Species Profile

Banded mongoose

***Mungos mungo* (Gmelin)**

Fr. Mangue rayee Ger. Zebramanguste

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Viverra mungo Gmelin 1788. Syst. Nat. 13th Ed., 1: 84. Type locality: "Bengala, Persia, aliisque asiae", later restricted by Ogilby (1835:101) to "Gambia". Thomas (1882:91) thought it likely that the specimens were obtained from the Cape (i.e. Cape of Good Hope, South Africa), as did Roberts (1929) and Allen (1939); this was not accepted by Ellerman et al. (1953) or Meester et al. (1986).

Taxonomy

Synonyms: *adailensis, bororensis*, *caurinus*, *colonus*, *fasciatus, gothneh*, *grisonax*, *marcrurus*, *macrosus*, *mandjarum*, *mungo*, *taenionotus*, *ngamiensis*, *pallidipes*, *rossi*, *senescens*, *somalicus*. *talboti*, *zebra, zebroides*

Description

A medium-sized, squat mongoose, whitish grey to dark brown in colour. Easily recognized by a pattern of 10-15 dark transverse bands running across the body from shoulders to the rump. There is no sexual dimorphism. Head small and broad with a short, pointed muzzle. Rhinarium small and lacking the central slit on the front; upper lip intact. Ears small and rounded. Body covered with coarse hair that is short at the head, lengthening toward the rump (reaching a length of 45 mm in eastern specimens). Tail covered in hair, darker toward the tip. Individual hairs of dorsal pelage are light in colour at the base, with two broad black bands and a narrow dark tip. Dorsal stripes are formed by a matched-up alignment of these banded hairs. The guard coat is thick. Ventral pelage very sparse. Limbs same colour as dorsal pelage. Five digits on forefeet, four on the hind. First digit of forefoot is small but with an unusally long claw (about 8 mm), used for digging. The other digits on the forefeet are armed with long, curved claws up to 20 mm long. The anal glands open into a subcircular pouch. Females have three pairs of abdominal mammae.

Braincase pear-shaped, broadest at the level of the ear openings and narrowing towards the post-orbital constriction, which lies well back of the upper portion of the post-orbital bars. Post-orbital bars incomplete, represented by small processes on the zygomatic arch and the frontals. Rostrum short and broad. Supra-occipital crest poorly developed; sagittal crest absent. Outer upper incisors considerably larger than the remainder; upper canines slightly curved, short, rounded and sharp, with the lower distinctly recurved. Upper and lower first premolars absent and all cheek-teeth having low, rounded cusps (Petter 1969, Skinner & Smithers 1990).

Similar Species

Mungos gambianus:

Brownish grey mongoose, with dark streaks of fur each side of a lighter coloured neck. Inhabits moist savannahs of north-western Africa, from Gambia to Nigeria. No banding pattern.

Crossarchus obscurus: Grizzled dark brown to grey mongoose, found in swamplands and forests of central and western Africa, in the countries of Ghana, Ivory Coast, Liberia, and Sierra Leone. No banding pattern.

Geographical Variation
Coetzee (1977) recognized 13 subspecies from the continent, but noted that many of them are morphologically and geographically not well defined. There is a wide degree of variation in colouration. For example, in southern KwaZulu-Natal, specimens attributed to *M. m. taenionotus* have dark reddish-brown upper parts, particularly noticeable between the black bands on the lower back. On the other hand, in specimens attributed to *M. m. grisonax* of Botswana and Namibia, the upper parts are light grey, with only a faint tinge of reddish-brown between the black bands. Specimens from drier savannah regions somewhat lighter in colour than those from more lush habitat. Kingdon (1997) *provisionally recognized four distinctive regional populations: M. m. mungo, in western Africa; M*. m. zebra, in the Horn of Africa; *M. m. colonus*, in eastern Africa; and *M. m. taenionotus*, in southern Africa. However, both the physical characteristics and boundaries of regional types await systematic definition.

