Helogale parvula DWARF MONGOOSE

Fr. Mangouste nain; Ger. Zwergichneumon

Helogale parvula (Sundevall, 1847). *Ofv. K. Svenska Vet.-Akad. Forhandl. Stockholm* 1847, 3 (4): 121 (1847). 'Caffraria superiore, juxta tropicum', restricted by Roberts (1951) to 'Zoutpansberg' [South Africa].

Dwarf Mongoose *Helogale parvula*.

Taxonomy   Polytypic. Coetzee (1977) presented a provisional breakdown of subspecies, grouping them into three sections; the subspecific taxonomy is confused and badly in need of revision, and Coetzee's (1977) framework is only tentatively followed here. It is likely that the current subspecific classification of *Helogale* is due to idiosyncrasies of collection sites and collected individuals. Synonyms: *atkinsoni*, *bradfieldi*, *brunetta*, *brunnula*, *ivori*, *macmillani*, *mimetra*, *nero*, *ochracea*, *ruficeps*, *rufula*, *undulata*, *varia*, *vetula*, *victorina*. Chromosome number: 2n = 36 (Fredga 1972).

Description   Smallest of the mongooses, with long, slender body and furry tail roughly equal to body in length. Head large with small ears that lie close to the head, and a pointed muzzle. The rhinarium, which encloses the nostrils, has a shallow depression on the front between the nostrils, and divides the hair on the upper lip. Smooth, short, finely grizzled pelage on forehead, back, upper limbs and tail, due to agouti banding of multiple shades on single hairs; grizzling less apparent on underparts. Most individuals reddish-brown overall, though shades of tan or darker brown are also common. Hair on upper parts more sparse than on underparts; body hairs longest toward the hindquarters, up to 15 mm in length (these hairs having broad dark tips), although tail hairs may be longer (to 18 mm). Underfur dense. Tail not tufted, but occasionally has slightly darker pelage at tip. No pronounced black tuft as in the Slender Mongoose *Herpestes sanguineus*, which is also substantially larger than *Helogale*. Plantigrade gait, with soles of feet touching the ground. Five digits on both fore- and hindfeet. The front feet are equipped with long curved claws, up to 10 mm across the curve, and well adapted for digging; those on the hindfeet are shorter (8 mm) (Skinner & Chimimba 2005). Both sexes have cheek and anal glands: the anus and openings of the anal glands are enclosed in a subcircular pouch, the lips of which close to a transverse line. Sexes are alike in size and general appearance, but ♂ ♂ are relatively easy to identify by the external genitalia; ♀ ♀ have two pairs of nipples. Young of the year can be distinguished by size because adult body mass is reached only in the second or third year (Creel & Creel 1991). For the first six months, juveniles can be distinguished by relatively large heads with blunt muzzles. For the first few weeks eyes are blue, but later change to brown.

The braincase is pear-shaped, narrowing in the front to the postorbital constriction; the postorbital bars are incomplete even in adults. The supraoccipital crest is well developed, while the sagittal crest is little more than a low ridge on the top of the braincase. The front chambers of the ear bullae are slightly larger than the hind. The rostrum is very short, relative to total skull length. The upper canines are long and sharp, reaching below the level of the base of the lower (Skinner & Chimimba 2005).

Geographic Variation   Coetzee (1977) recognized three sections:

parvula section (southern Africa)

H. p. mimetra: N Namibia, NW Botswana, S and W Angola, south of the Cuanza R.

H. p. nero: Namibia, from Erongo Mts to SE Kaokoveld.

H. p. parvula: South Africa, S Mozambique, Zimbabwe and NE Botswana.

H. p. ruficeps: Southern Province and Kafue area of Zambia; possibly into SE Angola.

undulata section (East and north-east Africa)

H. p. atkinsoni: N Somalia and adjoining Ethiopia.

H. p. ivori: coastal N Mozambique and Tanzania.

H. p. macmillani. Ethiopia.

H. p. rufula: C Kenya, ranging to Arusha in Tanzania (the form in the Serengeti).

H. p. undulata: Tete district and lower Zambezi Valley of Mozambique, adjoining parts of E Zambia, Malawi, inland N Mozambique, and southern highlands and C Tanzania.

H. p. vetula: coastal Kenya, Kenya east of the Tana R. and S Somalia.

varia section (central Africa)

H. p. ochracea: Uganda.

H. p. varia: NE Zambia, through Katanga to NE Angola.

H. p. victorina: NW Tanzania; possibly in adjacent Kenya and Uganda.

Similar Species

H. hirtula. Sympatric in the Horn of Africa region. Shaggier, paler, greyish pelage and noticeably darker feet; cheekteeth more heavily built, and not typically sectorial; the space between P4 and M1 much less than width of their protoconal lobes (Coetzee 1977).

