## Subgenus *Asinus*
## African Wild Ass

*Asinus* Gray, 1824. *Zool. Journ.* 1: 244.

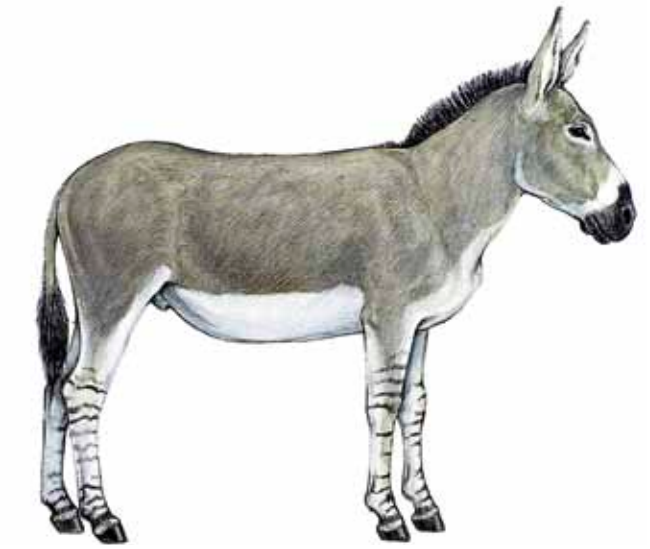
The subgenus *Asinus* embraces both the true ass, which is exclusively African (although also claimed from archaeological deposits in the south-western Arabian peninsula) and the Asiatic hemiones, kiangs and onagers. All species inhabit sandy and stony deserts and show some specialization of the hooves, apparently for the particularly tough wear that lower limbs must endure from consistently hard, unyielding substrates. The metacarpus is short compared with the metatarsus, and the biischial breadth is high compared with the biacetabular. The hoof itself is vertical-sided and leaves a distinctive track. The Asiatic asses (sometimes included in the subgenus *Hemionus*; Groves 2002) have somewhat redder coats than the African ass, which is mainly grey and white and is striped on the lower legs and shoulder (but only in some populations). Such striping could be seen as incipient or vestigial (but see Subgenus *Hippotigris* profile).

**Colin Groves**

## *Equus africanus* AFRICAN WILD ASS (ABYSSINIAN WILD ASS, SOMALI WILD ASS, NUBIAN WILD ASS)

Fr. Âne sauvage; Ger. Wildesel

*Equus africanus* von Heuglin & Fitzinger, 1866. *Systematische Übersicht der Säugethiere Nordost-Afrika's mit Einschluss der arabischen Küste, des rothen Meeres, der Somáli- und der Nilquellen-Länder, südwärts bis zum vierten Grade nödlicher Breite*. Sirzungsberichteder kaiselichen Akademie der Wissenschaften. Mathematcisch-Naturwissenschaftlicche Classe, 54: 537–611. Ain Saba, Eritrea (as fixed by Schlawe 1980).



African Wild Ass *Equus africanus*.

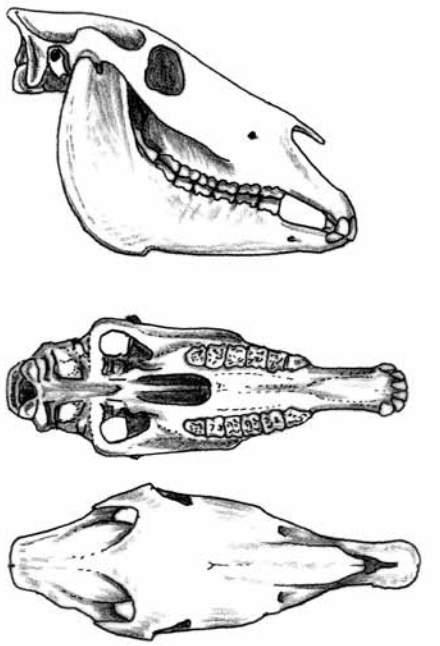
**Taxonomy** The African Wild Ass *Equus africanus* is the most probable ancestor of the domestic donkey, *E. asinus* Linnaeus, 1758. The earliest archaeological evidence for the donkey, in the Sudan, is dated to 5000 years ago, and only slightly later in Syria and Iran. Phylogenetic analyses suggest that north-east Africa is the most likely location of domestication, and that the donkey is the only ungulate domesticated solely in Africa (Beja-Pereira *et al*. 2004, Vilà *et al*. 2006). From 4000 years ago, domestic donkeys were brought to Europe by the Greeks in their colonies along the north-east coast of the Mediterranean, and later the Romans distributed them to all parts of their empire.

