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Acinonyx jubatus.

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Acinonyx Brookes, 1828

Felis Schreber, 1775, plate 105, 1777:392. Type species *Felis jubata*.
Acinonyx Brookes, 1828:33. Type species [*Acinonyx*] *venator*.
Cynailurus Wagler, 1830:30. Based on *Felis jubatus* Schreber.
Guepardus Duvernoy, 1834:10. Based on *Felis jubatus* Schreber.
Guepar Boitard, 1842:234. Incorrect subsequent spelling.
Cynofelis Lesson, 1842:48. Based on *Felis jubatus* Schreber.
Gueparda Gray, 1843:46. Incorrect subsequent spelling.
Cynaelurus Heuglin, 1861:14. Incorrect subsequent spelling.
Cynælurus Blanford, 1888:90. Incorrect subsequent spelling.
Geuparda Roberts, 1951:181. Incorrect subsequent spelling. Roberts attributed spelling to Layard, 1861, without further citation information.

CONTEXT AND CONTENT. Order Carnivora, family Felidae, subfamily Acinonychinae, genus *Acinonyx*. *Acinonyx* is monotypic.

Acinonyx jubatus (Schreber, 1775)

Cheetah

Felis jubatus Schreber, 1775, plate 105, 1777:392–393. Type locality "südliche Afrika; man bekömmt die Felle vom Vorgebirge der guten Hofnung."
[*Felis*] *iubata* Erxleben, 1777:510. Incorrect subsequent spelling.
Felis guttata Hermann, 1804:38. Type locality not specified.
Felis venatica Griffith, 1821:93. Type locality not specified.
[*Acinonyx*] *venator* Brookes, 1828:33. Type locality not specified.
Cynailurus jubatus: Wagler, 1830:30. Name combination.
Felis fearonii Smith, 1834:245. Type locality not specified: "inhabits Southern Africa, . . . North-east of Natal."
Guepardus jubatus: Duvernoy, 1834:10. Name combination.
Guepardus guttatus: Duvernoy, 1834:10. Name combination.
Guepar jubatus: Boitard, 1842:234. Name combination.
Cynofelis jubata: Lesson, 1842:49. Name combination.
Cynofelis guttata: Lesson, 1842:49. Name combination.
Gueparda jubata: Gray, 1843:46. Name combination.
Felis jubata senegalensis Blainville, 1843, plate 9 [indexed as plate 10]. Type locality "Senegal," preoccupied by *Felis leo senegalensis* Meyer, 1826:6.
Cynailurus soemmeringii Fitzinger, 1855:245. Type locality "Steppen der Kababish im Süden der Bajuda-Wüste."
Cynaelurus guttatus: Heuglin, 1861:14. Name combination.
Felis megabalica Heuglin, 1863:23. Type locality not specified.
Gueparda guttata: Gray, 1867:277. Name combination.
Felis megaballa Heuglin, 1868:53. Incorrect subsequent spelling.
Felis fearonis Fitzinger, 1869:664. Incorrect subsequent spelling of *F. fearonii* A. Smith.
Felis lanea P. L. Sclater, 1877:532. Type locality "Beaufort West in the Cape Colony."
C[*ynælurus*]. *jubatus*: Blanford, 1888:90. Name combination.
C[*ynælurus*]. *laneus*: Blanford, 1888:90. Name combination.
Cynælurus jubata Mivart, 1900:429. Incorrect subsequent spelling.
Cynælurus lanea Mivart, 1900:430. Incorrect subsequent spelling.
C[*ynailurus*]. *guttatus*: Hollister, 1911:225. Name combination.
Acinonyx guepard Hilzheimer, 1913:283. Unjustified replacement name for *Acinonyx venator* Brookes.
Acinonyx guttatus ngorongorensis Hilzheimer, 1913:290. Type locality "Ngorongoro."
Acinonyx guttatus obergi Hilzheimer, 1913:288–289. Type locality "Keetmannshoop."
Acinonyx raddei Hilzheimer, 1913:291. Type locality unclear.
Acinonyx wagneri Hilzheimer, 1913:285. Nomen nudem (Rosevear 1974).
Acinonyx hecki Hilzheimer, 1913, figure 1, 287–288. Type locality "Senegal."
Acinonyx jubatus velox Heller, 1913:7. Type locality "Loita Plains, British East Africa."
Acinonyx jubatus raineyi Heller, 1913:9. Type locality "Ulu, Kapiti Plains, British East Africa."
Acinonyx obergi: Zukowsky, 1924:45. Elevation to species rank.
Acinonyx rex Pocock, 1927:245, 250. Type locality "Umvukwe Range, northwest of Salisbury, Rhodesia."

CONTEXT AND CONTENT. As above. Fitzinger (1869) lists other synonyms that could not be validated. Hilzheimer's (1913) taxa derive from specimens in zoos. *A. jubatus* (Fig. 1) has 5 subspecies (Meester 1971).

A. j. hecki Hilzheimer, 1913, figure 1, 287–288, see above; *senegalensis* (Blainville) is a synonym.
A. j. jubatus (Schreber, 1775, plate 105, 1777:392), see above; *fearonii* (Smith), *fearonis* (Fitzinger), *guttata* (Hermann), *iubata* (Erxleben), *lanea* (Sclater), *obergi* Hilzheimer, and *rex* Pocock are synonyms.
A. j. raineyi Heller, 1913:9, see above; *ngorongnorensis* Hilzheimer and *velox* Heller are synonyms.
A. j. soemmeringii (Fitzinger, 1855:245), see above.
A. j. venaticus (Griffith, 1821:93), see above; *guepard* Hilzheimer, *raddei* Hilzheimer, and *venator* Brookes are synonyms.

