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Xerus inauris.

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Xerus inauris (Zimmerman, 1780)

Cape Ground Squirrel

Sciurus inauris Zimmermann, 1780:344. Type locality "Bewohnt die Cafferen, über hundert Meilen nordwärts des Vorgebürges der guten Hofnung . . . " translated, "Kaffirland, 100 miles north of the Cape of Good Hope."

Sciurus dschinschicus Gmelin, 1788:151. Type locality "In Provincia Indiae Dschinschi" = South Africa.

Sciurus capensis Kerr, 1792:266. Type locality "near mountains of the Sneeberg, eight hundred miles north from the Cape of Good Hope."

Sciurus namaquensis Lichtenstein, 1793:2. No type locality given. Restricted to "Orange River, Namaqualand" by Ellerman (1940).

Sciurus ginginianus Shaw, 1801:147. Type locality "Gingi in the East Indies" = South Africa.

Myoxus africanus Shaw, 1801:172. Type locality "mountains of Sneeburgh, about 800 miles above the Cape of Good Hope."

Sciurus albovittatus Desmarest, 1817:338. "Le Cap de Bonne-Espérance" = Cape of Good Hope.

Sciurus levaillantii Kuhl, 1820:67. Type locality "In Africa meridionali."

Sciurus setosus Smuts, 1832:33. Type locality "Habitat hoc animal in sylvis ac regionibus Coloniae inferioribus" = southern part of Cape of Good Hope.

Geosciurus inauris: G. M. Allen, 1939:293. Name combination.

Xerus inauris: Ellerman et al. 1940:422. First use of current name combination.

CONTEXT AND CONTENT. Order Rodentia, suborder Sciuromorpha, family Sciuridae, subfamily Sciurinae, tribe Xerini, genus *Xerus* (O'Shea 1991). *Xerus inauris* is monotypic (Skinner and Smithers 1990).

DIAGNOSIS. *Xerus inauris* (Fig. 1) lives sympatrically with only 1 species of African ground squirrel, *X. princeps*. *X. inauris* has white incisors, as opposed to yellow-orange in *X. princeps*. Tail of *X. inauris* has 2 black bands at base; tail of *X. princeps* is longer and bushier than tail of *X. inauris* (Herzig-Straschil and Herzig 1989) and has 3 black bands at base. Diameter of orbit is normally less than one-third of occipitonasal length in *X. inauris*, but greater than one-third of occipitonasal length in *X. princeps* (Meester et al. 1986). Nasalia strongly broaden anteriorly in *X. inauris*, but not in *X. princeps* (Herzig-Straschil et al. 1991).

GENERAL CHARACTERS. *Xerus inauris* is covered with short hair that is bristly and coarse, with no underfur. Dorsal parts are cinnamon in color with lighter and darker individual variation. Ventral parts of limbs, underbelly, sides of neck, and face are white, and skin is black. Characteristic features include small, exterior ear pinnae; white lateral stripe that extends from shoulder to thigh on each side of body; dull white lines around prominent eyes; and long (85% of length of head and body), dorsoventrally flattened tail of predominantly white hair with 2 black bands at base (Skinner and Smithers 1990; Waterman 1995).

Skull measurements (ranges, in mm, $n = 157$) are condylobasal length, 47.9–56.9; zygomatic breadth, 31.1–38.6; occipitonasal length, 51.1–61.3; length of maxillary toothrow, 10.0–12.6; length of mandible toothrow, 10.9–13.4; width of orbit, 14.7–17.5; postorbital width, 19.7–25.2; interorbital width, 15.1–19.9 (Fig. 2; Herzig-Straschil et al. 1991).

Sexual dimorphism exists but is not pronounced. Males tend to have ca. 8–12% greater mass than females, with ranges of 423–649 g for males and 444–600 g for females (Lynch 1983; Smithers 1971; Waterman 1995). One report of females being larger than males was based on 2 males and 9 females (Rautenbach 1982). Average length (in mm) of selected external measurements for males and females, respectively, are: total length, 452–476, 435–446; length of head and body, 243–282, 235–248; length of tail, 194–211, 196–207; length of hind foot, 62–68, 64–66; length of ear, 9–12, 9–13 (Bernard and Nurton 1993; Herzig-Straschil 1978; Lynch 1983; Smithers 1971; Waterman 1996).