Dologale dybowski. Central African Republic, NE DR Congo, S Sudan and W Uganda. A dark, brownish grizzled, dwarf mongoose with shaggier and thicker, less tapered tail.

Herpestes sanguineus. Larger, with pelage and body form very similar to the Dwarf Mongoose, but distinguished on the basis of size, long body and long tail with pronounced black tuft. Often sympatric in areas with Dwarf Mongooses, but is likely to be seen alone or in groups no larger than two or three.

Herpestes flavescens. Largely allopatric, although both are present in the Erongo Mts of Namibia where this species is also black and is often confused with the Dwarf Mongoose (G. Rathbun & M. Griffin pers. comm.). Larger, with relatively longer tail; solitary, diurnal and consumes more vertebrate prey.

Herpestes ochraceus. Sympatric in north-east Africa, but larger, and solitary or in pairs.

Distribution   Endemic to Africa, widely distributed in partially woody habitats of intermediate thickness from S Somalia and Ethiopia to NE KwaZulu–Natal in South Africa (around 28° S) and westwards to N Namibia and SW and C Angola and SE DR Congo. Mention of the species as being present in Gambia (e.g., Wozencraft 2005) is in error.

Habitat   Most common in open woodlands (e.g., *Acacia–Commiphora* woodland), thickets and wooded savannas, particularly where there are termitaria, rock outcroppings or crevices, or hollow logs for use as dens. Indeed, Waser *et al.* (1995) postulated that the most important determinant of Dwarf Mongoose habitat preference is the density of suitable dens. In many areas, large *Macrotermes* mounds are preferred den sites, and Dwarf Mongooses can be seen warming themselves atop these mounds upon emergence around sunrise, and just before re-entering the den at sunset. They avoid montane regions (usually found to altitudes of 2000 m) and thick forests. Dwarf Mongooses are supplanted by Banded Mongooses *Mungos mungo* in open short-grass
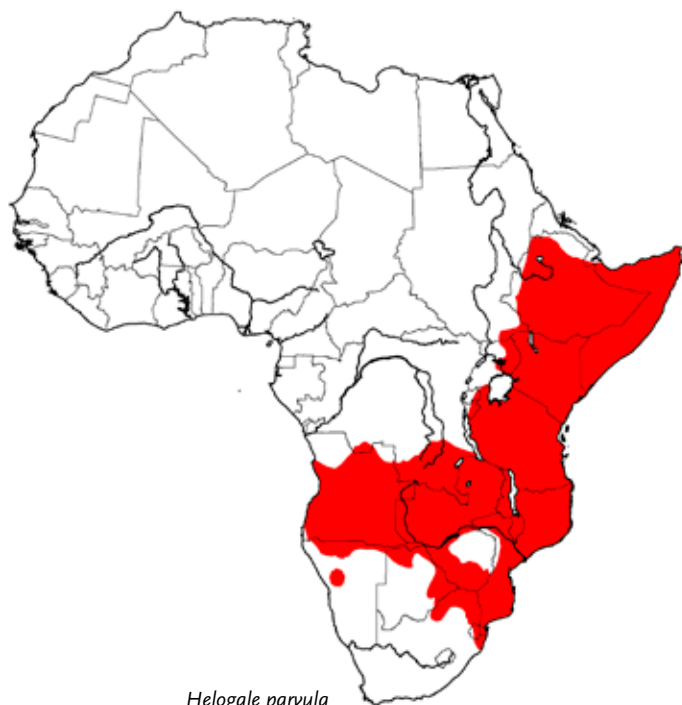
Helogale parvula

habitats (particularly where termitaries or other den sites are scarce), where they probably are more vulnerable to predation. Although they can persist on home-ranges without water during the dry season, and are found in semi-desert regions, Dwarf Mongooses are not found in highly arid areas.

Abundance   Dwarf Mongooses are often the most abundant small carnivores in areas of open woodland or wooded savanna, with densities as high as 8 ind/km² (though more typically around 5 ind/km²; Waser *et al.* 1995). Serengeti N. P. was estimated to hold 94,000 individuals, a number that is orders of magnitude higher than larger Serengeti carnivores (Waser *et al.* 1995).