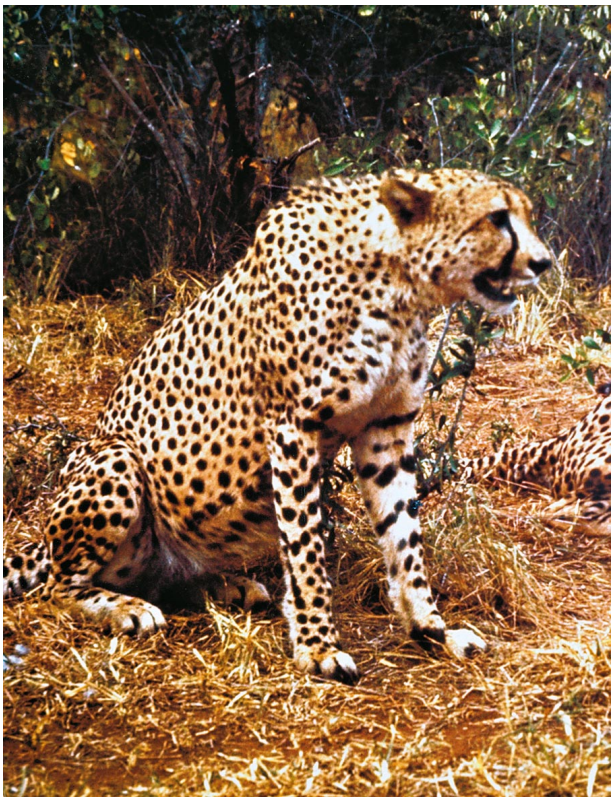

FIG. 1. Adult *Acinonyx jubatus*. Used with permission of the photographer Duncan MacFadyen.

FIG. 2. Dorsal, ventral, and lateral views of cranium and lateral view of mandible of *Acinonyx jubatus* (Chicago Field Museum 34669). Greatest length of cranium is 180 mm.

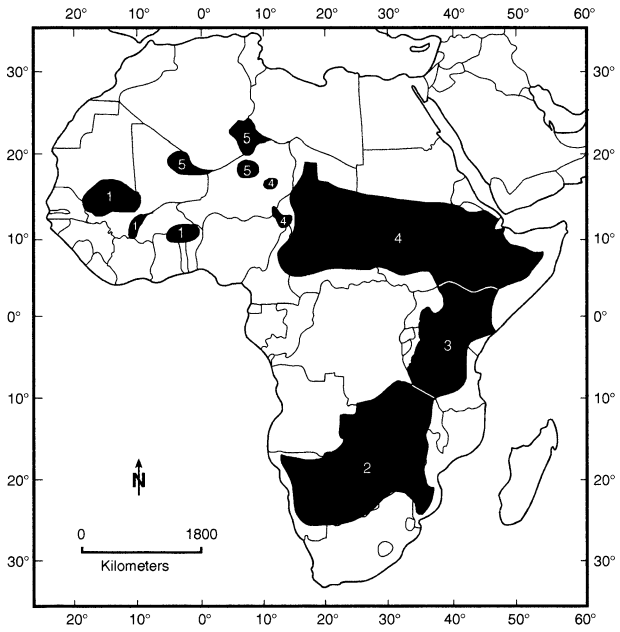

FIG. 3. Distributions of the 5 subspecies of *Acinonyx jubatus*: 1, *A. j. hecki*; 2, *A. j. jubatus*; 3, *A. j. raineyi*; 4, *A. j. soemmerringii*; and 5, *A. j. venaticus*.

DIAGNOSIS. *Acinonyx jubatus* is similar in size (60 captive males, X mass = 40.2 kg; 68 captive females, X mass = 35.0 kg—Caro 1994) to leopards (*Panthera pardus*) and cougars (*Puma concolor*—Caro 1994). However, cheetahs cannot be confused with other cats. Each cheetah has a unique arrangement of spots on face and body and a tear streak extending from the corner of the eye to the upper lip behind canines (Caro 1994; Mivart 1900). Lepoards do not have the tear streak and cougars do not have spots or the tear streak.

GENERAL CHARACTERS. Pelage is pale yellow, gray, or fawn on upper parts (Kitchener 1991) and is covered with small round black spots set closely together and not arranged in rosettes (Nowak 1999). Underparts are paler, often white. A pronounced lachrymal or tear stripe runs from anterior corner of eye down beside muzzle (Kitchener 1991). Ears are small and round with a black patch on back side (Eaton 1982) but tawny at base and edges. Tail is spotted above and pale below with a white tip. Last one-third of tail has a series of black rings (Nowak 1999). Coat is coarse and hair is somewhat longer on nape than elsewhere, forming a short mane (Nowak 1999). In young cubs, mane is much more pronounced and extends over head, neck, and back (Nowak 1999). Cubs are covered in a long, woolly, bluish-gray mane that makes them less conspicuous to predators on open savanna (Kitchener 1991). Cubs have uniform, gray, long hair with spots visible on underfur.