The International Commission on Zoological Nomenclature ruled (Opinion 2027, March 2003) *Equus africanus*, as the first available name based on a wild population, to be valid for the wild North African ass, and Gentry *et al*. (2004) recommended that *E. asinus* be used for the domestic donkey. Gentry (2006) criticized the incorrect use of the name *E. asinus* for the wild ass by Grubb (2005).

There are two recognized extant subspecies, although there is disagreement as to whether the African Wild Ass is one continuously distributed species exhibiting clinal variation, or if these represent valid subspecies (Ansell 1974, Groves & Willoughby 1981, Groves 1986, Yalden *et al.* 1986). Groves (1986) showed that there is some clinal change from the Atbara population (colour more buffy and shoulder cross thick) via the Red Sea coastal populations (colour greyer, and shoulder cross nearly always thin) to Somalia, and a marked change between N and S Eritrea. A subspecies from North Africa, the Atlas Wild Ass, is depicted in rock paintings and Roman mosaics (such as those from Hippone near Annaba, where one depicts an ass being captured with a lasso by mounted hunters) as having distinct leg stripes and shoulder stripe (often doubled) (Hufnagl 1972, Kowalski & Rzebik-Kowalska 1991, Groves 2002). The name *atlanticus*, often assigned to this form, is unavailable. Groves (2002) lists a third unnamed subspecies, *Equus africanus* ssp. (Saharan Wild Ass), authenticated for Ahaggar, Tibesti and Fezzan, and which is similar to *E. a. africanus*, but smaller and greyer, and with long, thin shoulder cross, but these may actually represent domesticated feral animals (see Kowalski & Rzebik-Kowalska 1991). The nomenclature of African Wild Ass is reviewed in detail by Groves & Smeenk (2007).

Synonyms: *aethiopicus*, *africanus*, *atlanticus* (unavailable), *dianae*, *hippagrus* (unavailable), *nubianus*, *sahariensis* (unavailable), *somalicus*, *somaliensis*, *taeniopus*. Chromosome number: 2n = 62–64, with the most frequently occurring diploid number being 63 (Benirshke & Malouf 1967, Ryder *et al.* 1978, Houck *et al.* 1998). This chromosomal variation is the result of a centric fission accompanied by a heterochromatic deletion. Karyotypes consisted of 34–36 metacentric/telocentric autosomes; the X chromosome is a large submetacentric, and the Y chromosome a small acrocentric (Houck *et al.* 1998). Hybrids between the two subspecies are fertile.

**Description** Lean and muscular, grey to reddish-buff in colour with a contrasting white underside and white muzzle with dark grey shading on the nostrils and upper and lower lips. Ears are long and



Lateral, palatal and dorsal views of skull of African Wild Ass *Equus africanus*.

*Equus africanus*

possibly play an important role in heat dissipation. Coat of hair is short and slick and reflects the sun. Both subspecies have an erect, thin mane that is usually pale in colour with a dark terminal border. Thin black dorsal stripe (sometimes absent in *E. a. somaliensis*); the Somali subspecies has distinct leg stripes (less marked, and sometimes, absent in Nubian subspecies). Tail tufted. Hooves small and narrow. One pair of nipples.