Adaptations   In the skull, the zygomatic arches are relatively heavy to support well-developed masseter muscles used to crunch the exoskeletons of robust invertebrates such as millipedes. The coronoid of the lower jaw is high and wide to accommodate the temporalis muscles, which activate the lower jaw. The carnassials of Dwarf Mongooses are lightly built compared with their congener the Somali Dwarf Mongoose *H. hirtula*, and are not particularly adapted to slicing (consistent with their primarily insectivorous diet). The lower first molar has three high cusps on the front and a broad grinding surface on the back half of the tooth; the remaining molars also have high cusps, also suggesting adaptation to a generally insectivorous diet (Skinner & Chimimba 2005).

As the smallest of the mongoose family, and given their diurnal activity, Dwarf Mongooses often fall prey to raptors, snakes, small felids and other mongooses. Much of their behaviour and social organization has been shaped by the simultaneous pressures to forage for invertebrates in or on the soil while avoiding predation. Consequently, they live invariably in groups of 2–21 adults (mean of 9), with some individuals serving as guards while others forage (Rasa 1989, Rood 1990).

Dwarf Mongooses commonly are associated with active termite mounds, particularly those of *Macrotermes falciger*. These mounds have a characteristic cone structure, sometimes more than 2 m above ground; the termites cultivate fungus gardens within these mounds, and because the fungus requires a particular temperature to flourish, ventilation shafts are constructed. The latter are not directly occupied by the termites, but the mongooses use these ventilation shafts as night-time dens or daytime cover from predators (Rasa 1985). Dwarf Mongooses will also den in rock crevices and occasionally in hollow logs, but have a strong association with termite mounds, if available.

Like other mongooses, Dwarf Mongooses have adaptations of the neurotransmitter system that makes them relatively immune to bites from snakes with neurotoxic venom (see, for example, Barchan *et al.* 1992), such as spitting cobras, and they often mob and attack such snakes to drive them away. While not immune to their venom, Dwarf Mongooses also vigorously mob snakes with haemotoxic venom, such as Puff Adders *Bitis arietans*.

Decker *et al.* (1992) studied the secretions of the anal glands, and found that ♂♂ had vitamin E present in the anal sac, whereas this compound was absent in the ♀♀. This suggests a possible sex-specific function of vitamin E in the Dwarf Mongoose.

Foraging and Food   While they occasionally prey upon small vertebrates such as murids, snakes and lizards, Dwarf Mongooses are almost entirely insectivorous (Shortridge 1934, Skinner & Chimimba
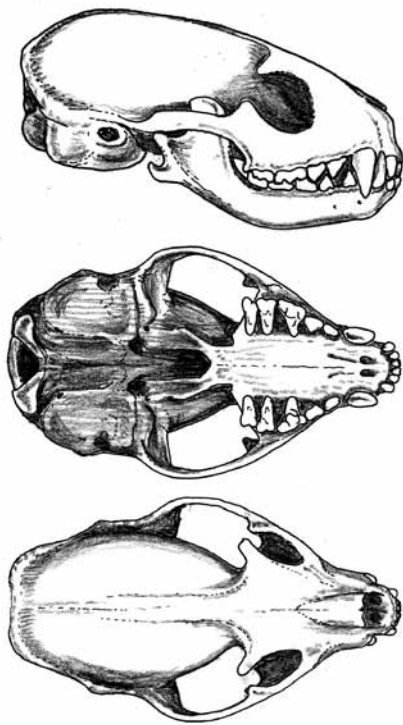
Lateral, palatal and dorsal views of skull of Dwarf Mongoose *Helogale parvula*.

2005). In a sample of 27 stomachs from southern Africa, Coleoptera, Orthoptera and Isoptera remains had the highest percentage occurrence. Prey identification in scats or stomach contents is hampered by the fact that Dwarf Mongooses masticate their food thoroughly.

Dwarf Mongooses forage for surface-active insects such as beetles, termites and grasshoppers, but very commonly dig up insects and larvae from the soil or litter, alternating bouts of digging, sniffing and listening intently. Packs spread out over an area of roughly 10–200 m² and forage independently within the area, moving slowly as a loose unit, with some individuals pausing to watch for predators. Flying insects are caught in the air with the forepaws, or, if on the ground, with a pounce with both forefeet pinning the insects to the ground. Large insects, such as locusts, are pinned down with a foot, bitten on the head and usually eaten headfirst. Some authors note that the lips are pulled back when Dwarf Mongooses eat stinging insects (Rasa 1973a), but they are often quite nonchalant about eating stinging prey such as scorpions, despite apparently being stung.

