Terrestrial Mammal Feces: a Morphometric Summary and Description

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The study of feces of terrestrial mammals brings out biological and ecological data such as the species presence, diet, behaviour, territory, parasitic fauna, and home-range use, which can be applied for conservation projects and support paleoecological research that use coprolites as the main source of study. Although the new biotechnological techniques allow more accurate data, the diagnosis based on morphometric analyses permits the primary identification of the taxonomic group origin to support the best choice of subsequent analyses. We present the compilation list of fecal shape and measurements available in the literature published in North America, Eastern and Southern Africa, Europe, and new data from Brazil. Shape and diameters are the best characteristics for taxonomic identification. Feces were assembled in 9 groups that reflect the Order, sometimes the Family, and even their common origin.

Key words: feces - coprolites - terrestrial mammals - fauna

Tracking is probably the oldest science (Liebenberg 1990). By looking for signs left by animals we learn to observe useful details to hunt them or to avoid them. Tracking reveals the age of marks left by animals and the natural behaviour of animals without the influence of the observer (Wemmer et al. 1996). As a non-invasive method, it constitutes an important tool for studying threatened species or animals difficult to observe and trap. It can be applied as well for studying rare and nocturnal animals. Although it requires observers who are well trained with sharp sensitivity, its low cost and accessible technology turn tracking into a good choice for field studies.

Besides the observer abilities, some other factors influence the find of marks and signs left by animals. Soil characteristics, vegetation, and local climate determine sign and mark conditions. Sandy and loamy soils preserve better footprints than soft soils with thick organic material of superposed layers**,** and stony areas. However, stony areas, dry ecosystems, and frozen ecosystems provide the best preservation for feces (Bang & Dahlström 1975). On the other hand, it is not easy to identify signs in areas where animals have high demographic densities.

Feces are the most evident and most easily recognizable sign (Liebenberg 2000). However, the rarity of some species difficult the observation, as well as others factors like, the presence of buried feces or the behaviour of defecating inside the water or on the branches of the trees. For identification, the original fecal shape must be maintained. Several factors can corrode the original fecal shape through time. These factors include heat, desiccation, or fast decomposition in humid and rainy regions. Fragmentation by other animals such as dung beetles and termites, which frequently consume herbivorous feces, is also another factor that prevents fecal preservation (Stuart & Stuart 1998). Feces can also be consumed by carnivores. For example spotted hyenas eat lion dung and fresh wild dog dung (Stuart & Stuart 1998).

Droppings consist of partly digested material and undigested parts of animals and plants. Fecal components may include feathers, bones, teeth, claws, scales, arthropod chitin, seeds and plant tissues, pollen grains, as well as mucus, cells, and a significant amount of living and dead bacteria (Bang & Dahlström 1975, Bjune 2000).

Mammal feces have a social communication role (Gorman & Trowbridge 1989). When randomly deposited they show the individual or group home-range, as among American marsupials, lagomorphs, some ungulates, some rodents, and primates. They are used as territorial marks when deposited in small volumes in prominent places such as trail junctions, rocks, trunks, or termite nests. Feces are used as strategic sensorial marks by all Carnivora family species except Hyaenidae (Gorman & Trowbridge 1989, Estes 1991, Romo 1995, Aragona & Setz 2001). Some mammals defecate in discreet individual latrines as do hyaenas (Gorman & Trowbridge 1989) and collared anteaters (*Tamandua tetradactyla*, Myrmecophagidae : Edentata) in the Brazilian Northeast (Chame 1988). Collective latrines are used by some ungulates, such as antelopes (Walker 1996), *Hyrax* spp (Kingdon 2001), and some procyonids (Page et al. 2001). Collective latrines can also be used for generations as in the case of *Kerodon rupestris* (Caviidae: Rodentia), an endemic species of the Brazilian semiarid region. Feces from this animal are found in rock-shelters and in the archaeological sites of the Serra da Capivara National Park (Ferreira et al. 1991, Araújo et al. 1993).

In the carnivores, the secretion produced by the anal gland adheres to the feces during defecation. The secretion of each species has a characteristic and complex odour and it supplies intra and interspecific information of an individual's territory, sex, reproductive state**,** and movements (Gorman & Trowbridge 1989). The size and the amount of feces produced by each individual varies with age, the

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type of ingested food, and its absorption capacity (Bang & Dahlström 1975). Size variation is more frequent among herbivores because of the alteration in the quality and amount of food ingested in different seasons. Size varies less among carnivores (Stuart & Stuart, 1998). Food characteristics also affect fecal consistency. Fibrous plants may be the only food found during dry periods or in arid environments, so animals produce hard and more compact feces. During rainy periods or in tropical rainforest ecosystems, the larger consumption of green leaves, sprouts, and fruits produce soft, large, and aggregated feces.

Scatology is the science that studies feces (Seton, 1925) and since 1970s the number of studies in this area is increasing (Putman 1984, Halfpenny & Biesiot 1986, Kohn 1997). Several types of information can be obtained from feces and their contents, including the identification of the animal (Seton 1925, Camardella et al. 2000), their activity centers (Walker 1996), diet composition (Johnson & Hansen 1978, Johnson & Aldred 1982, Emmons 1987, 1997, Inagaki & Tsukahara 1993, Chinchilla 1997, Santos & Hartz 1999, Kauhala & Auniola 2001), seasonal diet changes (Corn & Warren 1985, Aragona & Setz 2001), inventory of prey species (Floyd et al. 1978, Emmons, 1987, Camardella et al. 2000), the role of seed dispersion (Fragoso & Huffman 2000, Williams et al. 2000), health condition, and potential enteroparasitosis dynamics (Patton et al. 1986, Page et al. 2001). Researchers have been using feces counting methods for population estimation (Neff 1968). However, the effectiveness of this methodology is still controversial due to seasonal variation, the difficulty in estimating a daily defecation output, and predicting the time of fecal decomposition (Lancia et al. 1996, Patterson 1998).

Scatology developed from basic morphometric description to more sophisticated chemical analyses (Nagy & Gilbert 1968, Johnson & Carey 1979, Weaver & Fritts 1979, Weaver & Hoffman 1979, Major et al. 1980, Danner & Dodd 1982, Rollings et al. 1984, Fernández et al. 1997). Recently, the application of molecular biology techniques to the study of feces allowed new approaches for the management of threatened species (Reed et al. 1997). Through DNA recovered and identified from feces, it is possible to distinguish similar feces of sympatric carnivores (Farrel et al. 2000), population variation and biogeography of isolated ape groups in fragmented forests (Jensen-Seaman & Kidd 2001), and the variation in food behavior among individuals of the same species (Fedriani & Kohn 2001).

Despite biotechnological progress, the basic initial diagnosis provided by morphometry and the assemblage of signs observed in the field determine the starting point for subsequent studies, and the choice of more sophisticated techniques. For paleoparasitological studies it is important to identify the zoological origin of coprolites. So, the study of fecal morphology is important for modern wildlife study and paleoecological coprolite study.

Presented here is a comprehensive summary of fecal morphometric data from bibliographical sources for conspicuous species of terrestrial mammals. These data are from North America, Central America and South America, Europe, and Southern Africa, and Eastern Africa. It also includes the results of my studies in Brazilian arid Northeast.

MORPHOMETRIC CHARACTERISTICS OF TERRESTRIAL MAMMAL FECES

Data presented here were obtained from scientific journals and also from field guides published by non-academic editors (Burt & Grossenheider 1973, Murie 1974, Bang & Dahlström 1975, Russo & Olhausen 1987, Estes 1991, Walker 1996, Stuart & Stuart 1996, 998, Lienbeberg 2000, Kingdon 2001).