DISTRIBUTION. *Xerus inauris* is endemic to arid, open savannahs of southern Africa through Botswana, Republic of South Africa, and Namibia (Fig. 3; Herzig-Straschil 1978). Cape ground squirrels are widely distributed in Namibia except for coastal regions and the northwest, where *X. inauris* is replaced by *X. princeps* (Skinner and Smithers 1990). In Botswana, Cape ground squirrels occur in central and southwestern Kalahari (Smithers 1971). In Republic of South Africa, *Xerus inauris* occurs in the southwest region of North West Province, is widely endemic to the Free State east to 30° and in western Lesotho, and is limited to the north and northeast in Northern Cape Province. Graaff Reinet district marks their southern-most limit (Skinner and Smithers 1990). Cape ground squirrels were noted in Metebeleland, in southwestern Rhodesia (now Zimbabwe—Sclater 1901; Shortridge 1934; Straschil 1975). No reports of *Xerus inauris* in Zimbabwe have occurred after 1975, and 1 report specifically excludes occurrences in Zimbabwe (Lynch 1983).

FOSSIL RECORD. *Xerus* cf. *inauris* fossils are reported from 3 sites at Olduvai Bed I, Tanzania. Nine mandible fragments with p4 or m1–3, 2 mandible fragments with 1 molar, and 14 isolated molars are estimated to be 1.8–1.7 million years old (Denys 1990). The fossil Xerini from Olduvai Bed I are nearly indistinguishable in morphology from *Xerus inauris* (Denys 1990).

FORM AND FUNCTION. Nine transverse intermolar palatal ridges are interrupted at midline to form a furrow with 2 continuous ridges anterior to molars (Eisentraut 1975). Dental formula is i 1/1, c 0/0, p 1/1, m 3/3, total 20 (Zumpt 1970). Females have 2 pairs of mammary glands: 1 inguinal and 1 abdominal (de Graaff 1981; Zumpt 1970). Testes are ca. 20% of length of head and body (Waterman 1995; Zumpt 1970). Glans penis is relatively large, turns downward at apex, and has a well-developed terminal baculum. Baculum is ca. 8 mm in length and has a wide upper surface shaped like a spearhead with convexly rounded sides (Pocock 1923). Molting occurs once per year, between August and September and March and April (Herzig-Straschil 1978).

Xerus inauris rarely drinks and meets its minimal water requirements through consumption of herbaceous vegetation. Water is conserved metabolically by production of concentrated plasma,

FIG. 1. Photograph of an adult *Xerus inauris* from Namibia, Africa.

FIG. 2. Dorsal, ventral, and lateral views of cranium and lateral view of mandible of an adult male *Xerus inauris* from Sekhuma Pan, Botswana (National Museum of Natural History, USNM 382780). Greatest length of cranium is 58.1 mm. Used with permission of the photographer, C. Schennum, USNM.

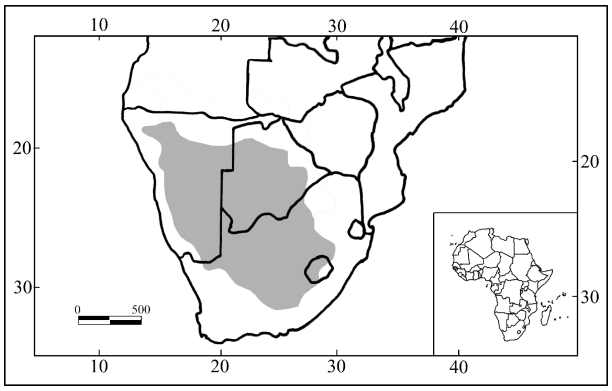

FIG. 3. Geographic distribution of *Xerus inauris*.

concentrated urine, and very dry feces. Highly concentrated urine (0.7–0.8 molar NaCl) is achieved by kidneys with a medullary thickness of 12.4 mm (Bolwig 1958, 1959; Haim et al. 1987; Marsh et al. 1978; van Heerden and Dauth 1987). Further water conservation occurs as saliva is produced only in extreme temperatures of ≥ca. 38°C. Skin has a well-developed epidermis, prominent keratin layer, no sweat glands, and very simple sebaceous glands (van Heerden and Dauth 1987). An enlarged cecum and an expandable stomach account for ca. 6% of body weight (Marsh et al. 1978). Cranial volume is 3.7 ± 0.1 ml (*SD*—Bernard and Nurton 1993).

ONTOGENY AND REPRODUCTION. Reproduction occurs throughout the year (Herzig-Straschil 1978; Smithers 1971; Waterman 1996), with peaks of mating in dry, winter months. A single breeding period per year has also been reported (Zumpt 1970). Estrus is ca. 3 h in length and occurs in only 1 female of the group at a time. When an estrous female is in a group, male-to-female sex ratio increases to ca. 11:1. In a single year, all females are capable of multiple cycles, although few females rear multiple litters (Waterman 1996). Gestation is ca. 48 days (Waterman 1996) or 42–49 days (Zumpt 1970).