Distribution
Endemic to Africa. Distributed widely across sub-Saharan Africa in a band stretching from Senegal and The Gambia to Ethiopia and Somalia, and south to about 31° in the KwaZulu-Natal province of South Africa. Although fairly widespread in southern Africa, the species appears to be rare in West Africa: it is not recorded from Ghana, has never been confirmed in Sierra Leone and Niger, and seems to be known only from the Keneba-Jifarong area in The Gambia (Grubb et al. 1998). Besides The Gambia, Grubb et al. (1998) state that there are well-known records from Guinea-Bissau and Nigeria, to which may be added Senegal (e.g. Niokolo-Koba National Park; Sillero-Zubiri & Marino 1997) and Ivory Coast (e.g. Comoe National Park; Fischer et al. 2002). Grubb et al. (1998) conclude that the species may have a disjunct distribution in West Africa, with an outlying localized population in the far west. In North-east Africa, their presence is not confirmed in Djibouti.

Habitat
Wide range of habitats but primarily found in savannah and woodland, usually close to water. Although commonly found in riverine conditions, it is believed that it is the physiognomy of the vegetation rather than the presence of water that determines their occurrence (Skinner & Smithers 1990). Often found in habitats containing termitaria, which are used as den sites. Absent from desert, semi-desert and montane regions.

Abundance
Density varies widely between habitats and locations. In the Serengeti plains banded mongooses live at a density of around 3 individuals/km^2 (Waser et al. 1995); this is similar to the estimated density of banded mongooses in southern KwaZulu-Natal, South Africa (2.4/km^2; Maddock 1988). By contrast, a peninsula population in Queen Elizabeth National Park, Uganda, lives at higher densities, averaging 18 individuals/ km^2 (Cant 1998, Gilchrist & Otali 2002). Generally less abundant in western regions compared to eastern and south-eastern areas of the distribution. Regional differences in abundance could be related to the specific spectrum of other mongooses present. The greatest overlaps in diet and habitat needs are likely to come from the Cusimanses (*Crossarchus* spp.), the Gambian mongoose (*Mungos gambianus*) and the Yellow mongoose (*Cynictis penicillata*).

Adaptations
The carnassials are better adapted to crushing than slicing, which, together with the weak zygoma and lack of a sagittal crest, suggests an adaptation to a diet of relatively soft or insectivorous food (Skinner & Smithers 1990).

Excellent senses of smell, vision and hearing. Terrestrial predators and humans may be sighted at a distance of 100 m or more, and the animals can distinguish avian predators from other, non-predatory birds (e.g. heron, hammerkop) at great distance. Group members respond to distant predators by vocalizing and by standing upright to gain a better view. When danger threatens at closer range, the animals adopt one of two anti-predator strategies, depending on the type of predator. Individuals respond to avian and large terrestrial predators such as leopard by giving a high-pitched alarm call that sends the entire group running for cover. By contrast, banded mongooses group together to drive off smaller terrestrial predators such as jackals *Canis* spp. or serval *Leptailurus serval*. Group members bunch tightly together and advance slowly, vocalizing aggressively (Kingdon 1977). Banded mongooses have been known to rescue group members seized by martial eagles *Polemaetus bellicosus* in the Serengeti (Rood 1983).

Banded mongooses are diurnal, typically emerging from refuges in the early morning and retiring before sunset; no nocturnal activity has been recorded for the species. Dens are typically located in abandoned termitaria, but may also be found in the hollows of tree roots, in sheltered spaces in gullys or underneath rock falls. Largely terrestrial, banded mongooses do climb to the tops of termitaria, which they use as vantage points, and are also able to climb trees when under stress. Simpson (1964) recorded a pack being chased by wild dogs *Lycaon pictus* that took to the high branches of a fallen tree. Little is known about the adaptive significance of the banded pattern on the animals' back and rump. Kingdon (1977) suggests that it may constitute a visual signal to conspecifics, or it may enhance the visual impact of communal threat displays toward predators.