Acinonyx jubatus has a slim body; very long legs; and a small, rounded head with short ears. Pupil of eye is circular when contracted (Lydekker 1895). Paws are narrow compared with those of other cats (Nowak 1999). Claws are blunt and slightly curved. *A. jubatus* has weakly retractile claws that have no skin folds to protect them.

Skull is vaulted and raised high above muzzle and cranium (Fig. 2). Skull is short and broad with enlarged nasal openings. Nasals are short and broad dorsally, and bony palate extends well behind molars. Unlike most other members of the Felidae, *A. jubatus* has very large nasal passages. Bullae are relatively small with strong paroccipital process that jut ventrally (Roberts 1951).

Average external measurements (in mm) of 10 free-living male (mean ± *SD*) and 7 female *A. jubatus* from Serengeti National Park, Tanzania, respectively, are: length of nose to anus, 123.3 ± 60, 135.3 ± 28.2; length of tail, 68.3 ± 2.3, 63.6 ± 4.9; length of hind foot, 28.0 ± 1.4, 27.1 ± 0.7; body mass (kg), 42.3 ± 5.6, 37.9 ± 4.8 (Caro et al. 1987). Shoulder height ranges from 700 to 900 mm (Nowak 1999). Average cranial measurements with parenthetical sample sizes (in mm) for males and females, respectively, are: width of incisors, 9.9 (6), 9.6 (5); width of incisors plus canines, 26.4 (11), 25.2 (8); width of nasals, 15.8 (11), 15.9 (8); width of maxilla, 41.2 (11), 39.4 (7); width of zygomatic arch, 60.0 (11), 56.5 (6); bullar length, 2.71 (10), 2.59 (8); bullar width, 1.71 (10), 1.62 (8); depth of skull, 6.86 (10), 6.48 (8); length of upper toothrow, 5.08 (11), 5.03 (7); length of mandible, 12.21 (10), 11.35 (8); and length of lower toothrow, 6.11 (9), 5.98 (8). Depth of skull and length of mandible are significantly larger in males (Wayne et al. 1986).

DISTRIBUTION. *Acinonyx jubatus* had a very wide distribution from the open grasslands of central India through southwestern Asia, Arabia, and throughout Africa (Fig. 3) where suitable, open habitats were available (Kitchener 1991; Turner 1997) and may have included the arid and semiarid regions of south, east, and north Africa and less arid areas in India, Russian Turkestan, Syria, Palestine, and Arabia (Eaton 1982). By the 1970s the dis-

tribution of cheetah was greatly reduced, and surveys indicate that cheetah survive in 25 African countries (Caro 1994; Myers 1975). Only Botswana, Namibia, and Kenya had populations of >2,000 individuals.

FOSSIL RECORD. Early fossil records of *A. jubatus* are from the Olduvai I bed, east Africa (northern Tanzania) in the lower Pleistocene fauna fossils (Hopwood 1951). The oldest cheetah fossils are from eastern and southern Africa from $3.5–3.0 \times 10^6$ years ago (Turner 1997).

Paleoecological records show that cheetahlike cats ranged across Asia, Africa, and North America as recently as 10,000 years ago (Kurtén 1968). At least 2 other species of Old World cheetahs might have existed at the same time (Caro 1994). *Acinonyx pardinensis* (ca. 95 kg) occurred in Eurasia and east and south Africa during the Villafranchian period, $1.9–3.8 \times 10^6$ years ago, earlier than suggested by the molecular phylogeny, and a smaller form, *A. intermedius*, found in the mid-Pleistocene, extended from Europe eastward to China (Caro 1994). *A. pardinensis* was larger and less cursorial than modern cheetahs and spread throughout the Old World.

American cheetahlike cats have been assigned to *Acinonyx*, *Felis*, and *Puma*, but a recent cladistic study (Van Valkenburg et al. 1990) places these large, long-limbed cats in the genus *Miracinonyx*. Two species are recognized: *M. inexpectata* and *M. trumani*. *M. inexpectata* includes a nearly complete skeleton from Hamilton Cave, West Virginia. The proportions were intermediate between extant cheetah and puma but larger with fully retractile claws. *M. trumani* was described from hundreds of bones from Natural Trap Cave, Wyoming (Adams 1979). The bones were larger but otherwise similar to *A. jubatus*. Thus, cheetah may have originated in North America and dispersed to Eurasia and Africa (Turner 1997).

FORM AND FUNCTION. The pelage of *A. jubatus* insulates the body from temperature changes, whereas the color and pattern of spots conceal cheetahs from prey in the open habitats where it hunts.

Cheetahs have a high concentration of nerve cells leading to the optic nerve. The concentrated band of nerve cells is called the visual streak and increases the visual acuity of cheetahs. This allows them to detect prey moving against the horizon in open habitats (Kitchener 1991).

Skull is high in proportion to its length (Mivart 1900). Cheetahs have a high proportion of temporalis muscle fibers that pull horizontally. This is offset with short canines and thus, smaller opening of the jaws when a killing bite is delivered (Ewer 1973). Infraorbital canal of cheetahs is extremely small (Mazak 1968; Pocock 1951), and nerves from tactile receptors at bases of vibrissae run through it.