Murids, such as multimammate mice (*Mastomys* spp.), when these are taken, are pinned down with the forefeet and killed with a bite to the head. The head is eaten first and then the trunk, but only after skinning, by means of hooking the neck skin with the foreclaws and pulling it down, simultaneously pulling on the neck with the mouth. The entrails are extracted with the teeth. Small snakes are bitten a short distance behind the head then dropped, and repeatedly bitten, then shaken violently until they are quiescent, when they are pinned down with the forepaws and eaten head first. Whereas single animals will prey upon small snakes, larger snakes are usually attacked by the whole group (Rasa 1985). Larger prey, such as large snakes, may be shared by the group, but Dwarf Mongooses rarely share prey with other adults (Rasa 1985). They commonly share food with juveniles, allowing youngsters to learn the job of finding and obtaining prey in gradual steps.

Dwarf Mongooses have been observed standing up on their hind legs on a rock, beneath a Red Ivory tree *Berchemia zeyheri*, grasping the thin, terminal branches with their forepaws, and pulling these towards them in order to remove the berries with their mouths (Hiscocks & Perrin 1991b). Rasa (1985) also observed them eating eggs; those from small birds are bitten open at the end and the contents licked out, while larger eggs such as those from francolins (*Francolinus* spp.) are clasped in front of them on the ground and thrown backwards under the body and upwards so that the egg is propelled against a hard object to break it open. They then either lick up the contents or use their paws to scoop the contents and then lick these. Dwarf Mongooses do not use this method often, in comparison with Banded Mongooses, which sometimes smash invertebrates in the same manner.

Social and Reproductive Behaviour   Dwarf Mongooses are a highly social and cooperative species, found exclusively in groups, except for individuals in the process of dispersing. Packs comprise both related individuals and unrelated immigrants; in the Serengeti N. P., where the species has been the focus of a long-term study, packs average nine adults (range = 2–21), with slightly more adult ♀♀ than ♂♂, plus young of the year from one to four sequential litters (Waser *et al.* 1995). Packs are structured by a rigid dominance hierarchy, comprising a single dominant breeding pair with a life-long bond (usually the oldest individual of each sex), and with subordinates reproductively suppressed and helping to raise the young of the dominants (Rood 1978, 1980, 1983a, 1990, Creel *et al.* 1992, Creel & Waser 1994, Keane *et al.* 1994).

Dwarf Mongooses are, like other social mongooses such as the Banded Mongoose and Meerkat *Suricata suricatta*, remarkably cooperative, with pack members collectively defending a shared territory, and most members engaging in behaviour such as watching for predators while others forage, babysit, jointly mark the home-range and allogroom. Relations within packs are amicable and strong, as evidenced, for example, by reports of alpha males rescuing pack members from danger (Rood 1983a), and the provision of food and care for incapacitated animals (Rasa 1976b). More routinely, most adults of a pack groom, feed and carry the pack's young, and frequently engage in social grooming with other adults.

Groups are territorial, and will usually attack non-resident mongooses on their territory (though see Rasa 1985). Home-ranges in the Serengeti N. P. averaged 27.4 ± 3.3 ha (Rood 1978), and there is some fidelity to these: of seven packs that ranged over a 2.2 km² study area in the Serengeti N. P., two were still using the same core areas and dens after five years. Dwarf Mongooses jointly mark their territories, particularly objects near the termite mounds that they use as sleeping quarters. Scent-marking is achieved using both anal and cheek glands, which they rub on objects (and also on partners and offspring); marking with the everted anal gland is achieved in the typical anal drag fashion, or by means of a handstand. It is not unusual to see several pack members simultaneously leaping onto their forefeet and grabbing a branch with their hindfeet to deposit anal marks. Faeces and urine are deposited in communal latrines. There is little overlap between territories (Rasa 1987), although ranges of adjacent packs may overlap slightly. These may serve as sites of confrontation between neighbouring groups, sometimes leading to injuries. In the short term, larger packs usually displace smaller packs in these conflicts, but this does not necessarily cause long-term changes in territory boundaries.

The alpha female usually initiates pack movements each morning. If other pack members try to initiate movements, they are often ignored. Before moving out, guards, or babysitters, are posted to look after the pups that are too young to accompany the group on their foraging trips. Litters may occasionally be left unguarded for a few hours, but usually at least one pack member stands guard until the young are old enough to leave the den around 5–6 weeks; as many as three or more pack members may remain with the pups while the group forages (Rasa 1977a, 1986, Rood 1978). Babysitters remain at the den for several hours, foregoing foraging, until relieved by another set of babysitters (Rood 1978). The breeding ♀ is actually the least likely adult to be found guarding the young during a foraging bout.

