON SALDERN, A., H. SCHLIEMANN, F. I. B. KAYANJA, AND J. JACOB. 1987. Die analbeutel von *Civettictis civetta*. *Zeitschrift für Säugetierkunde*, 52:96-115.
- WEMMER, C. 1977. Comparative ethology of the large-spotted genet *Genetta tigrina* and some related viverrids. *Smithsonian Contributions to Zoology*, 239:1-93.
- WEMMER, C., AND D. E. WILSON. 1983. Structure and function of hair crests and capes in African Carnivora. Pp. 239-264, *in* *Advances in the study of mammalian behavior* (J. F. Eisenberg and D. G. Kleiman, eds.). Special Publication of the American Society of Mammalogists, 7:1-753.
- WOZENCRAFT, W. C. 1984. A phylogenetic reappraisal of the Viverridae and its relationship to other Carnivora. Ph.D. dissert., The University of Kansas, Lawrence, 477 pp. (Vol. I) + 547 pp (Vol. II).
- Editors of this account were ELAINE ANDERSON, GUY N. CAMERON, ALICIA V. LINZEY, and KARL F. KOOPMAN. Managing editor was JOSEPH F. MERRITT.
- JUSTINA C. RAY, DEPARTMENT OF WILDLIFE ECOLOGY AND CONSERVATION, P.O. BOX 110430, UNIVERSITY OF FLORIDA, GAINESVILLE, FLORIDA 32611.