Brain is considerably convoluted and corpus albicans is divided into 2 corpora mammillaria (Mivart 1900). Nasals are short. Nasal passages are large with 1 infraorbital foramen on each side (Kitchener 1991; Mivart 1900). Nasal aperture is bounded on either side by roots of upper canines; reduction in the size of the teeth permits the enlarged aperture.

Dental formula is i 3/3, c 1/1, p 3/2, m 1/1, total 30 (p2 may be absent in some individuals—Nowak 1999). The small upper molar is visible when skull is in profile. Second premolar (p3) is large and projects downward as much as the carnassial or p4 (Mivart 1900). Cheek teeth are narrow and bladelike for slicing flesh. Canines are small and flattened (Ewer 1973).

Whiskers of *A. jubatus* are fewer compared with those of other cats (Ewer 1973). A cheetah's larynx has divided thyroarytenoid folds with a depression between the rostral and caudal folds and a vocal fold with a sharp edge that does not allow the cheetah to roar (Hast 1989).

Respiratory tracts of *A. jubatus* have a wide cross section, particularly the nasal cavities and connecting passages to pharynx and to trachea. This facilitates movement of air during breathing (Grzimek 1990). Enlargement of these connecting tracts is one of the primary reasons for the pronounced bulging of the skull. The cheetah has a relatively small heart that pumps only a small amount of blood. Hunting by cheetahs involves a high speed chase to run down their prey and a throat bite to suffocate the prey. Wide and large nasal passages help increase the concentration of oxygen in the blood during prey suffocation, allowing the cheetah to regain its breath after capture (Kitchener 1991). The short canines of the cheetah are used to make a throat bite, which occludes the prey's trachea leading to suffocation, essential for dispatching medium-sized prey (Ewer 1973; Kitchener 1991).

Cheetahs are digitigrade. Hind limbs are longer than forelimbs. Radius, ulna, tibia, fibula, metacarpals, and metatarsals of lower leg are elongated for increased stride length (Kitchener 1991). Tibia and fibula are firmly bound together with fibrous tissue that allows very little rotation about lower leg (Ewer 1973). Back tends to hang slightly when standing (Kingdon 1977). While running, flexing and straightening of the vertebrae column increases stride length (Hildebrand 1961). Tail is long and used as a counterbalance when turning at high speeds (Kitchener 1991). Cheetahs have a preponderance of fast-twitch fibers in the locomotor muscles (83% of the vastus lateralis and ca. 61% of the gastrocnemius). Locomotor muscles of cheetahs are capable of anerobically based exercise (Williams et al. 1997).

Cheetahs use their claws as running spikes to increase their grip while pursuing their prey (Kitchener 1991). Cheetahs have very firm foot pads due to running on firm ground. Ridges, which act like the tread on car tires, run along foot pads (Ewer 1973).

ONTOGENY AND REPRODUCTION. Female *A. jubatus* are polyestrus and cycle ca. every 12 days (range, 3–27 days) in captivity. Females may be receptive from 1 to 14 days (Caro 1994). Cheetahs are induced ovulators and evidence for seasonal breeding is weak (Caro 1994). Females reproduce at 13–16 months of age (Wrogemann 1975) with an average age of sexual maturity between 21 and 22 months (Kitchener 1991). Copulation frequency for cheetahs is 3–5 times per day (Kitchener 1991).

Mean motile sperm per ejaculate (25.3×10^6—O'Brien et al. 1985) and circulating testosterone levels are generally lower for male *A. jubatus* < 5 years of age, although captive males have sired offspring in their 3rd year of life (Caro 1994). A high proportion of spermatozoa have abnormalities (Caro 1994).

Gestation is 90–95 days (Caro 1994; Kitchener 1991). Births occurred during January–August in east Africa, November–January in Namibia, and November–March in Zambia (Nowak 1999). From 1969 to 1994 in the Serengeti Plains, Tanzania, females gave birth to their 1st litter at ca. 2.4 years, interbirth interval was 20.1 months, and mean litter size was 2.1 cubs (Kelly et al. 1998). Average longevity of females that survived to independence (i.e., remain with mothers) was 6.2 years. Minimum male longevity was 2.8 years for those born in the study area, but 5.3 years for immigrants (Kelly et al. 1998).

Litter size can be up to 8 but 6 young are normally the most that emerge from the lair in the wild (Caro 1994; Caro et al. 1987). Females produced an average of 1.7 young to independence and mean reproductive rates were 0.36 young per year, or 0.17 litters per year at independence in Tanzania (Kelley et al. 1998). At birth, young weigh 250–300 g (Kitchener 1991), but can average 463 g in captivity (Wack et al. 1991). Young remain in a lair (usually in a marsh, tall vegetation, or a rocky outcrop) for ca. 8 weeks and may be carried to new lairs during this period (Laurenson 1993). Young open their eyes after 4–11 days and begin walking after 12–13 days (Kitchener 1991).

Young have a thick covering of long, bluish-gray or smoky-gray hair that appears on nape, shoulders, and back soon after birth. The function of this seems to be camouflage from predators. Infant hair disappears after ca. 3 months of age but a short mane is retained into adolescence and for longer in some individuals (Caro 1994). Milk or deciduous teeth erupt between 3 and 6 weeks (Broom 1949) and are replaced by permanent teeth at ca. 8 months of age (Caro 1994). Young are weaned at 3–6 months. Young may not separate from their mother until they are 15–17 months old (Caro 1994; Eaton 1974).