Vocal communication is conspicuous and diverse. Foraging group members emit a more or less continuous stream of low grunts that serve as contact calls. Responses of other pack members to warning and alarm calls vary depending on pitch and amplitude. Other distinct calls include a screeching contact call, when individuals become separated from the pack, a rally call, used upon seeing members of a neighbouring groups, and threat and aggression calls, used in competition over food. A study of one captive group found that there were nine sonographically distinct calls (Messeri et al. 1987), but there are probably a number of other additional specialized calls that are used more rarely in a natural setting.

Scent plays an important role in maintaining group identity and cohesion, and in the advertisement of territorial boundaries. Group members regularly mark each other with a sticky, pungent secretion from the anal glands. Individuals that become lost during foraging trips locate the group by scent, and upon reintroduction to the group the returning individuals are vigorously marked by the other group members. Objects such as large rocks or branches are used as marking posts at which group members anal mark, cheek mark, defecate, and urinate. Some observations suggest that males can determine the reproductive status of females in a neighbouring group by monitoring the scent marks at shared marking posts. After smelling the scent of groups containing oestrous females, males will sometimes make forays deep into the home range of a neighbouring group in search of extra-group copulations (Cant, unpubl.).

Hamerkop *Scopus umbretta* apparently form feeding associations with banded mongooses (Steyn 1991). The birds have been observed to chase and eat any small lizards and frogs that escape from the foraging mongooses. Warthogs sometimes lie down or stand still to allow banded mongooses to groom them for ticks and other ectoparasites.

Foraging and Food
Diet mainly consists of insects, myriapods, snails, small reptiles, the eggs and young of ground-nesting birds, and wild fruits (Rood 1975, Smithers 1971, Smithers & Wilson 1979, Rautenbach

1982, Hiscocks & Perrin 1990). The analysis of a sample of 14 stomachs from Zimbabwe and Botswana revealed that insects occurred in every stomach, mainly Coleoptera and their larvae, followed by grasshoppers, mole crickets, formicid ants, their eggs and larvae, and caterpillars (Smithers 1971, Smithers & Wilson 1979). Groups also take advantage of human waste food at garbage dumps (Gilchrist & Otali 2002, Otali & Gilchrist 2004).

Each morning, the group embarks on a foraging trip lasting several hours before retiring to shade to rest. There is usually a second foraging session in late afternoon. Foraging distances average 2-3 km in Uganda (Neal 1970) but may be more extensive, up to 10 km, in the more open savannah of the Serengeti (Rood 1975, 1986). Foraging members of the group fan out and search for food independently, sniffing the ground, turning over leaf litter, and digging in the earth with their front paws. Individuals rarely dig more than a few centimetres below the surface for prey. Dung of large herbivores, especially elephants, is enthusiastically tackled due to the high density of beetle prey within. Group members maintain contact with each other by emitting low grunts every few seconds. Individuals generally do not share food but defend potential food items (foraging holes, scrapes or dung) and food items from other individuals.

Millipedes, frogs and other prey that produce noxious secretions are rolled around in the earth before being eaten. Baxter (1993) recorded a banded mongoose feeding on a shrew, *Crocidura flavescens* in captivity. The mongoose bit off the shrew's head and then proceeded to bite into the thoracic cavity while pulling downwards, with its forepaws and claws, on the skin, progressively removing the skin with its large, unpalatable subcutaneous glands.
Eggs and hard shelled organisms (e.g. dung beetles) are cracked open by clasping them between the front paws and throwing them back between the hind legs onto a rock or other hard surface, in much the same way as does the dawrf mongoose *Helogale parvula* (Simpson 1964).