The compiled data, presented in Tables I-IV and in the Figure allows the morphometric analysis and the identification of 9 similar fecal groups. Our groups are in accordance with Seton (1925) who emphasized that the form and the contents of feces are excellent guides for the diagnosis of each mammalian Order. They reflect their peculiar anatomy. Feces have a low value to the diagnosis at the Family level, and none at generic level. Seton (1925) presents the curious and seemingly contradictory statement that fecal shape is a valuable and auxiliary consideration in specific diagnosis, and that size and food contents can sometimes separate close related species (Chame 1991).

GROUP I


Cylindrical feces (sausage-shaped), with sub-divisions, tapered at one of the extremities. Characteristic of the Carnivora Order.

The Felidae family feces can be identified by their compact form with well defined segments and one of the extremities especially tapered (Table I, II, III and Figure). Other families and subfamilies can be distinguished by the difference of diet remains, such as in pinnipeds and aquatic mustelids (Lutrinae), whose feces are only composed of fish, crustacean, and mollusc remains. Felid feces reflect strictly carnivorous diet. However, grass leaves ingested to aid hair elimination are also found. Fruit, seed, insect, crustacean, plant tissues, and shell fragments are commonly found in omnivorous canids, mustelids, viverids, and procyonids feces.

In North America, felid feces with diameters larger than 2.5 cm can be identified to jaguar (*Panthera onca*) and puma (*Puma concolor*). Feces with smaller diameters are assigned to other felid species (Johnson et al. 1984). In Brazilian Northeast a diameter larger than 2.1 cm is enough to separate the great felids (*P. onca* and *P. concolor*) from the small felids (*Leopardus tigrinus*, *Leopardus wiedii*, *Leopardus pardalis*, and *Herpailurus yaguaroundi*) ($P < 0.0001$, Chame 1988). Morphometric patterns can not distinguish puma from jaguar feces, and both species are sympatric (Emmons 1997).

In Costa Rica, Chinchilla (1997) showed that ocelot feces (*Leopardus pardalis*) have a significantly smaller diameter ($\chi = 2.26 \pm 2.46$ cm, $n = 15$) than jaguar ($\chi = 3.15 \pm 1.82$ cm, $n = 16$) and puma ($\chi = 2.92 \pm 1.09$ cm, $n = 9$) ($P < 0.05$). As in the other regions of the Americas, the measurements do not distinguish the great feline feces. In similar studies in Peru, Romo (1995) found that the puma fecal diameter exceeded 2.5 cm, whereas Andean Fox (*Pseudalopex culpaeus*) varied from 1.7 to 2.2 cm, and mountain cat feces (*Leopardus colocolo*) varied from 1.3 to 1.6cm.

Studies of sympatric North American canids show that feces with diameters larger than 3 cm can be identified as of wolf (*Canis lupus*), and smaller, similarly shaped feces were from coyote (*Canis latrans*). Only 4.9% of coyote feces are misdiagnosed as wolf feces (Waever & Fritts 1979). However, with chemical and molecular analysis it is possible to identify coyote, fox and bobcat feces (Stokes & Stokes 1986). In Europe, the Gray Wolf feces (*Canis lupus*) vary from 10-15 x 2.5-3 cm and the Red Fox feces (*Vulpes vulpes*) from 8-10 x 2 cm (Table III). Thus, feces from these animals can be identified by morphometry (Bang & Dahlström 1975).

In Brazil the maned-wolf (*Chrysocyon brachyurus*) is the larger canid species. Its feces have diameters larger than 2.5 cm, and also an characteristic odour and texture. Furthermore, its feces contain fruit remains which are distinctive to this animal (Motta-Júnior et al. 1999, Aragona & Setz 2001). In central Brazil (Serra da Canastra National Park) we found a sample of maned-wolf feces with a diameter of 4.5 cm, considerably larger than cougar and jaguar feces. Other Brazilian canids are smaller, so it is easy to identify maned-wolf feces (Dalponte 1997) (Table IV).

In Africa the great diversity of medium and large carnivores do not allow a feces morphometric diagnosis criteria (Table I).

Feces of large carnivores can sometimes be totally white as happens with jaguar and puma in America, lion (*Panthera leo*) and hyenas in Africa, and wolf (*Canis lupus*) in Europe and North America. White feces are a result of high calcium content as a consequence of bone ingestion (Bang & Dahlström 1975, Chame 1991). They can be also be completely black as lion feces, due to the great amount of blood ingested (Lienbenberg 2000).

GROUP II

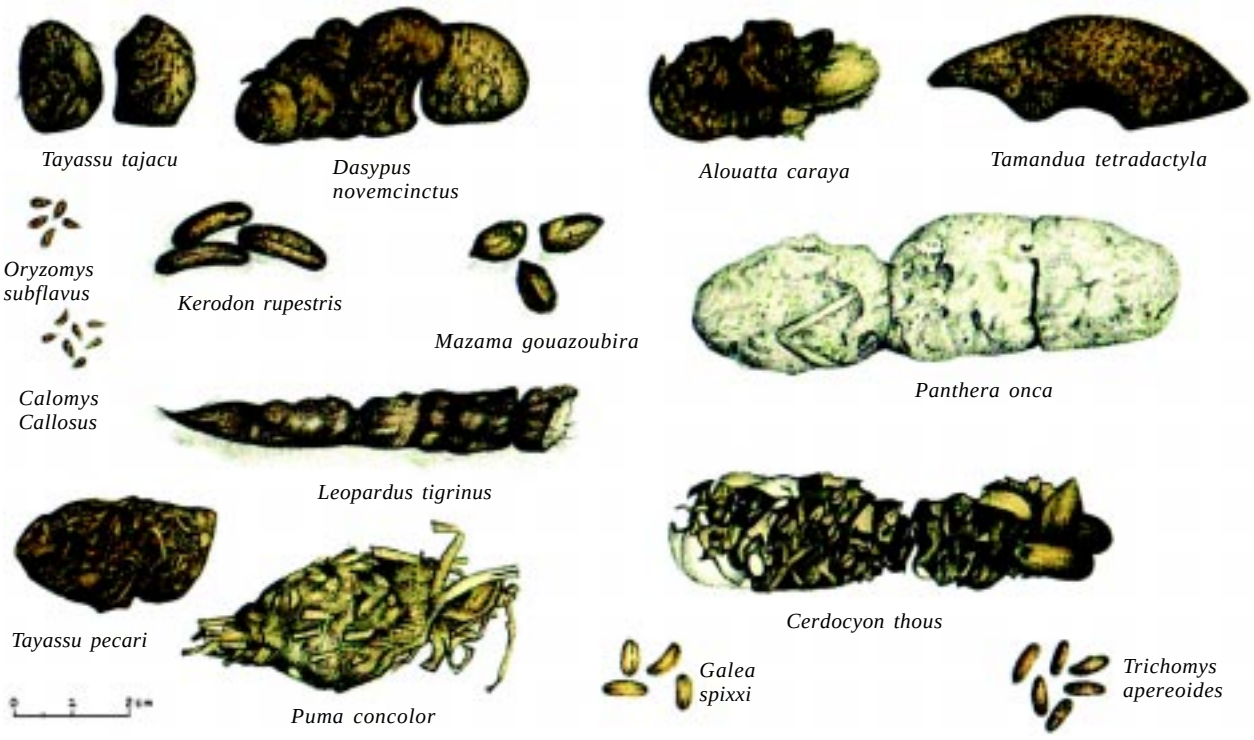
Well rounded little and single pellets deposited in small patches or in large accumulations. This kind of feces includes the order Lagomorpha (hares and rabbits) and some ungulates, as the hyrax (Procavidae: Hyracoidea), and antbear (aardvark) (Orycteropodidae: Tubilidentata) (Table I, II, III). Antbear is the closer proto-ungulate to modern species of hoofed ungulates, and has a common origin with tapirs, rhinos, hyraxes, elephants, and artiodactyles (Kingdon 2001).