ECOLOGY. In India, cheetahs occur in dense, forest regions and in South Africa in open or lightly forested, grassy country (Eaton 1982). In southwest Africa, cheetahs occur on stony ridges; stony ridges in the sand veld; and less frequently in dense bush country or thick, dry forest, montane moorlands, or swamps (Eaton 1982). Ca. 6,000–15,000 cheetahs occur worldwide (Caro 1994).

Diet of cheetahs consists mainly of gazelles (*Gazella*), impalas (*Aepyceros melampus*), other small and medium-sized ungulates, and calves of large ungulates (Myers 1975). A female with cubs may kill such an animal every day, whereas lone adults hunt every

2–5 days (Myers 1975). Hares, other small mammals, and birds are sometimes taken. Cheetahs generally eat their prey where killed, prefer the blood and the entrails, and often do not touch the rest of the carcass (Denis 1964). Cheetahs rarely return to a previous day's kill (Denis 1964).

Cheetahs are mainly diurnal, hunting principally at dawn and dusk (Denis 1964). They do not conceal their food or scavenge (Myers 1974).

Animals in 3 separate age–sex classes may live either alone or in groups, including females and mothers with young, independent adolescents, and males (Caro 1994). Groups tend to be composed of females with young or 2–4 related adult males (Nowak 1999). Male coalitions commonly defend a territory against other males, perhaps facilitating access to prey and mates (Caro and Collins 1987). Although increased coalition size results in greater per capita foraging returns, group size has far greater impact on reproductive success through its effect on intraspecific competition between males (Caro 1994). Groups avoid each other and mark the area they are using. Marking is accomplished by regular urination on prominent objects (Nowak 1999). Fighting among males is not common and deaths due to fighting are rare (Eaton 1982).

Cheetahs in groups are less likely to be harassed by spotted hyenas (*Crocuta crocuta*) and by male cheetahs than are single cheetahs, lowering the chances of group members being injured by these predators (Caro 1994). Cheetah may be preyed upon by lions (*Panthera leo*) and leopards (Eaton 1982).

Cheetahs have the highest juvenile mortality (71%) yet recorded for nonhunted populations of cats in the wild (Caro 1994). Predation on cheetah young is the most important natural limiting factor on cheetahs. Disease in captive cheetahs includes cirrhosis of the liver and other liver diseases, feline distemper, pneumonia and other bronchial diseases, rickets, and tuberculosis (Eaton 1982).

Since the 1600s, humans tamed some cheetahs to run down game (Nowak 1999) in ancient Assyria, Egypt, and Sumeria, and more recently this was done by the royalty of Europe and India. If the hunt was successful, the cheetah was rewarded with a portion of the kill. Tame individuals are usually playful and affectionate (Nowak 1999).

The principal threats to free-living cheetahs in the wild come from habitat destruction, loss of prey, and direct persecution. Cheetahs are hunted where cattle are raised and are shot as vermin in Namibia and Zimbabwe. The fur fashions of past years almost led to their extinction (Grzimek 1990). In Kenya, scattered evidence suggests cheetah numbers are stable rather than declining in the last decade (Gros 1998). The cheetah has disappeared in Asia, except for Iran and possibly adjacent parts of Afghanistan, Pakistan, and Russian Turkestan. The cheetah is now strictly protected throughout its remaining range, but those animals outside protected areas are experiencing progressive habitat loss.

Cheetahs breed in captivity, but the number of animals producing offspring is low and infant mortality is high (Caro 1994). Reintroductions are extremely successful in protected areas within their former range that do not have lions or spotted hyenas and result in rapid population growth. For example, 6 introduced cheetahs increased to 17 within 1 year, and 8 introduced cheetahs increased to 24 within 2 years in Pilansberg National Park, Bophuthatswana, South Africa, and Suikerbosrand Nature Reserve, respectively. Cheetahs possess traits associated with the successful reintroductions of other species: they are amenable to behavioral manipulation, have a broad diet, exploit new areas, and are euryaceous (Stanley Price 1989).

Cheetahs can be located by radiocollars and direct sighting, such as searching in the vicinity of alert prey or carcass remains. Details of capture, censusing, recording, sampling techniques, and tracking are available (Caro 1994; Eaton 1982).

BEHAVIOR. *Acinonyx jubatus* is normally amicable toward conspecifics, but several males sometimes gather near and fight over an estrous female (Nowak 1999). Vocalizations include antagonistic vocalizations, purrs of contentment, a chirping sound made by a female to its young, and an explosive yelp that can be heard from 2 km away.

Density of female cheetahs is high where cover is abundant and where high concentrations of Thomson's gazelles aggregate during the course of their migration. Females also can be found feeding on small clusters of gazelles in areas of localized rainfall. Idiosyncratic movements of females within their home ranges make female concentrations somewhat unpredictable (Caro 1994). Depending on the movement patterns of females, males may hold territories or roam in search of females (Caro 1994). Adult nonresidents occur inside and outside of territories, but adolescent males and single floating males tend to stay outside of territorial boundaries (Caro 1994).