Social and Reproductive Behaviour
Banded mongooses are cooperatively breeding mammals that typically live in groups of 15 – 20 individuals. Around campsites or other artificial food sources groups may number up to 70 (Pienaar 1964). In Queen Elizabeth National Park, Uganda, nine groups of banded mongooses averaged 16 individuals (> 6 months old) and occupied home ranges ranging in size from 0.3 km^2 –2.0 km^2 (Rood 1975, 1986, Cant 1998, 2000, Cant et al. 2001, De Luca & Ginsberg 2001, Gilchrist & Otali 2002). In other, drier regions (e.g. southern Africa) home ranges are apparently larger (>2 km^2; Hiscocks and Perrin 1991). Groups may utilize up to 40 dens within their home range, changing between dens every 2 to 3 days (less often when breeding). All members of a group sleep in the same den overnight and pups remain in the den whilst the group forages during their first 3 to 4 weeks of life. Favourite den sites include abandoned termitaria, crevices, gulleys and thickets, and even the burrows of springhare *Pedetes* spp and aardvark *Oryceropus afer*, but the animals will also den in outhouses and other artificial shelters (Neal 1970, Rood 1975, Hiscocks & Perrin 1991).

Home ranges are vigorously defended against neighbouring groups of conspecifics. Encounters between groups usually lead to physical conflict, during which animals may be severely wounded and even killed (Rood 1975. Cant et al. 2001). Upon sighting each other, members of rival groups respond by standing erect and giving a distinctive, screeching call which alerts the rest of their group to the presence of a rival group. The sight of a large rival group is sometimes sufficient to cause a small group of mongooses to flee, with members of the larger group chasing behind (Rood 1975, Cant et al. 2001). Groups more closely matched in size bunch together and approach each other with caution, stopping frequently to stand upright and stare at their opponents. Typically, members of the two groups approach to within twenty or thirty metres of each other before rushing forward, with members of both groups fanning out and engaging in one-to-one fights or chases with their opponents. Face to face confrontations between individuals are brief (< 5 seconds) and violent, involving repeated bites and scratches with the front paws until one of the combatants bolts. Groups that have become scattered sometimes retreat, bunch

together, and advance again. In this way, fights between large, evenly matched groups sometimes last for over an hour.

There is usually no conspicuous dominance hierarchy in the daily lives of a group, except among males when females are in oestrus. Levels of aggression are usually low because individuals forage independently on small, scattered invertebrate prey (Rood 1975). When aggression over a food item occurs, the finder or owner is usually the winner (De Luca & Ginsberg 2001). During oestrus, which starts around 10 days after parturition, males exhibit an obvious dominance hierarchy when competing for access to females. Females, by contrast, do not interfere with each other or directly compete for matings Despite this lack of overt aggression among females during mating, females often form an age-based hierarchy in which older females enter oestrus a few days before their younger group mates, and gestate larger litter sizes (Cant 2000).

Oestrus females are closely guarded for 2 to 3 days by dominant males. The staggered pattern in which females enter oestrus allows the same one or two dominant males to guard and mate with all the adult females in the group (Cant 2000). Dominant males follow oestrous females closely, and are aggressive to any males that attempt to mate. These dominant (or mate-guarding) males are generally bigger than the subordinate males, and obtain the great majority of observed matings, but females go to considerable lengths to escape their mate guard in order to mate with other males in the group. For example, if a mate-guarding male stops to eat a prey item such as a beetle, the guarded female will often run off to mate with a non-guarding male. The degree to which female mating behaviour promotes shared paternity among males is not yet known.

Both males and females actively seek copulations with individuals in neighbouring groups. The rate at which neighbouring groups encounter each other increases during oestrus, and both males and females have been seen to lead the group deep into a neighbouring group's home range in pursuit of copulations. Females may accept or pursue these matings with extra-group males as a way of avoiding inbreeding depression (Rood 1975; Cant et al. 2002*).* Inbreeding depression may be a particular problem for banded mongooses because both males and females often remain in their natal group beyond the age of reproductive maturity.