In this group, shape and diet do not allow to identify the origin of the feces, except for *Orycteropus afer* (Aardvark) (Table I), a termite, ant, and larva consumer.

GROUP III

Single and cylindrical pellets. They present two round extremities, or with one extremity slightly tapered. This group includes all the rodents. These feces vary from very small, such as in Muridae and Sciuridae rats, to medium, such as in porcupine (Hystricidae in Africa and Erithizonthidae in America), gophers (Geomyidae) paca (Agoutidae), agouti (Dasyproctidae), and Castoridae (in Europe and North America).

In Northeastern Brazil, feces of *Trichomys apereoides* (Echymyidae), *Oryzomys subflavus* (Muridae: Sigmodontinae), *Calomys callosus* (Cricetidae), *Galea spixi*, and *Kerodon rupestris* (Caviidae) ($P < 0.0001$) (Table IV) can be distinguished by diameter measurements (Chame 1988).



Feces' shape from Northeastern Brazilian Mammals

GROUP IV


This group is related to Group III. Single pellets are cylindrical, inflected, and with the extremities usually round. However, what differentiates them from the others is a characteristic furrow along the length (coffee bean shape). This group includes the African rodents (great canerats) of the family Thrynomyidae (*Thryonomys gregorianus* and *T. swinderianus*) (Table I). This African rodent family is represented by fossils 20 million years old in North Africa. The family shows many similarities with certain current rodents of South America, especially *Carterodon* (Kingdon 2001). In Northeastern Brazil we found *Kerodon rupestris* and *Galea spixii* (Caviidae) feces that are also included in this group (Table IV, Figure). Both families belong to the guinea pig-type rodents (Caviomorpha), and have a common origin.

The feces of *K. rupestris* and *G. spixii* can be diagnosed accurately. *K. rupestris* feces present prominent furrow in the concave face and a diameter larger than 0.8 cm. In *G. spixii* feces the furrow is in the convex part and the diameter is smaller than 0.8 cm (Table IV, Figure).

GROUP V


Cylindrical or rounded pellets usually pointed at one end and concave in the other extremity (Table I, II, III, Figure). This group includes all of Artiodactyles (Super Order Ungulata), except those of Bovini tribe (Bovinae) that includes the bisons, the buffalos and domestic cattle. They are well adapted to semi-arid environments (Kingdom 2001). The droppings of single pellets can be deposited in latrines, as for the rhinoceros (Walker 1996), and depending on fresh food available they can be condensed to form large soft and green patties.

The feces of two deer species from Brazilian semi-arid region (*Mazama gouazoubira* and *Mazama americana*) cannot be differentiated by the shape and size (Table I, II, IV), as observed also in similar species in Africa, North America and Europe.

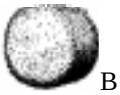
GROUP VI


Flattened feces that accumulate in circular piles. The shape of this group is very familiar to people because it includes feces of domestic cattle, buffalo, and bison (Bovini: Bovinae). During dry seasons, and in dry environments, these feces are brittle and the number of piles are few. During humid periods, they are amorphous (Stuart & Stuart 1996).

GROUP VII

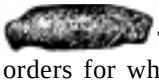

Single riniform (kidney-shaped) feces. This group just includes feces of the family Equinidae (Perissodactyla: Ungulata) and warthog (*Phacochoerus africanus*) (Suidae). They occur united, or in cake-like deposits in humid areas or during summer in temperate countries.

GROUP VIII


Big and cylindrical feces like bars that characterise large ungulates such as the elephants, hippopotamus, and rhinoceros. The two African species of rhinoceros use collective latrines which can be shared when they are in the same territory (Stuart & Stuart 1998). Dung of the white rhinoceros (*Ceratotherium simum*) contains only grass, while black rhinoceros (*Dicerus bicornis*) is easily identified by its fibrous and woody contents (Walker 1996, Liebenberg 2000).

This group also includes South American anteaters (Myrmecophagidae: Xenarthra). Collared anteater feces (*Tamandua tetradactyla*) are cylindrical and continuous. They measure 1.8-8.1 x 1.1-2.8 cm and easily break when they fall on the ground. They are deposited close to shelters, in easily recognisable individual latrines. The surface is flat and ant and termite remains can be observed with naked eye. Although there are no morphometric studies of feces of other species of this family, it is possible that their size could be used to distinguish them. Giant anteater (*Myrmecophaga tridactyla*) is the larger species weighing from 22 to 39 kg. The silky or pygmy anteater (*Cyclopes didactylus*) just weighs between 155 to 275 g. Two other species have the same size but do not share the same geographical distribution (Emmons 1997). These species are *T. tetradactyla* (that weighs from 3.6 to 8.4 kg) and the Northern tamandua (*Tamandua mexicana*).

GROUP IX


This group includes species, families, and orders for which feces are of mixed shape and size. Opossuns (Didelphidae: Marsupialia), primates, armadillos (Dasypodidae: Xenarthra) and insectivores (Insectivora) are included in this group. Feces are amorphously cylindrical or rounded, but without any common or possible specific characteristic to be attributed to any group. However, they can be identified when associated to other evidence such as footprints, other marks, or when there is a complete knowledge of the local fauna of the region.

Usually, primate feces can be identified if the feeding sites are known such as with capuchin monkey studies (*Cebus apella*, Cebidae) in southern Brazil (Pizo & Oliveira 1999), and black-howler-monkeys (*Alouatta caraya*, Atelidae) in the Brazilian Northeast (Chame & Olmos 1997).

FINAL CONSIDERATIONS

Nine groups can be characterised by fecal morphometry, and the patterns of shape and size of the terrestrial mammal feces are sufficiently consistent to group them (Bang & Dahlström 1975). Although the size of the feces varies with individual animal age, as well as food habits, a size limit can be standardised and attributed to them. Particularly, in my studies conducted in the Northeast of Brazil, the shape and diameter of the feces are a better specific indicators than length. Shape can be identified as the first indicator for the diagnosis of the fecal origin, cor-

roborating the statements of Seton (1925). The statistical analysis of measurements can distinguish species of the same group, as in rodents of the Northeast of Brazil (Chame 1988). When the diet is well known for a determined area, it can be an important factor to distinguish species, as in the case of the African rhinoceros and South American canids (Chame 1991, Motta-Júnior et al. 1996, Dalponte 1997, Aragona & Setz 2001).

The groups of feces identified in this work suggest that the morphology of the feces may reflect a species phylogeny, corroborating paleontological data about the evolution and radiation of the mammals.

It is expected that the definition of morphometric patterns to identify terrestrial mammal feces can be used not only for the progress of field studies of current fauna, but also to stimulate biomolecular studies based on feces for paleoecological, and paleoparasitological studies (Chame et al. 1991, Araújo et al. 2000) that use coprolites as a primary source of investigation.

As the study of the feces and coprolites starts in the field, with the tracking animals or with the archaeological excavations, it is the observer's acuity and sharpness in the gathering the largest amount of information left by the animals in nature, together with laboratory results, that makes it possible to rebuild movements, ecosystems, and biological and ecological relationships. In essence, it allow us to determine what has happened when there were no observers present.