Foraging groups remain in close vocal contact while foraging and moving, and also post guards, which watch for predators while others forage. Sentinels will move to a vantage point, such as a termite mound, from which to scan the area (Rasa 1986). If the sentinel sounds an alarm call, usually in response to a bird of prey, the group will freeze, or head straight for the nearest cover if the danger proves immediate (Rasa 1985). In the absence of any danger, the sentinel will return to foraging after a few minutes. Pack members share sentinel duty, with certain male members contributing more time than others. Different alarm calls are used for different predators: the notes are particularly distinct for terrestrial ('tchrr!') versus aerial ('tchee!') predators. Dwarf Mongooses respond to the alarm calls of other species such as hyraxes and hornbills (Rasa 1985), which also respond to mongoose alarm calls.

Dwarf Mongooses are commonly found sunning themselves in the early morning or afternoon near the entrances of the residence-mounds, during which they commonly indulge in allogrooming and autogrooming. Mongooses normally groom themselves and others by nibbling with their incisors. They appear to enjoy grooming in much the same way that some domestic cats enjoy being petted. Trapped mongooses are often relatively free of ectoparasites, suggesting that allogrooming may function in social behaviour in addition to its more typical function. Allogrooming pairs are usually of the same sex, and typically similar in social rank within the pack. Most adults also groom youngsters of both sexes.

As noted earlier, only the dominant pair generally breeds; mongooses that achieve alpha status usually have a tenure of several years. If one of the alpha pair dies, then the individual is replaced from within the pack by the oldest adult of the same sex. During the peak of oestrus, the alpha pair consorts all day, the dominant ♂ seldom being found more than a few centimetres from the ♀ (Rasa 1973b, 1987, Rood 1980), and the ♂ shows a marked increase in aggression towards other ♂♂ (Rood 1980, Rasa 1987). At this time, the pair may engage in as many as 50 mounts per hour (Creel *et al.* 1992, 1993), and may copulate as many as 2386 times, apparently ejaculating in 10% of these (Rasa 1985). Copulation takes a mean of 21 sec (n = 67; Rood 1990), the longest recorded being 11 min. The alpha female will occasionally mate with subordinate ♂♂, even during the peak of oestrus (Rood 1980, Creel *et al.* 1992); subordinate ♀♀ mate with ♂♂ of all ranks.

Despite mating, most female subordinates fail to establish pregnancy, their oestrogen levels returning to baseline. In ♀♀, reproductive suppression operates either by blocking ovulation (most probable), fertilization or implantation, though not by abortion of established pregnancies (Creel 1996). Adult subordinate ♀♀ quickly obtain full
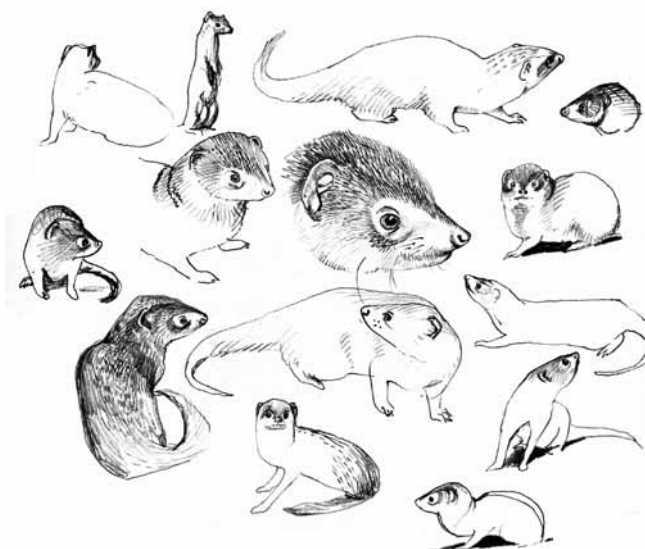
Dwarf Mongoose *Helogale parvula*.

reproductive activity after becoming dominant ♀♀, either by dispersing or by inheriting a pack following the death of the prior alpha female (Rood 1980). In ♂♂ reproduction is suppressed mainly by aggressive interference with the mating attempts of subordinates, and reproductive hormone levels in subordinates are not depressed, although their testes are significantly smaller. Subordinates are more likely to mate with other subordinates (Creel *et al.* 1992).