Banded mongooses are unusual amongst the social mongooses/social carnivores because most females in each group reproduce. Up to 10 females may give birth within a group. Female group-mates exhibit an exceptional degree of birth synchrony. In Uganda, multiple breeding females gave birth on exactly the same day in 40% of breeding attempts (Cant 2000, Gilchrist 2001). Where females gave birth on different days, there was rarely more than a few days between births. The failure rate of asynchronous litters was particularly high. There is apparently strong selective pressure for synchrony of parturition because females have been known to miscarry or abort in order to synchronize with other females giving birth (Gilchrist 2001). Birth synchrony may have evolved as a way of escaping the threat of infanticide by dominant breeders, since it is likely to reduce the ability of infanticidal males and females to discriminate between offspring (Cant 2000). Alternatively birth synchrony may help to swamp potential predators and minimise the total period that the communal litter must remain in the natal den.

Offspring are kept underground in the den for the first 3 to 4 weeks of life. Pups may be transferred between dens 2 or 3 times during this period. Each day one or more (average 2.0; Cant 2003) 'babysitters' remain behind at the den to guard the pups while the rest of the group goes off to forage. Babysitters guard pups against predators such as snakes and monitor lizards, and, importantly, against rival groups of banded mongooses, who sometimes attack a natal den and, if successful, kill the pups inside. Adult males babysit most and adult females least (Gilchrist 2001). Dominant males (with higher likelihood of paternity in the litter) babysit more than subordinate males, but reduce their contribution during oestrous periods, when they compete for paternity in the next litter (Cant 2003). Subadults generally do less babysitting than adults.

At around 4 weeks old pups start to accompany adults on short afternoon foraging trips, and by 5 weeks the pups leave the den in the morning with the rest of the group. Typically, each pup

closely follows an 'escort' (usually an adult), begging frequently. These associations between pups and adults are usually stable over time, with the same pup following the same adult each day, from emergence until independence (at around 90 days) (Gilchrist 2004). The pup is responsible for maintaining the association, by following and defending its escort against approaches from other pups (Gilchrist 2004). Adults actively care for pups by contacting, carrying, grooming, playing with, and provisioning pups. Adults provision pups by dropping, or leaving whole or partial prey items. Adults also defend pups against potential predators and pups often shelter under the belly of their escort when frightened or threatened. The closer a pup associates with an escort, the higher is the pup's likelihood of survival (Gilchrist 2004).

Dispersal occurs via two distinct modes (Cant et al. 2001). First, groups of males, females or both are sometimes driven out of their natal groups as the result of intense aggression from other group members. The primary agents of this aggression are dominant males and breeding females but subordinates of either sex may also contribute to driving individuals out of the group. Evictions occur in especially large groups and the timing (during oestrus or early gestation) suggests that reproductive competition may motivate eviction. When males and females are evicted simultaneously they subsequently split into two same-sex subgroups and disperse separately, presumably to avoid inbreeding. Evicted subgroups have been known to disperse over 25km from their natal group.

The second mode of dispersal occurs when groups of same-sex individuals leave their natal group voluntarily to join members of the opposite sex. Animals of intermediate age (between one and three years old) are most likely to disperse, whether this is forced or voluntary. In the Serengeti, dispersing males have been observed to invade an established group and drive out the resident males (Waser et al. 1995). In Uganda, two group takeovers by groups of females have been observed, both of which involved the eviction of the only female previously in the group. Immigration by single individuals is extremely rare. Dispersing animals attempting to establish a new home range are frequently involved in fights with resident groups. These fights can lead to severe injuries and an elevated mortality rate among adult males (Cant et al. 2001).

Reproduction and Population Structure

In Uganda, groups produced an average of four litters per year (Rood 1975, Cant 2000). In drier areas, breeding is less frequent, with groups producing one or two litters per year (Waser et al. 1995). Breeding is not tightly synchronized between groups (Rood 1975). However, breeding is to some extent timed to coincide with the wettest months: the probability that groups gave birth in a particular month increased with that month's rainfall (Cant 1998) and groups will stop breeding altogether during periods of drought. In southern Africa, young appear to be born during the warm, wet summer months from Oct to end Feb, as evidenced by Shortridge's (1934) record of a pregnant female taken in Nov in Namibia, and Rowe-Rowe (1978) finding litters of 2-8 young during the months of Oct, Dec and Feb.