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TABLE I

Feces' measures and shapes from African mammals

Mammals' species	Feces' measures L x W cm ∅ cm	Feces' shape	References
LAGOMORPHA			
Leporidae			
Lepus saxatilis (Hare)	L = 1 cm		Lienbenberg 2000 Walker 1996
Lepus capensis (Cape Hare)	L = 1 cm		Walker 1996
RODENTIA			
Sciuridae			
Xerus inaurus (Ground squirel)	1.5 x 0.5 cm		Walker 1996

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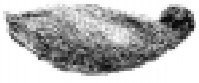
Mammals' species	Feces' measures L x W cm ∅ cm	Feces' shape	References
Paraxerus cepapi (Tree Squirel)	L = 0.5 cm		Walker 1996
Pedestes capensis (Springhare)	L = 2 cm		Lienbenberg 2000 Walker 1996
Thryonomyidae			
Thryonomys swinderianus (Greater Cane-rat)	L = 2 cm		Walker 1996 Stuert & Stuart 1998
Hystricidae			
Histrix africaeaustralis (Porcupine)	5 cm		Lienbenberg 2000 Walker 1996
INSETIVORA			
Erinaceidae			
Atelirix frontalis (Hedgehog)	L = 1.5 cm		Walker 1996
PRIMATA			
STREPSIRHINI (Prosimians)			
Galogonidae			
Galago moholi (Lesser Bushbaby)	L = 5 cm	amorph	Walker 1996
CATARRHINI (Old monkeys and man)			
Cercopithecidae			
Papio cynocephalus P.urcinus (Chacma baboon)	L = 5-10 cm		Lienbenberg 2000 Walker 1996
Cercopithecus aethiops Cercopithecus mitis (monkeys)	L = 3-5 cm		Lienbenberg 2000 Walker 1996
CARNIVORA			
Canidae			
Lycaon pictus (Wild dog)	7.5 x 2.9 cm		Walker 1996
Vulpes chama (Cape Fox)	9.5 x 1.8 cm		Walker 1996
Otocyon megalotis (Bat-eared Fox)	3.4 x 2 cm		Walker 1996
Canis mesonelas (Black-backed Jackal)	7.4 x 2 cm		Walker 1996

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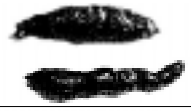
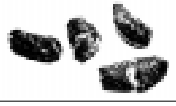
Mammals' species	Feces' measures L x W cm ∅ cm	Feces' shape	References
Canis adustrus (Side-Stripped Jackal)	9.6 x 1.5 cm		Walker 1996
Mustelidae			
Ictonys striatus (Striped Polecat)	6.8 x 5.4 cm		Walker 1996
Mellivora capensis (Honey Badger)	6.8 x 2.2 cm		Walker 1996
Lutrinae			
Aonyx capensis (Cape Clawless otter)	L = 8 cm 5 x 2.6 cm		Lienbernberg 2000 Walker 1996
Lutra maculicolis (Spotted-necked Otter)	3.4 x 2.6 cm		Walker 1996
Hyaenidae			
Hyaena brunnea (Brown Hyaena)	L = 5 cm		Lienbernberg 2000
Crocuta crocuta (Spotted Hyaena)			
Proteles cristata (Aardwolf)	11.2 x 4.5 cm		Walker 1996
Viverridae			
Genetta tigrina (Large–spotted Genet)	7.5 x 1.5 cm		Walker 1996
Genetta genetta (small-spotted Genet)	5.5 x 4.7 cm		Walker 1996
Herpestidae			
Suricata suricatta (Suricate)	5 x 1.8 cm		Walker 1996
Rhynchogale melleri (Meller's Mongoose)	8 x 1 cm		Walker 1996
Cynictis penicillata (Yellow Mongoose)	4.4 x 1 cm		Walker 1996
Galerella pulverulenta (Small Grey Mongoose)	4 x 2 cm		Walker 1996

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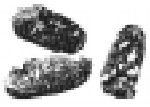
Mammals' species	Feces' measures L x W cm ∅ cm	Feces' shape	References
Ichneumia albicauda (White-tailed Mongoose)	7 x 1.3 cm		Walker 1996
Atilax paludinosus (Water Mongoose)	3.2 x 2.2 cm		Walker 1996
Herpestes ichneumon (Large Grey Mongoose)	9 x 2.3 m		Walker 1996
Galerella sanguinea (Slender Mongoose)	7 x 1.3 cm		Walker 1996
Mungus mungo (Banded Mongoose)	3.2 x 1.2 cm		Walker 1996
Helogale parvula (Dwarf Mongoose)	3.6 x 1.5 cm		Walker 1996
Felidae			
Panthera leo (Lion)	15 x 4.4 cm		Walker 1996 Stuart & Stuart 1998
Panthera pardus (Leopard)	No data		Walker 1996
Felis caracal (Caracal)	5.5 x 1.7 cm		Walker 1996
Felis serval (Serval)	12 x 2.2 cm		Walker 1996
Felis lybica (African Wild cat)	3.5 x 2 cm		Walker 1996
Felis nigripes (Small spotted cat)	4.7 x 1.8 cm 1-1.4 cm ∅		Walker 1996 Stuart & Stuart 1998
Dendrohyrax arboreus (Tree Dassie)	6.6 x 2.4 cm		Walker 1996

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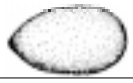
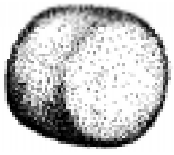
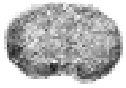
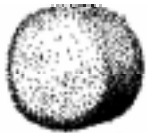
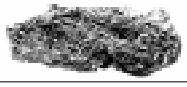
Mammals' species	Feces' measures L x W cm ∅ cm	Feces' shape	References
UNGULATA (Super Order)			
TUBILIDENTATA			
Orycteropodidae			
Orycteropus afer (Antbear)	L = 4 cm		Lienbenberg 2000
HYRACOIDEA			
Procavidae			
Procavia capensis (Dassie or Rocky Hyrax)	L = 1 cm 1.5 x 1 cm		Lienbenberg 2000 Walker 1996
Heterohyrax brucei (Yellow-spotted Rock Dassie)	1.5 x 1 cm		Walker 1996
PROBOSCIDAE			
Elephantidae			
Loxodonta africana (Elephant)	L = 15-20 cm		Lienbenberg 2000
PERISSODATYLA			
Equidae			
Equus burchelli (Burchell's Zebra)	6 x 4 cm		Walker 1996
Equus zebra zebra (Mountain Zebra)	L = 5 cm		Lienbenberg 2000
Rhinocerotidae			
Ceratotherium simum (White Rhino) *Diceros bicornis* (Black Rhino)	L = 10-15 cm		Lienbenberg 2000
ARTIODACTYLA			
Hippopotamidae			
Hippopotamus amphibius (Hippo)	L = 10 cm		Lienbenberg 2000
Suidae			
Potamochoerus porcus (Bushpig)	11 x 4.4 cm		Walker 1996