Hunting typically involves stalking of prey and an open, high-speed pursuit from 100–300 m away, but is seldom successful if >200 m. Once prey is overtaken it is usually knocked down by the force of the cheetah's charge and then seized by the throat and strangled. Cheetahs use an enlarged dew claw to facilitate the take-down of prey. Young learn hunting techniques from the mother. At independence, their abilities to chase prey at high speed and knock it over are poorly developed (Caro 1994). Factors related to hunting success include prey characteristics (species, sex, age, and condition), herd size, cover type, prey responses before attack, prey responses during attack, number of hunting cheetahs, length of cheetah's attack, cheetah–prey distance when prey begin running, and cheetah–prey distance when cheetah attacked (Eaton 1970, 1982). Adult cheetah have the highest running speed recorded reliably for any animal (29 m/s or 64 miles/h—Sharp 1997). Cheetah can only maintain these speeds for ca. 500 m (Schaller 1972).

Offspring generally accompany their mother on most hunts but with increasing frequency as they grow older (Caro 1994). The adult female cheetah is necessary for young to learn to catch and kill prey (Eaton 1982). Cheetah females encourage their young of 5 months to capture prey by releasing live prey for them to kill (Caro 1994). When cheetah cubs play, the distance they chased each other and their success in catching each other increased with age but their ability to remain concealed during play stalks and crouches did not improve with age (Caro 1995).

GENETICS. The 2N = 38. Fifty-five cheetahs from Transvaal and in Namibia had no genetic variation at each of 47 allozyme loci (O'Brien et al. 1983a, 1983b). Electrophoretic studies, reproductive surveys, experiments using reciprocal skin grafts, and analyses of the major histocompatibility complex also show extreme lack of genetic variability (Caro 1994; Yuhki and O'Brien 1990). Genetic monomorphism results in spermatozoal abnormalities and difficulty with captive breeding (O'Brien et al. 1985, 1987). DNA analyses date the genetic monomorphism to ca. 10,000 years ago (Menotti-Raymond and O'Brien 1993) because of population bottlenecks in the Pleistocene (O'Brien et al. 1987) or to interchange between subpopulations equivalent to panmictic breeding (Caro 1994; O'Brien et al. 1987). Consequences of reduced genetic variability may be increased juvenile mortality and susceptibility to disease. However, increased mortality of young would not be expected in species purged of deleterious recessives (Caro 1994).

CONSERVATION STATUS. The International Union for Conservation of Nature and Natural Resources classifies the cheetah as vulnerable and the Asiatic subspecies (*A. j. venaticus*) as endangered. The entire species is listed as endangered by the United States Department of the Interior, Fish and Wildlife Service, and is on appendix 1 of the Convention of International Trade in Endangered Species (CITES 1982).

REMARKS. The derivation of cheetah is from the Hindu chita (Skinner and Smithers 1990). The etymology of *Acinonyx jubatus* is Latin and Greek. *Acin* is Latin, meaning a berry; and *onyx* is Greek, meaning a claw. *Acinonyx* could have been derived from the Greek prefix *a* and *kineo* (to move) in reference to the cheetah's nonretractable claws (Caro 1994). The species name is Latin and refers to a mane or crest that is apparent in young individuals and some adults (Caro 1994). Hunting leopard is also a common name.

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LITERATURE CITED

Adams, D. B. 1979. The cheetah: native American. Science 205: 1155–1158.

Blainville, H. M. D. de. 1843. Ostéographie ou description iconographique comparée du squelette et du système dentaire des mammifères récents et fossils pour servir de base à la

zoologie et la géologie. Volume 2. J. B. Baillière et Fils, Paris, France.

BLANFORD, W. T. 1888–1891. The fauna of British India, including Ceylon and Burma. Mammalia. Taylor and Francis, London, United Kingdom.

BOITARD, P. 1842. Le jardin des plantes descripion et moeurs des mammifères de la ménagerie et du muséum d'histoere naturelle. J. J. Dubochet, Paris, France.

BROOKES, J. 1828. A catalogue of the anatomical and zoological museum of Joshua Brookes, Esq., F.R.S. F.L.S. &c. Richard Taylor, London, United Kingdom.

BROOM, R. 1949. Notes on the milk dentition of the lion, leopard and cheetah. Annals Transvaal Museum 21:183–185.

CARO, T. M. 1994. Cheetahs of the Serengeti Plains: group living in an asocial species. University of Chicago Press, Illinois.

CARO, T. M. 1995. Short-term costs and correlates of play in cheetahs. Animal Behaviour 49:333–345.

CARO, T. M., AND D. A. COLLINS. 1987. Ecological characteristics of territories of male cheetahs (*Acinonyx jubatus*). Journal of Zoology (London) 211:89–105.

CARO, T. M., M. E. HOLT, C. D. FITZGIBBON, M. BUSH, C. M. HAWKEY, AND R. A. KOCK. 1987. Health of adult free-living cheetahs. Journal of Zoology (London) 212:573–584.

CONVENTION OF INTERNATIONAL TRADE IN ENDANGERED SPECIES (CITES). 1982. Quotas for trade in specimens of cheetah. Eighth meeting of the CITES of Wild Flora and Fauna. Document 8. 22:1–5.

DENIS, A. 1964. Cats of the world. Riverside Press, Cambridge, London, United Kingdom.

DUVERNOY, G. L. 1834. Notice critique sur les espèces de grands chats nommées, par Hermann: *Felis chalybeate* et *guttata*. Société d'Histoire Naturelle de Strasbourg, France.

EATON, R. L. 1970. Hunting behavior of the cheetah. Journal of Wildlife Management 34:56–67.