Although subordinate ♀♀ are reproductively suppressed, 12% (usually older subordinates) still become pregnant every year, accounting for about 27% of pregnancies (Creel & Waser 1991). Most of these pups are killed by the alpha female (Rasa 1973b, Rood 1983a); however, their offspring are sometimes raised if they avoid infanticide by the dominant ♀, and particularly if raised in joint litters. Genetic data reveal that 15% of all offspring are produced by subordinate ♀♀, and that subordinate ♂♂ sire approximately 25% of the pups (Keane *et al.* 1994). Occasionally, the pregnancies of subordinates are synchronized with those of the dominants, and then pups may be raised in a joint litter (Creel & Waser 1991, Keane *et al.* 1994). The mean size of joint litters (3.2 offspring at emergence) is significantly larger than that of alpha-male-only litters (2.4 offspring). In such cases, despite the presence of an additional lactating ♀, the dominant's production of mature offspring is reduced by 22% in joint litters; thus the dominant's young do not survive better as a result of communal nursing (Creel 1996). Another form of communal nursing occurs: for every four subordinates that lactate following pregnancy, one ♀ lactates without pregnancy (Rood 1980). This extreme form of alloparental care is known to occur in the wild only in female Dwarf Mongooses and male Dayak Fruit Bats *Dyacopterus spadiceus* (Francis *et al.* 1994).

Young usually are born in termitaria. Adults of both sexes contribute to raising offspring in many ways, by feeding, grooming, guarding and 'babysitting' them (Rasa 1973, 1977, 1989, Rood 1978, 1983a); subordinate pregnant ♀♀ will even suckle young of the alpha pair (Rood 1980, Creel *et al.* 1991). If the group moves to another mound, the subordinates carry the pups until they can walk themselves, from about 3.5 weeks of age. Cooperative breeding is, therefore, highly evolved in Dwarf Mongooses, to the point that unaided breeding pairs very rarely raise any offspring to independence (Creel 1990). The

energetic investment in reproduction is unusually high, both in terms of the number of offspring produced, and the growth rate of individual offspring. Without non-breeding helpers, these costs cannot be sustained. Of 237 breeding attempts in a Serengeti population, only 12 (5%) were made by unaided pairs, and only one (<0.5%) of these pairs raised any offspring to independence (Creel & Creel 1991). On this basis, it is fair to call the species an obligately cooperative breeder.

Both sexes disperse, usually as young adults and often as a group of littermates of the same sex, or a same-sexed group of similar ages. Males are more likely than ♀♀ to disperse (and to disperse farther), and the risks associated with dispersal account for the better survival of ♀♀, which yields a female-biased sex ratio among adults, even though slightly more ♂♂ are born (see Reproduction and Population Structure) (Waser, Creel et al. 1994). Dispersal is important because immigrants are more likely to become dominants and reproduce earlier than are individuals who remain within their natal packs. For example, out of a sample of 31 individually known mongooses that achieved alpha status, 25 (13 ♀♀ and 12 ♂♂) were immigrants, compared with six that did not disperse and remained within their natal packs; similarly, seven ♀♀ that emigrated to other packs and attained alpha status bred at two years of age, compared with three ♀♀ that failed to disperse and only bred at four years of age (Creel & Waser 1994, Waser, Creel et al. 1994).

Young of the year are initially fed by adult packmates (not only the parents), and learn to forage by following an adult and observing, at first being fed directly, but later being allowed to do the final digging or capture. Food availability varies seasonally and drives seasonal patterns of reproduction, with breeding during the wet season, when invertebrate availability is higher.

As mentioned elsewhere, Dwarf Mongooses use different alarm calls in response to different predators, probably because the best response differs for attacks by raptors and terrestrial predators. While moving and foraging, each mongoose frequently makes a quiet call ('boop') that allows the group to stay in contact even if they cannot see one another. When playing, young mongooses make a wide range of twittering, bird-like noises.

Dwarf Mongooses associate with many other species to reduce predation risk, and respond to the alarm calls of species such as hyraxes and hornbills. Although they are frequently present in the same area, they do not share burrows with Banded Mongooses in the same manner as Yellow Mongooses Cynictis penicillata and Meerkats. Dwarf Mongooses are sometimes found in association with insectivorous birds such as Drongos (Dicrurus spp.) and Lilac-breasted Rollers Coracias caudatus, but the strongest associations are between mongooses and two bush hornbills (Tockus spp.), with the birds awaiting the emergence of the mongooses in the morning before foraging together (and sometimes, if the mongooses are later than usual, the hornbills call down their holes to wake them up!). Hornbills benefit by catching flying insects disturbed by the mongooses, while the mongooses benefit from alarm calls given by the hornbills from their higher vantage point (Rasa 1983, 1985). Rasa (1985) also mentions their association with rough-scaled plated lizards inhabiting the termite mounds and which feed on faecal pellets of the mongooses.

Reproduction and Population Structure   In the Serengeti N. P. litters are born almost exclusively between the months of Nov and May, with occasional litters in Oct and Jun (Rood 1980); this annual peak is timed so that most litters are born during periods of substantial rainfall and with at least one month of good rainfall to come, and such that lactation coincides with months of highest insect abundance (Waser et al. 1995). In southern Africa, all evidence points to their breeding during the summer wet season when insects are plentiful (Skinner & Chimimba 2005).