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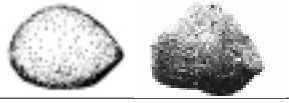
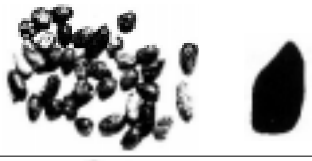
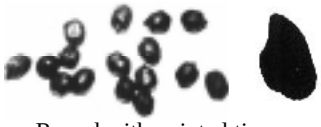
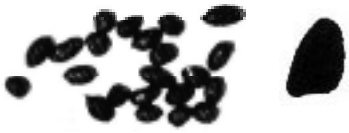
Mammals' species	Feces' measures L x W cm ∅ cm	Feces' shape	References
Phacochoerus aethiopicus (Desert Warthog)	L = 5 cm 5.8 x 5.2 cm		Lienbenberg 2000 Walker 1996
Giraffidae			
Giraffa camelopardalis (Giraffe)	L = 2-3 cm 2.5 x 1.9 cm		Lienbenberg 2000 Walker 1996
Boviidae			
Syncerus caffer (Buffalo)	L = 15 cm		Lienbenberg 2000 Stuart & Stuart 1998 Walker 1996
Madoqua kirkii (Damara Dik-dik)	L = 0.5-1 cm 0.6 x 0.5 cm (n = 100)	Round with a distinctive point 	Walker 1996 Stuart & Stuart 1998
Ourebia ourebia (Oribi)	0.75 x 0.5 cm 1.3 x 0.6 cm (n = 100)		Walker 1996 Stuart & Stuart 1998
Neotragus moschatus (Suni)	0.8 x 0.3 cm 0.4 x 0.2 cm (n = 100)		Walker 1996 Stuart & Stuart 1998
Raphicerus melanotis (Grysbok)	0.7 x 0.4 cm 0.7 x 0.4 cm (n = 100)		Walker 1996 Stuart & Stuart 1998
Raphicerus sharpei (Sharpe's Grysbok)	0.5 x 0.3 cm		Walker 1996
Oreotragus oreotragus (Klipspringer)	L = 1.3 cm 1 x 0.6 cm (n = 100)		Walker 1996
Philantomba monticola (Blue Druiker)	0.5 cm ∅ 0.8 x 0.5 cm (n = 100)	 Round with pointed tips	Walker 1996 Stuart & Stuart 1998
Cephalophus natalensis (Red Druiker)	L = 1-2 cm 0.5 x 0.4 cm (n = 100)	 Fairly pointed	Walker 1996 Stuart & Stuart 1998

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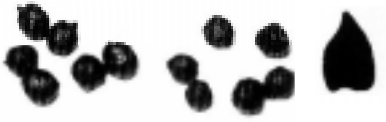
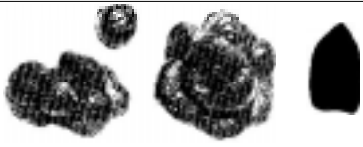
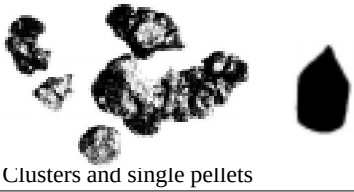
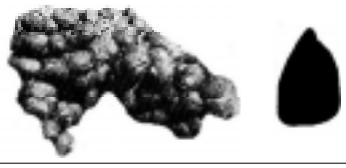
Mammals' species	Feces' measures L x W cm ∅ cm	Feces' shape	References
Sylvicapra grimmia (Common Druiker)	0.6 cm ∅ 0.6 x 0.5 cm (n = 100)	 Round with tiny pointed end in latrines	Walker 1996 Stuart & Stuart 1998
Raphicerus campestris (Steenbok)	L = 3 cm 0.8 x 0.4 cm (n = 100)	 Distinctly pointed	Walker 1996 Stuart & Stuart 1998
Damaliscus dorcas phillipsi (Blesbok)	1.3 x 1.1 cm		Walker 1996
Damaliscus dorcas dorcas (Bontebok)	1.3 x 1.1 cm 1.5 x 0.9 cm (n = 100)		Walker 1996 Stuart & Stuart 1998
Damaliscus lunatus (Topi, Tiang or Tsessebe)	2.2 x 1.8 cm 2.1 x 1.3 cm (n = 100)	 More pointed than that of the others species of the genus	Walker 1996 Stuart & Stuart 1998
Redunca arundinum (Reedbuck)	1.7 x 1 cm 1.2 x 0.9 cm (n = 100)		Walker 1996 Stuart & Stuart 1998
Redunca fulvorufula (Mountain Reedbuck)	1 cm ∅ 0.9 x 0.4 cm (n = 100)	 Clusters and single pellets	Walker 1996 Stuart & Stuart 1998
Antidorcas marsupialis (Springbok)	1.3 cm ∅ 1.1 x 0.7 cm (n = 100)	 Clusters and single pellets	Walker 1996 Stuart & Stuart 1998
Aepyceros melampus (Impala)	1-2 x 0.7 cm 1.1 x 0.6 cm (n = 100)	 Clusters and single pellets	Walker 1996 Stuart & Stuart 1998
Connochaetes taurinus (Blue Wildbeest)	2 x 1 cm (n = 100)		Walker 1996 Stuart & Stuart 1998
Connochaetes gnou (Black Wildebeest)	No data (similar *G. taurinus*) 1.5 x 1 cm (n = 100)		Walker 1996 Stuart & Stuart 1998

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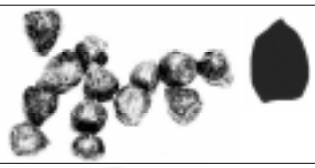
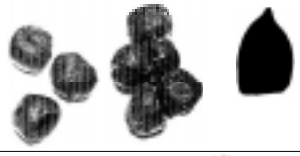
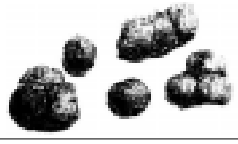
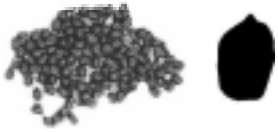
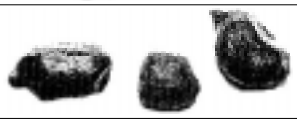
Mammals' species	Feces' measures L x W cm ∅ cm	Feces' shape	References
Gazella rufifrons (Thomson's Gazelle)	1 x 0.6 cm (n = 100)		Stuart & Stuart 1998
Gazella granti (Grant's Gazelle)	1 x 0.6 cm (n = 100)		Stuart & Stuart 1998
Oryx gazella (Gemsbok)	L > 1.7 cm 1.6 x 1.1 cm (n = 100)		Walker 1996 Stuart & Stuart 1998
Alcelaphus buselaphus (Red Hartebeest)	0.8 x 0.7 cm 1.7 x 1 cm (n = 100)		Walker 1996 Stuart & Stuart 1998
Hippotragus niger (Sable)	L = 1.5 cm 2 x 1.3 cm (n = 100)		Walker 1996 Stuart & Stuart 1998
Hippotragus aquinus (Roan Antelope)	L = 2.7 cm 2 x 1.2 cm (n = 100)		Walker 1996 Stuart & Stuart 1998
Kobus vardonii (Puku)	1.1 cm ∅		Walker 1996
Kobus leche (Red Lechwe)	1.6 cm ∅ 1.4 x 1.4 cm (n = 100)		Walker 1996 Stuart & Stuart 1998
Kobus ellipsiprymnus (Waterbuck)	No data 2 x 1.4 cm (n = 100)	 Clusters Single pellets	Walker 1996 Stuart & Stuart 1998
Tragelaphus scriptus (Bushbuck)	Cakes 3.3-2.2 cm 1.4 x 0.6 cm (n = 100)	 Clusters Single pellets	Walker 1996 Stuart & Stuart 1998
Tragelaphus angasii (Nyala)	L = 1.5 cm 1.6 x 1 cm (n = 100)		Walker 1996 Stuart & Stuart 1998
Tragelaphus spekei (Sitatunga)	2.5 x 1.3 cm		Walker 1996