Females begin lactating just before giving birth. Lactating females move to a separate burrow but return to the group after weaning or losing their litter. Young emerge from natal burrows at ca. 45 days of age. Males are not involved in rearing young (Waterman 1995, 1996). Litters typically consist of 1–3 pups, with a 1:1 sex ratio (Herzig-Straschil 1978; Waterman 1996). Pups are altricial at birth, weigh ca. 20 g, and are blind and naked (Herzig-Straschil 1978). Pups in the wild remain in burrows until 45 days of age. Captive pups begin vocalizing by the 5th day after birth; hair and whiskers begin to grow by the 7th day; and by the 14th day beige hair covers body (Herzig-Straschil 1978). Eyes open at ca. 35 days (Herzig-Straschil 1978), with 1 report of eye opening between days 10 and 14 (Zumpt 1970). Young eat solid food within 7 days of emergence from natal burrows, and nipples of adult females become flat. Duration of lactation is ca. 52 days (Waterman 1996). Early growth is rapid, with mass increasing from 23 g at 7 days postpartum to 350 g at 71 days postpartum (Herzig-Straschil 1978). Rate of growth slows over next 3 months, as pups increase to near adult size of 570 g by 153 days. First molt occurs by end of first 5 months (Herzig-Straschil 1978).

Onset of sexual maturity differs between males and females. Males reach sexual maturity at 8 months and disperse from natal group, while females generally do not become sexually mature until 10 months and remain in natal group (Waterman 1995). A significant delay (up to 6 months) in sexual maturity occurs in subadult females living with >1 reproductive adult female as compared with females living with a single adult female.

ECOLOGY. Cape ground squirrels are diurnal, nonhibernating, burrow-dwelling inhabitants of arid and semiarid regions of southern Africa (Herzig-Straschil 1978). They prefer open sandy veld or grassland with hard ground and can occur in scrub on fringes of pans or on floodplains or in cultivated fields (de Graaff 1981; Smithers 1971). Ambient temperatures range from 39.3°C in summer to −10.6°C in winter (van Heerden and Dauth 1987). Soil surface temperatures are as high as 61.7°C (Bennett et al. 1984).

Cape ground squirrels dig and live in burrow clusters that average ca. 700_m² in size (Waterman 1995) and have 2–100 burrow openings (X = 32, n = 15—Herzig-Straschil 1978). Burrows may provide protection from extreme ambient temperatures (van Heerden and Dauth 1987) and from aerial and most terrestrial predators (Herzig-Straschil 1979). Use of burrows during midday sun and activity aboveground during morning and evening hours may occur (Bolwig 1959), but *X. inauris* spends most of the day foraging aboveground (Herzig-Straschil 1979). Cape ground squirrels orient their backs toward the sun and shade their bodies by positioning their bushy tails toward the sun, up over their head and back, and use other thermoregulatory behaviors, such as dust bathing (Bennett et al. 1984; Straschil 1975).

A burrow cluster is inhabited by a social group consisting of 1–4 adult females and their offspring (Herzig-Straschil 1978). Social groups usually consist of 2–3 adult females and up to 9 subadults of either sex (Waterman 1995). Three is the maximum sustainable number of adult females per group in Namibia due to predation and reproductive suppression of subadult females.

Groups with >3 adult females fission to form distinct, smaller groups (Waterman 2002). Males form permanent, nonaggressive bands of unrelated individuals, which can include up to 19 males. Groups of 4–5 males form temporary subbands, with size and composition changing daily. Male groups live independently from females, only joining a female group when a female is in estrus (Waterman 1995). Female and male groups commonly share burrow clusters with suricates (*Suricata suricatta*) and yellow mongoose (*Cynictis penicillata*—Smithers 1971).

Diet includes bulbs, fruits, grasses, herbs, insects, seeds, and shrubs. Foraging occurs daily, as *Xerus inauris* is not known to hoard food (Herzig-Straschil 1978). Insect remnants (beetles, caterpillars, locusts, and termites) were recorded in over one-third of the 175 stomachs examined (Zumpt 1963), but no animal matter was found in other stomachs (Marsh et al. 1978). Meat was eaten in captivity (Shortridge 1934; Zumpt 1963).

Parasites include *Ctenocephallaes connatus*, *Echidniphaga bradyta*, *Echidniphaga gallinacea*, *Neohaematopinus faurei*, and *Synosternus caffer* (Straschil 1975), *Rhipicephalus theileri* (Waterman 2002), and *Xeroxyuris parallela*, which is exclusive to *X. inauris* (Hugot 1995). Efforts to control rabies and eliminate crop damage have led humans to exterminate Cape ground squirrels via poisonous gasses (Zumpt 1963, 1970).