Oestrus lasts 1–7 days, and ♀♀ come into oestrus in tight synchrony, with subordinates entering oestrus a day later than the alpha female, suggesting that subordinates begin follicular activity in response to diestrus in the dominant ♀ (Rood 1980, Creel et al. 1992, 1993). Gestation lasts 49–53 days (Rasa 1973b, 1987, Rood 1980), with a mean litter-size of 3.3 offspring at emergence from the den (approximately 2–3 weeks after birth) (Creel et al. 1992); in captivity, up to seven young may be born. Rood (1990) found that large groups had significantly larger litter-sizes than small groups. Neonates weigh 21.3 g on average, so that an average litter weighs 20% of the mother's mass (Creel & Creel 1991). Alpha females may conceive during the postpartum oestrus, and, typically, 2–4 litters (mean = 2.4) are produced during a period of 5–6 months in the wet season, which translates into a female producing pups equivalent to roughly 10% of her own mass each month, for several months in a row (Rood 1980, Creel & Creel 1991, Creel & Waser 1994). Lactation lasts 56 days on average, with pups growing 2.6 g/day (growth being positively affected by the number of adult and yearling helpers in the pack, and by rainfall; Creel & Creel 1991), while the female is often pregnant with her next litter. As noted above, this heavy energetic investment in reproduction cannot be sustained without dominant ♀♀ spending significantly more time foraging than other pack members during the breeding season and without assistance from non-breeding helpers, who assist by feeding pups and guarding them while the breeding ♀♀ forages (Creel 1990, Creel & Creel 1991, Creel et al. 1991, Creel, Monfort et al. 1995).

In Serengeti N. P, the sex ratio at birth was slightly biased (52.5%) in favour of ♂♂ in a sample of 846 pups. By the age of two years, the sex ratio is female-biased, due to higher mortality in ♂♂, who are more likely to disperse and suffer increased mortality when not associated with a pack (Creel & Waser 1994, Waser, Creel et al. 1994). Mean annual survival in the Serengeti N. P. was 0.68 for 182 ♂♂ and 0.74 for 165 ♀♀ beyond the age of one (Waser et al. 1995). For juveniles, annual survival from emergence to their first birthday was 0.41 and did not differ by sex. Dwarf Mongooses are sexually mature as yearlings, but very few young adults reproduce, owing to social suppression of reproduction; only 1% of yearling ♂♂ attained dominant breeding positions compared with more than 70% for six-year-olds (Creel et al. 1992). Maximum longevity observed in the wild is ten years for ♂♂, 14 for ♀♀ (Waser et al. 1995); a captive specimen lived for 18 years (Weigl 2005).

Predators, Parasites and Diseases   Major predators include raptors, particularly Pale Chanting-goshawks Melierax canorus, Martial Eagles Polemaetus bellicosus, Tawny Eagles Aquila rapax and Bateleurs Terathopius ecaudatus; monitor lizards; snakes, particularly Puff Adders Bitis arietans and spitting cobras (Naja spp.); and other small carnivores such as White-tailed Mongooses Ichneumia albicauda, Egyptian Mongooses Herpestes ichneumon, Banded Mongooses (particularly on young), Servals Leptailurus serval, Black-backed Jackals Canis mesomelas and Ratels Mellivora capensis (Rasa 1983, Rood 1990).

As described above, the selection pressure of predation has been an important force in the evolution of sociality in mongooses. Dwarf Mongooses are small, diurnal, forage in the soil for invertebrates and occupy relatively open habitats. These factors combine to leave a solitary animal very vulnerable to predation when foraging, and sociality allows for a system in which a sentinel keeps watch while others feed, and then feeds in its turn. Other social mongoose species, like the Banded Mongoose, tend to be small, diurnal, prey on invertebrates and occupy open habitats with substantial predation risk (Rood 1986). Solitary mongooses tend to be larger, more nocturnal, occupy thicker habitats and prey on vertebrates.

Very little is known about the role of diseases in mongoose population dynamics, or about the diseases that they may vector or harbour as a reservoir species. It is possible that their dynamics are affected by some of the viral pathogens known to affect other carnivores, such as canine distemper, rabies and parvovirus. There is also little information available on parasites, but leishmanial parasites have been isolated from this species (Mutinga *et al.* 1982) and Levine *et al.* (1975) recorded at least two species of coccidian parasites, *Isospora garnhami* and *I. hoarei*.

Conservation   IUCN Category: Least Concern. CITES: Not listed.