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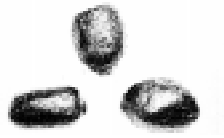
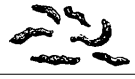
Mammals' species	Feces' measures L x W cm ∅ cm	Feces' shape	References
Tragelaphus strepsiceros (Kudu)	1.7 cm ∅ 2.1 x 1 cm (n = 100)	 Similar to those of young giraffe	Walker 1996 Stuart & Stuart 1998
Tragelaphus imberbis (Lesser Kudu)	1.1 x 0.7 cm (n = 100)		Stuart & Stuart 1998
Tragelaphus euryceros (Bongo)	1.4 x 0.7 cm (n = 100)		Stuart & Stuart 1998
Taurotragus oryx (Eland)	2.8 x 2.1 cm		Walker 1996
Ammotragus lervia (Barbary sheep or Aoudad)	1.6 x 1.1 cm (n = 100)		Stuart & Stuart 1998

TABLE II

Feces' measures and shapes from North American mammals

Mammals' species	Feces' measures L x W cm ∅ cm	Feces' shape	References
MARSUPIALIA			
Didelphidae			
Didelphis marsupialis (Opossum)	L = 4.2 cm L = 4.4 cm		Russo & Olhausen 1987 Murie 1982 Stokes & Stokes 1986
XENARTHRA			
Dasypodidae			
Dasypus novemcinctus (Nine-banded armadillo)	L = 3.5 cm		Murie 1982
INSETIVORA			
Soricidae			
Sorex articus (Artic Shrew)	0.4 x 0.1 cm		Murie 1982
Blarina brevicauda (shorttail Shrew)	1.2 x 0.2 cm		Murie 1982
Cryptotis parva (Pygmy Shrew)	0.6 x 0.1 cm		Murie 1982

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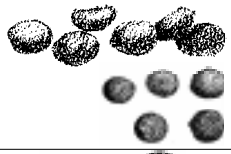
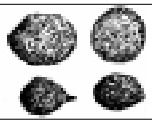
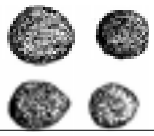
Mammals' species	Feces' measures L x W cm ∅ cm	Feces' shape	References
LAGOMORPHA			
Leporidae			
Lepus californicus (Blacktail Jackrabbit or Blacktail Hare)	L = 1-1.2 cm		Russo & Olhausen 1987 Murie 1982
Lepus townsendii (Whitetail Jackrabbit or Whitetail Hare)	L = 1.8 cm 1.3-1.7 x 1.4-0.9 cm		Russo & Olhausen 1987 Murie 1982
Lepus americanus (Snowshoe Hare)	L = 1-1.3 cm		Russo & Olhausen 1987 Murie 1982
Lepus arcticus (Artic Hare or Tundra Hare)	1.6 x 1.4 cm		Murie 1982
Lepus europaeus (European Hare)	1.7 x 1.1 cm		Murie 1982
Sylvilagus bachmani (Brush Rabbit)	L = 0.6-0.8 cm		Russo & Olhausen 1987
Sylvilagus nuttallii (Mountain Cottontail)	L = 0.7-0.9 cm		
Sylvilagus audubonii (Audubon Cottontail or Desert Cottontail)	L = 0.8 cm		
Sylvilagus floridanus (Cottontail)	0.7-0.9 cm ∅		Murie 1982 Stokes & Stokes 1986
Sylvilagus idahoensis (Pygmy Rabbit)	0.3-0.6 cm ∅		Murie 1982
Ochotonidae			
Ochotona princeps (Pika, Cony, Rocky Rabbit or Piping Hare)	L = 3-5 cm 0.2 cm ∅	 Dry  Soft	Russo & Olhausen 1987 Murie 1982
RODENTIA			
Sciuridae			
Marmota flaviventris (Yellow-belled Marmot)	L = 2.8-4 cm		Russo & Olhausen 1987

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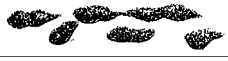
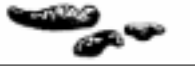
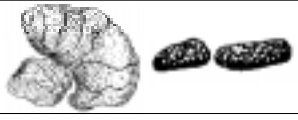
Mammals' species	Feces' measures L x W cm ∅ cm	Feces' shape	References
Cynomys spp. (Prairie Dog)	L = 1-0.5 cm		Murie 1982
Citellus variegatus (larger Rock Squirrel)	1.5 x 0.7 cm		Murie 1982
Citellus armatus (Uinta Ground Squirrel)	1.3 x 0.2 cm		Murie 1982
Tamias striatus lysteri	0.6 x 0.2 cm		Murie 1982
Eutamias minimus (Least Chipmunk)	L = 0.5-0.7 cm		Russo & Olhausen 1987
Eutamias speciosus (Lodgepole Chipmunk)	L = 0.7 cm		
Eutamias merriami (Merriam Chipmunk)	L = 0.5-1.2 cm		Russo & Olhausen 1987
Eutamias amoneus (Yellow pine Chipmunk)			
Eutamias townsendii (Townsend Chipmunk)			
Eutamias sonomae (Sonoma Chipmunk)			
Eutamias alpinus luteiventris	1 x 0.2 cm		Murie 1982
Eutamias dorsalis	0.5 x 0.1cm		Murie 1982
Sciurus carolinensis (Eastern Gray Squirrel)	1 x 0.4 cm		Murie 1982
Sciurus alberti (Tassel-eared Squirrel)	0.6 x 0.3 cm		Murie 1982
Sciurus niger (Fox Squirrel)	L = 1-1.2 cm		Russo & Olhausen 1987
Sciurus griseus (Western Gray Squirrel)	L = 0.9-1.4 cm		Russo & Olhausen 1987 Murie 1982 Stokes & Stokes 1986
Tamiasciurus douglasi (Chickaree, Douglas Squireel or Pine Squirrel)	L = 0.6-1 cm		Russo & Olhausen 1987 Murie 1982
Tamiasciurus hudsonicus (Red Squirrel)	1.5 x 0.2 cm		Murie 1982 Stokes & Stokes 1986
Glaucomys (Flying Squirrel)	1.1 x 0.2 cm		Murie 1982
Glaucomys sabrinus (Northern Flying Squirrel)	L = 0.4-1.2 cm		
Spermophilus beecheyi (California Ground Squirrel)	L = 1-1.4 cm		Russo & Olhausen 1987
Spermophilus lateralis (Golden-mantled Ground Squirrel)	L = 1.2-1.4 cm		
Geomyidae			
Thomomys talpoides (Northern Pocket Gophers)	L = 2.8-4 cm 0.8 x 0.2 cm		Russo & Olhausen 1987 Murie 1982