BEHAVIOR. Female social groups do not share the same burrow cluster with other female groups. Home ranges for a female social group are ca. 4 ha, with core areas of ca. 0.25 ha (Waterman 1995). Squirrel densities are ca. 4 per ha and sex ratio is 1:1. Home-range sizes can more than double, and densities decrease, during periods of scarce resources, such as drought (Waterman and Fenton 2000). Home ranges of female groups may overlap slightly on edges of range, but sharing of core areas is prevented by agonistic behavior between groups (Herzig-Straschil 1979; Waterman 1995). Home ranges of male groups encompass several female groups and average 12.1 ha (Waterman 1995). Daily activity budget for time spent aboveground includes ca. 70% feeding activity, 15–20% vigilant behavior, and ca. 10% social interactions (Herzig-Straschil 1978; Waterman 1995).

Members of female social groups share feeding and sleeping ranges, display no dominance hierarchy, and interact amiably with each another (Waterman 1995). A "dominant female" was described without supporting data (Herzig-Straschil 1978). Male groups are not territorial and have frequent immigration and emigration of members. Males have a distinct linear hierarchy based on age and maintained by displacements (Waterman 1995). Male–male competition occurs, although "fighting" consists of nonviolent leaping displays from which no injuries occur (Waterman 1998). Allogrooming occurs between females and members of their social group (Herzig-Straschil 1978), between males and other males regardless of rank (Waterman 1995), and between an estrous female and males (Herzig-Straschil 1978).

When a female is in estrus, males approach, solicit, and chase to gain breeding access. Male hierarchy and female choice determine which male will copulate with an estrous female, with the dominant male usually obtaining 1st breeding (Waterman 1998). Females allow multiple copulations with the original male and subsequent males. Males attempt to disrupt copulations if they have not already copulated with that female. Mate guarding is rare; in 2 observed instances of mate guarding, each male had not yet copulated with the female they were guarding. One male achieved copulation and ceased mate guarding, while the other male left the area without copulating with the female (Waterman 1998).

In the presence of a predator, such as a snake, female and male Cape ground squirrels "mob" the predator. Multiple individuals, with tails piloerected, will lung at the snake while placing their bushy tails between the snake and their bodies. When the snake lunges, Cape ground squirrels retreat. Multiple mobbings usually drive off predators (Waterman 1995, 1997).

Vocalizations in *X. inauris* include an alarm call, described as a high-pitched whistle-like sound given in response to a perceived threat (Herzig-Straschil 1979; Zumpt 1970). The alarm call has 2 variations (Zumpt 1970). The shrill, short "bi-jo" sound indicates greatest alarm and elicites the greatest reaction from others, while the medium-pitched, "bi-joo" sound indicated a less imminent threat. Deep, aggressive growls occur during agonistic encounters between individuals (Herzig-Straschil 1979). Low "talk" chatter occurred when a Cape ground squirrel entered a colony or during feedings in captivity (Zumpt 1970). Play calls, nest-chirping, and protest squeaks are used by juvenile squirrels. Play calls are high "tschip-tschip-tschip" vocalizations given when young play and nest-chirping is a soft "mouk-mouk" sound made by captive young at the age of 1 week. Loud protest squeaks are made by young when handled by their mother or humans (Herzig-Straschil 1979).

GENETICS. Diploid number is 38. Karyotype consists of 7 metacentric and 10 submetacentric chromosome pairs and 1 acrocentric pair with distinct satellites. Submetacentric X chromosome is medium sized, and metacentric Y chromosome is relatively small (Robinson et al. 1986). Albinism occurs and was 1st observed in 1973 in western Orange Free State. This mutation causes a lack of pigmentation, resulting in pink eyes and claws, and white fur, which is softer and less bristly than normal for *X. inauris* (Straschil 1974).

REMARKS. Generic name *Xerus* is derived from the Greek *xeros*, meaning dry, probably referring to the arid regions Cape ground squirrels inhabit. Specific name *inauris* refers to their small ear pinnae. Local people commonly refer to them as bush or fantailed meerkats, vaalmeerkats, or waaiersterts (Zumpt 1970). *X. inauris* has many native names in the many languages of the region, such as: in Bechuana, Pholwána; in Berg Bamara, |Geis-ta+nab; in Herero, Erupúka-okawáka and Okapuka; in ||K'au||en and Naron Bushmen, !Naob; in Nama Hottentot, |Geis-ta+nab, |Gae+nab (Berseba), and Aguimp; and in Ovambo, Nyánga (Shortridge 1934).

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