Gestation period is around 9 weeks. Mean foetal litter size of pregnant females 3 to 4 weeks before parturition was 3.2 (range=1-6) (pooled data of Cant 2000, Gilchrist et al 2004) Younger, smaller females carried fewer, relatively smaller foetuses than their older group-mates. Abortion or miscarriage is generally rare, but more common in young females conceiving their first litter (Gilchrist et al 2004).

In the Serengeti, reproduction in females was first observed at two years of age (Waser et al. 1995). In Uganda, the average age of first conception was 321 days (Gilchrist et al 2004). An average of 81% of adult females conceived in each breeding attempt, with 92% of pregnant females carrying to term (pooled data of Cant 2000 and Gilchrist et al. 2004). There was no effect of age on the probability of breeding for adult females (Cant 2000, Gilchrist et al 2004).

In the Ugandan population, the birth weight of pups ranged from 20-50g. Eleven pups from one litter captured between 33 and 38 days old averaged 275g. At 65 days old the pups from this litter

weighed 423g. Ten weeks after emergence (100 days old) they averaged 541g (n=7). At one year, 16 individuals from three different litters weighed 1311g. Adult males (>1 year old) weighed an average of 1476g; adult females averaged 1389g (Cant 1998).

In the Serengeti, average annual survivorship was 0.67 (Waser et al. 1995). In Uganda, annual survivorship of adults averaged 0.78 to 0.86 (Cant 1998, Otali & Gilchrist 2004). In both populations, adult males and females survived at similar rates. There are no accurate data on longevity in the wild, but banded mongooses in captivity may reach 12 years (Van Rompaey 1978). Mortality of pups was high. Twenty-one per cent of litters failed to produce a single emergent pup, and only fifty-one per cent of emergent pups survived to three months old (Gilchrist 2001). Few pups were visibly ill prior to disappearance, and the main cause of pup mortality is apparently predation.

In Uganda, the sex ratio was male biased, from emergence of pups to adulthood (Cant 1998, Gilchrist 2001). The underlying cause of these biased sex ratios is unknown: there is no information on the sex ratio at birth, and there are no detectable differences in survival between males and females after they emerge from the den.

Predators, Parasites and Diseases
Rock python (*Python sebae*) and leopard (*Panthera pardus*) have been observed eating adults in the Ugandan population. Marabou stork (*Leptoptilus crumeniferus*) and monitor lizard (*Varanus niloticus*) have been observed to kill pups (Otali & Gilchrist 2004). Ticks and fleas are common on adults. Little known about diseases, but possible vector of rabies. Susceptible to human TB *Mycobacterium tuberculosis* (Alexander et al. 2002).

Conservation
IUCN Red list of Threatened Species

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Waser, P. et al. 1995

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Body Measurements
Mungos mungo
HB (male): 366 (300-400) mm, n = 85
HB (female): 361 (330-385) mm, n = 76
T (male): 220 (193-310) mm, n = 101
T (female): 219 (194-240) mm, n = 86
HF (male): 70 (53-75) mm, n = 101
HF (female): 69 (53-74) mm, n = 86
E (male): 27 (23-26) mm, n = 12
E (female): 25 (22-26) mm, n = 5

WT (male): 1.45 (0.89-1.88) Kg, n = 111
WT (female[1]): 1.37 (0.99-1.74) Kg, n = 48
[1]non-pregnant females only.

Measurements from Queen Elizabeth National Park, Uganda (J. S. Gilchrist, unpubl.), except ear measurements from former Transvaal, South Africa (Rautenbach 1982)

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