Dwarf Mongooses have a wide distribution, attain high densities and have small territories such that even small protected areas can harbour large populations. They are often the most common carnivore in the habitats they occupy, and because of their abundance and wide distribution, may have greater than appreciated effects on ecosystems, despite their diminutive size.

Measurements

Helogale parvula
TL (♂♂): 375 (340–410) mm, n = 34
TL (♀♀): 387 (340–410) mm, n = 19
T (♂♂): 166 (152–183) mm, n = 24
T (♀♀): 165 (142–188) mm, n = 19
HF c.u. (♂♂): 46 (41–51) mm, n = 23
HF c.u. (♀♀): 46 (41–49) mm, n = 19
E (♂♂): 17 (15–21) mm, n = 21
E (♀♀): 18 (14–21) mm, n = 19
WT (♂♂): 269 (223–341) g, n = 13
WT (♀♀): 265 (213–341) g, n = 11
GLS: 46.0–50.0 mm, n = 35
GWS: 27.0–30.0 mm, n = 35
Botswana (Smithers 1983)
Skull measurements: Southern Africa (Roberts 1951)

Key References   Creel 1990, 1996; Creel *et al.* 1991, 1992, 1993, 1995; Creel & Waser 1991, 1994; Rasa 1973a,b, 1976a,b, 1977a,b, 1985, 1987, 1989; Rood 1978, 1980, 1983a, 1986, 1990; Waser, Creel *et al.* 1994, 1995.

Scott Creel

GENUS *Crossarchus*

Cusimanses

Crossarchus F. Cuvier, 1825. *In* E. Geoffroy Saint-Hilaire & F. Cuvier, *Hist. Nat. Mammifères* 3 (47): 1–3.

The genus contains four species: Alexander's Cusimanse *Crossarchus alexandri*, Ansorge's Cusimanse *C. ansorgei*, Common Cusimanse *C. obscurus* and Cameroon Cusimanse *C. platycephalus*. *Crossarchus platycephalus* has been considered a subspecies of *C. obscurus* (Wozencraft 1989a, 1993), but Goldman (1984) and Colyn & Van Rompaey (1994b) considered them distinct species (and see Wozencraft 2005).

The genus is restricted to areas of lowland forest between SW Guinea and E DR Congo and W Uganda with isolated populations on Mt Elgon, E Uganda and NE Angola. Common Cusimanse inhabits the West faunal region and Cameroon Cusimanse the West Central region; these two allopatric species are separated by the Volta R. (western Dahomey Gap). Further east, Ansorge's Cusimanse and Alexander's Cusimanse mainly inhabit the lowland forests of the Congo basin.

Members of the genus are small, darkish-brown with a coarse, shaggy pelage ticked with yellowish-white to reddish-brown; hairs on head and face lighter than on body. Ears short and round. All members have a long snout (less pronounced in Ansorge's Cusimanse). No longitudinal grove on upper lip. Head and distal parts of fore- and hindlimb shorter-haired than body and tail; brownish underfur long but shorter than guard hairs. Tail shorter than head and body length and tapers from base to tip. Legs short; five-toed feet, slightly webbed, long claws. Plantigrade gait. Area between digital pads and plantar pads naked in fore- and hindfeet; posterior 30% of hindfoot naked. Paired anal scent glands. The genus name, *Crossarchus*, comes from the Greek *crossotos* fringed, and *archos* anus, and refers to the wrinkled folds of the circumanal glandular sac. Ectotympanic portion of bulla larger than entotympanic. Dental formula is I $^3/_3$, C $^1/_1$, P $^3/_3$, M $^2/_2$ = 36. Upper and lower first premolars are absent.

Crossarchus was considered synonymous with *Mungos* by Hill & Carter (1941) and a subgenus of *Mungos* by Ellerman *et al.* (1953).
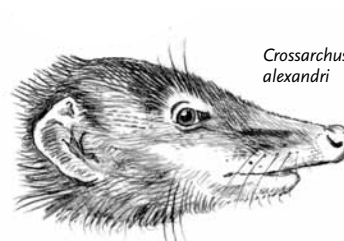
Harry Van Rompaey & Marc Colyn

Crossarchus ansorgei
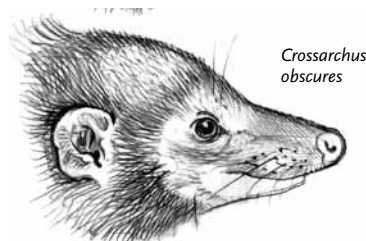
Crossarchus obscures

Crossarchus alexandri

Three *Crossarchus* spp.