EATON, R. L. 1974. The cheetah. Van Nostrand Reinhold, New York.

EATON, R. L. 1982. The cheetah: the biology, ecology, and behavior of an endangered species. Robert E. Krieger Publishing Company, Malabra, Florida.

ERXLEBEN, J. C. P. 1777. Systema regni animalis per classes ordines, genera, species, varietates: cum synonymia et historia animalium. Classis I. Mammalia. Weygandianis, Leipzig, Germany.

EWER, R. F. 1973. The carnivores. Weidenfeld and Nicolson, London, United Kingdom.

FITZINGER, L. 1855. Bericht an die kaiserl. Academie der Wissenschaften über die von dem Herrn Consulatsverweser Dr. Theodor v. Heuglin für die kaiserliche Menagerie zu Schönbrunn mitgebrachten lebenden Thiere. Sitzungsberichte der kaiserlichen Akademie der Wissenschaften. Mathematisch-Naturwissenschaftliche Classe 17:242–253.

FITZINGER, L. J. 1869. Revision der sur natürlichen Familie der Katzen (*Feles*) gehörigen Formen. Abtheilung III. Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften, Mathematisch-Naturwissenschaftlichen Classe 59(1):629–716.

GRAY, J. E. 1843. List of the specimens of Mammalia in the collection of the British Museum. Trustees of the British Museum, London, United Kingdom.

GRAY, J. E. 1867. Notes on the skull of the cats (Felidae). Proceedings of the Zoological Society of London 1867:258–277.

GRIFFITH, E. 1821. General and particular descriptions of the vertebrated animals, arranged conformably to the modern discoveries and improvements in zoology [also titled Clafs quadrimembria, order Carnivora, general and particular descriptions of carnivorous animals]. Baldwin, Cradock, and Joy, London, United Kingdom.

GROS, P. M. 1998. Status of the cheetah *Acinonyx jubatus* in Kenya: a field interview assessment. Biological Conservation 85:137–149.

GRZIMEK, B. 1990. Grzimek's encyclopedia of mammals. Volume 5. McGraw-Hill, New York.

HAST, M. H. 1989. The larynx of roaring and non-roaring cats. Journal of Anatomy 163:117–121.

HELLER, E. 1913. New races of carnivores and baboons from equatorial Africa and Abyssinia. Smithsonian Miscellaneous Collections 61(19):1–12.

HERMANN, J. 1804. Observationes zoologicae quibus novae complures, aliaeque animalium species describuntur et illustrantur. A. Koenig, Paris, France.

HEUGLIN, T., VON. 1861. Forschungen über die Fauna des Rothen Meeres und der Somali-Küste. Ein systematisches Verzeichniss der Säugerthiere und Vögel, welche in diesen Regionen bisher beobachtet worden sind, mit Rüchsicht auf geogr. Petermann's Mittheilungen aus Justus Perthes' Geographischer Anstalt über Wichtige Neue Erforschungen auf dem Gesammtgebiete der Geographie. Justus Perthes, Gotha, Germany.

HEUGLIN, T., VON. 1863. Über katzenartige Raubthiere des obern Nilgebietes. Verhandlungen der Kaiserlichen Leopoldino-Carolinischen Duetschen Akademie der Naturforscher 4(3):22–23.

HEUGLIN, T., VON. 1868. [Title unknown]. Zeitschrift für Allgemeine Erdkunde 3:53 (not seen, cited in Lydekker 1895:202).

HILDEBRAND, M. 1961. Further studies on locomotion of the cheetah. Journal of Mammalogy 42:84–91.

HILZHEIMER, M. 1913. Über neue Gepparden nebst Bemerkungen über die Nomenklatur dieser Tiere. Sitzungsbericht der Gesellschaft Naturforschender Freunde zu Berlin 5:283–292.

HOLLISTER, N. 1911. The nomenclature of the cheetahs. Proceedings of the Biological Society of Washington 24:225–226.

HOPWOOD, A. T. 1951. The Olduvai fauna. Pp. 20–25 in Olduvai gorge: a report on the evolution of the hand axe culture in beds I–IV (L. B. S. Leakey, ed.). Cambridge University Press, Cambridge, United Kingdom.

KELLY, M. J., ET AL. 1998. Demography of the Serengeti cheetah (*Acinonyx jubatus*) population: the first 25 years. Journal of Zoology (London) 244:473–488.

KINGDON, J. 1977. East African mammals: an atlas of evolution in Africa. Volume 3A. Academic Press, London, United Kingdom.

KITCHENER, A. 1991. The natural history of the wild cats. Christopher Helm, A. and C. Black, London, United Kingdom.

KURTÉN, B. 1968. Pleistocene mammals of Europe. Weidenfeld and Nicholson, London, United Kingdom.

LAURENSON, M. K. 1993. Early maternal behavior of wild cheetahs: implications for captive husbandry. Zoo Biology 12:31–43.

LESSON, R. P. 1842. Nouveau tableau du règne animal. Arthus Bertrand, Paris, France.

LYDEKKER, R. 1895. A handbook to the Carnivora. Part I. Cats, civets, and mungooses. W. H. Allen and Company, London, United Kingdom.

MAZAK, V. 1968. Notes sur les caracteres craniens de la sous-famille des Pantherinae (Carnivora; Felidae). Mammalia 32: 670–676.