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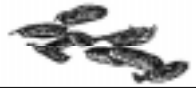
Mammals' species	Feces' measures L x W cm ∅ cm	Feces' shape	References
Perognatus parvus (Pocket mouse)	0.2 x 0.1-0.05 cm 0.6 x 0.2 cm		Murie 1982
Castoridae			
Castor canadensis (Beaver)	L = 1.5 cm		Russo & Olhausen 1987 Murie 1982
Microtinae			
Ondatra zibethica (Muskrat)	L = 1.0-1.3 cm		Murie 1982 Russo & Olhausen 1987 Stokes & Stokes 1986
Neofiber hallen (Florida water rat)	1.4 x 0.4 cm		Murie 1982
Erithizontidae			
Erithizon dorsatum (Porcupine)	L = 3.5-4.7 cm		Russo & Olhausen 1987 Murie 1982 Stokes & Stokes 1986
Aplodontiidae			
Aplodontia rufa (Aplodontia)	1.5 x 0.5 cm		Murie 1982
Caviidae			
Dasyprocta (Agouti)	4 x 1.5 cm		Murie 1982
Dasyproctidae			
Cuniculus paca (Paca)	3 x 1.5 cm		Murie 1982
Zapodidae			
Zapus (Jumping mouse)	0.9 x 0.1 cm		Murie 1982
Cricetidae			
Neotoma fuscipes (Dusky-footed Woodrat)	1 x 1.4 cm		Russo & Olhausen 1987
Neotoma cinerea (Bushytail Woodrat)	0.3 x 0.2 cm		Russo & Olhausen 1987 Murie 1982
Neotoma lepida (Desert Woodrat)	L = 1-1.4 cm		Russo & Olhausen 1987
Peromyscus (White-Footed Mouse or Deer Mouse)	1.7 x 0.3 cm		Murie 1982
Onychomys (Grasshopper Mouse)	1 x 0.2 cm		Murie 1982
Reithrodontomys (Harvest Mouse)	0.4 x 0.1 cm		Murie 1982
Oryzomys (Rice Rat)	1.4 x 0.2 cm		Murie 1982
Sigmodon (Cotton Rat)	0.8 x 0.1 cm		Murie 1982

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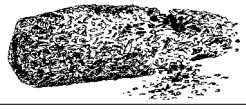
Mammals' species	Feces' measures L x W cm ∅ cm	Feces' shape	References
Microtinae			
Micritus miuru	0.6 x 0.1 cm		Murie 1982
Microtus richardsoni (Richardson Vole)	0.7 x 0.2 cm		
Microtus montanus (Mountain Vole)	0.5-0.2 x 0.1 cm		
Microtus operarius	0.3 x 0.1 cm		Murie 1982
Dicrostonys groelandicus (Collared lemming)	0.7-0.3 x 0.2 cm		Murie 1982
Lemmus trimucronatus (Brown lemming)	0.4 x 0.2-0.1 cm		Murie 1982
CARNIVORA			
Mustelidae			
Martes americana (Pine Marten)	L = 5.5 cm 1 cm ∅		Russo & Olhausen 1987 Murie 1982
Martes pennanti (Fisher)	1.6 cm ∅		Murie 1982 Stokes & Stokes 1986
Mustela frenata (Long-tailed Weasel)	L = 2.8 cm 0.6 cm ∅		Russo & Olhausen 1987 Murie 1982
Mustela erminea muricus (Shorttail weasel)	0.5 cm ∅		Murie 1982 Stokes & Stokes 1986
Mustela vison (Mink)	1 cm ∅		Murie 1982 Stokes & Stokes 1986
Mustela nigripes *(Black-footed Ferret)*	No data		Murie 1982
Gulo luscus (Wolverine)	L = 13 cm		Murie 1982
Lutra canadensis (River Otter)	L = 6-6.5 cm 1.3 cm ∅		Russo & Olhausen 1987 Murie 1982 Stokes & Stokes 1986
Enhydra lutris (Sea Otter)	8.5 x 3 cm		Murie 1982
Mephitis mephitis (Striped Skunk)	L = 3-4.4 cm 1.6 cm ∅		Russo & Olhausen 1987 Stokes & Stokes 1986
Spilogale putorius (Spotted Skunk)	0.6 cm ∅		Murie 1982
Spilogale gracilis (Spotted Skunk)	L = 3-4 cm		Russo & Olhausen 1987

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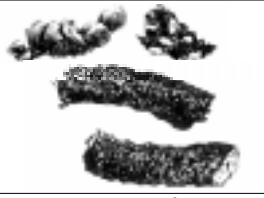
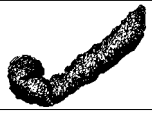
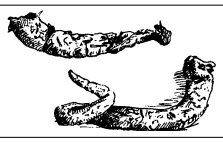
Mammals' species	Feces' measures L x W cm ∅ cm	Feces' shape	References
Taxidea taxus (Badger)	L = 3.4-4.9 cm 1.6 cm ∅		Russo & Olhausen 1987 Murie 1982
Procyonidae			
Procyon lotor (Raccoon)	L = 3-5 cm 2.5 cm ∅ Comunity latrines		Russo & Olhausen 1987 Murie 1982 Stokes & Stokes 1986 Page et al. 2001
Nasua narica (Coati)	L = 6.6 cm		Murie 1982
Bassariscidae			
Bassariscus astutus (Ringtail or Cacomistle)	L = 7.6 cm		Murie 1982
Ursidae			
Ursus americanus (Black Bear)	L = 8-11 cm 5.7 x 2.8 cm		Russo & Olhausen 1987 Murie 1982 Stokes & Stokes 1986
Ursus horribilis (Grizzly Bear)	5.7 cm ∅		Murie 1982
Canidae			
Canis lupus (Gray Wolf)	L = 16 cm > 3 cm ∅ > 2.5 cm ∅		Murie 1982 Weaver & Fritts 1979 Halfpenny & Biesot 1986
Canis latrans (Coyote)	5.5-8.8 x 2 cm L = 10.6 cm < 3 cm ∅ 1.8-2.5 cm ∅		Russo & Olhausen 1987 Murie 1982 Weaver & Fritts 1979 Stokes & Stokes 1986 Halfpenny & Biesot 1986
Vulpes fulva (Red Fox)	L = 5.8 cm > 1.8 cm ∅		Murie 1982 Halfpenny & Biesot 1986
Vulpes macrotis (San Joaquin Kit Fox)	L = 3.1-6.9 cm		Russo & Olhausen 1987 Olhausen 1987
Urocyon cinereoargenteus (Gray Fox)	5 x 1 cm L = 6.4 cm		Russo & Olhausen 1987 Murie 1982
Alopex lagopus (Arctic Fox)	L = 6.4 cm		Murie 1982

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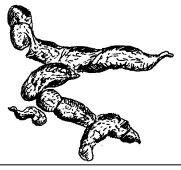
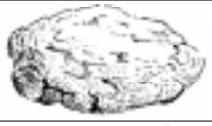
Mammals' species	Feces' measures L x W cm ∅ cm	Feces' shape	References
Felidae			
Lynx rufus (Bobcat or Wild cat)	L = 5-12.7 cm L = 10 cm		Russo & Olhausen 1987 Murie 1982 Stokes & Stokes 1986
Puma concolor (Mountain Lion or Cougar or Puma)	L = 7.6-22.8 cm 13 x 3.2 cm > 2.5 cm ∅		Russo & Olhausen 1987 Murie 1982 Johnson et al.1984
Panthera onca (Jaguar)	10.8 x 2.2 cm > 2.5 cm ∅		Murie 1982 Johnson et al.1984
Leopardus pardalis (Ocelot)	12.7 x 1.6 cm		Murie 1982
PINNIPEDIA			
Otariidae			
Eumetopias jubata (Northern Sea lion)	L = 5-6.3 cm		Murie 1982
UNGULATA (Super Order)			
ARTIOCADTYLA			
Bovidae			
Ovis canadensis (Bighorn Sheep)	L = 1.3-1.6 cm Cakes: 8 cm 1-1.3 x 0.6-0.9 cm	 Dry  Soft	Russo & Olhausen 1987 Murie 1982
Oreamnos americanus (Mountain Goat)	1 x 0.4-0.6 cm Cakes: 4.3 x 2.3 cm	 Dry Soft	Murie 1982
Bison bison (Bison or Buffalo)	Cakes: 30.5 cm		Murie 1982
Ovibos moschatus (Muskox)	1 x 0.6-1 cm		Murie 1982
Antilocapridae			
Antilocapra americana (Pronghorn Antelope)	L = 1.8 cm Cakes: 4 x 0.6-1.8 x 0.8-1cm	 Dry Soft	Russo & Olhausen 1987 Murie 1982