MEESTER, J. 1971. The mammals of Africa: an identification manual. Smithsonian Institution Press, Washington, D.C.

MENOTTI-RAYMOND, M., AND S. J. O'BRIEN. 1993. Dating the genetic bottleneck of the African cheetah. Proceedings of the National Academy of Sciences USA 90:3172–3176.

MEYER, J. N. 1826. Dissertatio inauguralis anatomico-medica de genere felium. Doctor of Medicine dissertation, University of Vienna, Austria, 62 pp.

MIVART, ST. G. J. 1900. The cat: an introduction to the study of backboned animals especially mammals. Charles Scribner's Sons, New York.

MYERS, N. 1974. Status of the leopard and cheetah in Africa. Proceedings of an International Symposium on the World's Cats 3:53–69.

MYERS, N. 1975. The cheetah *Acinonyx jubatus* in Africa. International Union of the Conservation of Nature Monograph 4:9–90.

NOWAK, R. N. 1999. Walker's mammals of the world. Sixth edition. Johns Hopkins University Press, Baltimore, Maryland.

O'BRIEN, S. J., ET AL. 1987. East African cheetahs: evidence for two population bottlenecks? Proceedings of the National Academy of Sciences USA 84:508–511.

O'BRIEN, S. J., D. E. WILDT, G. GOLDMAN, C. R. MERRIL, AND M. BUSH. 1983a. The cheetah is depauperate in genetic variation. Science 221:459–462.

O'BRIEN, S. J., ET AL. 1983b. The South African cheetah: a multidisciplinary approach reveals a provocative genetic status and natural history. Proceedings of the American Association of Zoo Veterinarians 1983:16.

O'Brien, S. J., et al. 1985. Genetic basis for species vulnerability in the cheetah. Science 227:1428–1434.

Pocock, R. I. 1927. Description of a new species of cheetah (*Acinonyx*). Proceedings of the Zoological Society of London 18:245–252.

Pocock, R. I. 1951. Catalogue of the genus *Felis*. Trustees of the British Museum, London, United Kingdom.

Roberts, A. 1951. The mammals of South Africa. Hafner Publishing Co., New York.

Rosevear, D. R. 1974. The carnivores of West Africa. British Museum (Natural History), London, United Kingdom.

Schaller, G. B. 1972. The Serengeti lion; a study of predator–prey relations. University of Chicago Press, Illinois.

Schreber, J. C. D. 1775, 1777. Die Säugthiere in Abbildungen nach der Natur mit Beschreibungen. Walther, Erlangen, Germany 3:281–590, plates 81–165.

Sclater, P. L. 1877. [No title]. Proceedings of the Zoological Society of London 1877:530–533.

Sharp, N. C. C. C. 1997. Timed running speed of a cheetah (*Acinonyx jubatus*). Journal of Zoology (London) 241:493–494.

Skinner, J. D., and H. N. Smithers. 1990. The mammals of the southern African subregion. University of Pretoria, Republic of South Africa.

Smith, A. 1833–1835. An epitome of African zoology; or, a concise description of the objects of the animal kingdom inhabiting Africa, its islands and seas. Part 1. Mammalia. South African Quarterly Journal 2:16–32, 49–64, 81–96, 113–128, 145–160, 169–192, 209–224, 233–248.

Smithers, R. H. N. 1971. Family Felidae. P. 10. in The mammals of Africa (J. Meester and H. W. Setzer). Part 8.1. Smithsonian Institution Press, Washington, D.C.

Stanley Price, M. R. 1989. Animal re-introductions: the Arabian oryx in Oman, Cambridge University Press, United Kingdom.

Turner, A. 1997. The big cats and their fossil relatives. Columbia University Press, New York.

Van Valkenburgh, B., F. Grady, and B. Kurten. 1990. The Plio–Pleistocene cheetah-like cat *Miracinonyx inexpectatus* of North America. Journal of Vertebrate Paleontology 10:434–454.

Wack, R. F., L. W. Kramer, W. Cupps, and P. Currie. 1991. Growth rate of 21 captive-born, mother-raised cheetah cubs. Zoo Biology 10:273–276.

Wagler, J. 1830. Natürliches System der Amphibien, mit vorangehender Classification der Säugthiere und Vögel. J. G. Cotta'schen Buchhandlung, Munich, Germany.

Wayne, R. K., W. S. Modi, and S. J. O'Brien. 1986. Morphological variability and asymmetry in the cheetah (*Acinonyx jubatus*), a genetically uniform species. Evolution 40:78–85.

Williams, T. M., G. P. Dodson, O. Mathieu-Costello, D. Morsbach, M. B. Worley, and J. A. Phillips. 1997. Skeletal muscle histology and biochemistry of an elite sprinter, the African cheetah. Journal of Comparative Physiology, B. Biochemical, Systemic, and Environmental Physiology 167:527–535.

Wrogemann, N. 1975. Cheetah under the sun. McGraw-Hill, New York.

Yuhki, N., and S. J. O'Brien. 1990. DNA variation of the mammalian major histocompatability complex reflects genomic diversity and population history. Proceedings of the National Academy of Sciences USA 87:836–840.

Zukowsky, L. 1924. Beitrag zur Kenntnis der Säugetiere der nördlichen Teile Deutsch-Südwestafrikas unter besonderer Berücksichtigung des Groβwildes. Archiv für Naturgeschichte 90(1):29–164.

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