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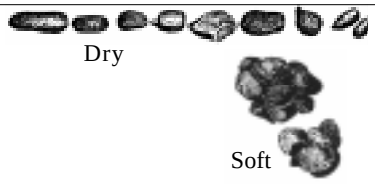
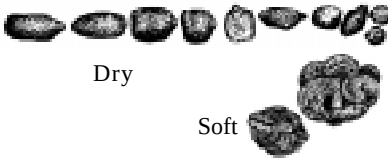
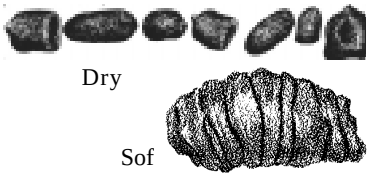
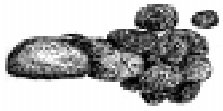
Mammals' species	Feces' measures L x W cm ∅ cm	Feces' shape	References
Cervidae			
Odocoileus hemionus (Mule Deer)	L = 1.2-1.8 cm Cakes: 6.7 cm 0.6-1.8 x 0.6-1.5 cm	 Dry Soft	Russo & Olhausen 1987 Murie 1982
Odocoileus virginianus (White-tailed Deer or Flag-tail)	L = 1.2-2.8 cm Cakes: 4.8 cm 0.8-1.8 x 1-1.8 cm	 Dry Soft	Russo & Olhausen 1987 Murie 1982
Cervus canadensis (Wapiti or Canadian Elk or Elk)	L = 1.8-3.5 cm Cakes: 11 cm 1.7-2.5 x 1.2-1.5 cm	 Dry Sof	Russo & Olhausen 1987 Murie 1982
Alces alces (Moose)	2-3.4 x 1.5-1.8 cm		Murie 1982 Stokes & Stokes 1986
Rangifer caribou (Caribou or Reindeer)	0.7-0.9 x 0.4-0.8 cm Cakes: 5.5 x 3 cm		Murie 1982
Tayassuidae			
Pecari angulatus (Peccary)	1.2-3 x 1.4 cm		Murie 1982

TABLE III

Feces' measures and shapes from Europe mammals

Mammals' species	Feces' measures L x W cm ∅ cm	Feces' shape
INSECTIVORA		
Erinaceus europaeus (Hedgehogs)	3-4 x 0.8-1 cm	
LAGOMORPHA		
Lepus capensis (Hare)	1.5-2 cm ∅	
Oryctolagus cuniculus (Old world rabbit or domestic rabbit)	1 cm ∅	

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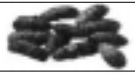
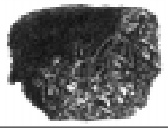
Mammals' species	Feces' measures L x W cm ∅ cm	Feces' shape
RODENTIA		
Sciuridae		
Sciurus vulgaris (Tree squirrels)	0.5-0.8 x 0.5-0.6 cm	
Castoridae		
Castor fiber (European Beaver)	2-4 x 2 cm	
Muridae		
Ondatra zibethicus (Muskrat)	1.2-1.4 x 0.5 cm	
Arvicola amphibius (Water voles)	0.7-1 x 0.3-0.4 cm	
Microtus arvalis (Voles, Meadow mice)	0.6-0.7 x 0.2-0.3 cm	
Lemmus lemmus (True Lemmings)	0.6 x 0.3 cm	
Rattus norvergicus (Norway Rat)	1.7 x 0.6 cm	
Rattus rattus (Black Rat)	1 x 0.2-0.3 cm	
Mus musculus (Mice)	0.6 x 0.2-0.25 cm	
Capromyidae		
Myocastor coypus (Nutria, Coypu)	2-3 x 1 cm	
CARNÍVORA		
Canidae		
Vulpes vulpes (Red Fox)	8-10 x 2 cm	
Canis lupus (Wolf)	10-15 x 2.5-3 cm	No data
Ursidae		
Ursus horribilis (Grizzly bear)	6 cm ∅	
Mustelidae		
Meles meles (Old World Badger)	No data	
Martes martes (Martens, Fisher, Sable)	8-10 x 1.2 cm	

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Mammals' species	Feces' measures L x W cm ∅ cm	Feces' shape
Mustela putorius (Weasel, Minks, Ferret)	6.8 x 0.9 cm	
Mustela erminea (Ermine or Stoat)	0.5 cm ∅	No data (same as *M. nivalis*)
Mustela nivalis (Least Weasel)	0.2 cm ∅	
Felidae		
Felis catus (Domestic cat)	6-8 x 1-1.5 cm	
Lynx lynx (Lynx)	6 cm ∅	
UNGULATA (Grand order)		
Artiodactyla		
Suidae		
Sus scrofa (Pig)	7 cm ∅	No data
Cervidae		
Cervus elaphus (Red deer, wapiti, elk)	2-2.5 x 1.3-1.8 cm	
Dama dama (Fallow deer)	1-1.5 x 0.8-1.2 cm	
Capreolus capreolus (Roe deer)	1-1.4 x 0.7-1 cm	
Alces alces (Moose)	2-3 x 1.5-2 cm	
Rangifer tarandus (Reindeer or Caribou)	1.2-1.5 x 0.7-1 cm	
Bovidae		
Ovis aries (domestic sheep)	1 cm ∅	
Rupicapra rupicapra (Chamois)	1.5 cm ∅	

Based on Bang & Dahlström (1975).

TABELA IV

Feces' measures from Northeastern Brazilian Mammals

Mammals' Species	Feces' length cm	Feces' diameter cm
XENARTHRA		
Dasypodidae		
Dasypus novemcinctus (nine-banded armadillo)	1.1-3.7	1.1-2.8 (n = 15)
Myrmecophagidae		
Tamandua tetradactyla (southern tamanduá)	1.8-8.1	1.5-2.5 (n = 28)
RODENTIA		
Caviidae		
Kerodon rupestris (Mocó or rocky cavy)	0.9-1.7	0.4-0.6 (n = 49)
Galea spixii (Preá)	0.5-0.8	0.2-0.4 (n = 53)
Echymyidae		
Trichomys apereoides (Rabudo)	0.4-1.1	0.1 -0.4 (n = 57)
Muridae (Sigmodontinae)		
Oryzomys subflavus	0.4-0.6	0.1-0.2 (n = 20)
PRIMATA		
Alouatta caraya (black howler monkey)	1.1-4.1	1.9-2.6 (n = 4)
CARNIVORA		
CANIDAE		
Cerdocyon thous (Crab-eating fox)	1.5-10.8	1.7-2.3 (n = 9)
FELIDAE		
Panthera onca (jaguar)	2.6-11.2	2.4-2.8 (n = 14)
Puma concolor (puma or cougar)	3.7-6.1	2.2-3.2 (n = 4)
Leopardus tigrinus (little spotted cat)	3.1-3.4	1.5-1.5 (n = 4)
UNGULATA		
Artiodactyla		
Cervidae		
Mazama gouazoubira (Brocket deer)	0.9-5.1	0.5-2.8 (n = 25)
Mazama americana (Red Brocket deer)	0.7-1.0	0.7-0.92 (n = 15)
Tayassuidae		
Tayassu tajacu (Collared peccary)	0.9-2.4	1.2-2.2 (n = 39)
Tayassu pecari (White-lipped peccary)	0.9-2.3	0.8-1.3 (n = 20)