Groves (2002) describes the skull as being characterized by a very long cranium, short palate, long diastema, squared upturned occipital crest, and wide external auditory meatus. Orbit is high and rounded (not anteroposteriorly elongated as in other species – with the exception of Cape/Hartmann's Mountain Zebra *Equus zebra*).

## Geographic Variation

*E. a. somaliensis* (Somali Wild Ass): E Eritrea, NE and E Ethiopia, Somalia. Dorsal stripe sometimes absent (and when present sometimes incomplete); occasionally short, thin shoulder stripes (sometimes absent); and individually distinct leg stripes; ears short; apparently longer legged and shorter bodied than Nubian.

*E. a. africanus* (Nubian Wild Ass): N Eritrea and NE Sudan. Dorsal stripe present (and nearly always complete from mane to tail-tuft); shoulder stripe only thick in some populations (e.g., Atbara), and sometimes absent; leg stripes sometimes present (and then only restricted to a few bands at the fetlocks); ears longer and thinner.

**Similar Species** Domestic and feral donkeys often are found in the same habitat as the African Wild Ass. However, domestic donkeys are about two-thirds the size of the African Wild Ass, their coat colour varies from grey to brown to black and they tend to have a longer coat of hair giving them a 'rough' rather than 'slick' appearance. Domestic donkeys have proportionally shorter legs and cranial length. Preliminary genetic analyses indicate that the domestic donkey in Africa has different mitochondrial DNA haplotypes from the African Wild Ass (A. Oakenfull pers. comm.).

## Distribution

*Historical Distribution* During the Pleistocene, the African Wild Ass may have existed in Israel and Syria. Historically, the Atlas Wild Ass was found in the Atlas region of NW Algeria, and adjacent parts of Morocco and Tunisia. It survived in this area until about 300 A.D. (Antonius 1938). In recent times, there have been reports of wild asses in N Chad and the Hoggar Massif of the C Sahara (e.g., Dupuy 1966; and see Kowalski & Rzebik-Kowalska 1991), but it is doubtful whether these are true wild asses.

The Nubian Wild Ass *E. a. africanus* lived in the Nubian desert of NE Sudan, from east of the Nile R. to the shores of the Red Sea, and south to the Atbara R. and into N Eritrea. During aerial flights in the 1970s, wild asses were seen in the Barka Valley of Eritrea and in the border area between Eritrea and the Sudan.

The Somali Wild Ass *E. a. somaliensis* was found in the Denkelia region of Eritrea, the Danakil Desert and the Awash River Valley in the Afar region of NE Ethiopia, W Djibouti, and into the Ogaden region of E Ethiopia. In Somalia, they ranged from Meit and Erigavo in the north to the Nugaal Valley, and as far south as the Shebele R. A comprehensive review of the historical literature concerning African Wild Ass distribution can be found in Yalden *et al.* (1986) and Bauer *et al.* (1994).

*Current Distribution* The African Wild Ass is found in Eritrea, Ethiopia and Somalia. Some animals may persist in Djibouti, but recent surveys have not recorded their presence (Künzel *et al.* 2000). African Wild Asses may still be found in Sudan and Egypt, but their presence has not been documented. In Ethiopia and Somalia the population has been severely reduced, both in population size and range.

**Habitat** In Ethiopia and Eritrea, African Wild Asses live in arid grass and bushlands of the Great Rift Valley. They are found in a volcanic landscape and range from rocky mountains (as high as 1500 m) to below sea level in the Dalool Depression.

**Abundance** In Ethiopia, during the 1970s, African Wild Asses could be found from Yangudi-Rassa N. P. to the Mille-Serdo Wild Ass Reserve. At that time there were between 15 and 30 individuals per 100 km$^2$. Currently, there are few African Wild Asses left in Yangudi-Rassa and less than 1 per 100 km$^2$ are left in the Mille-Serdo Wild Ass Reserve. Even if as many as one individual per 100 km$^2$ exists throughout the species' former range (16,000 km$^2$), the population in Ethiopia probably numbers less than 160 individuals (Moehlman 2002).

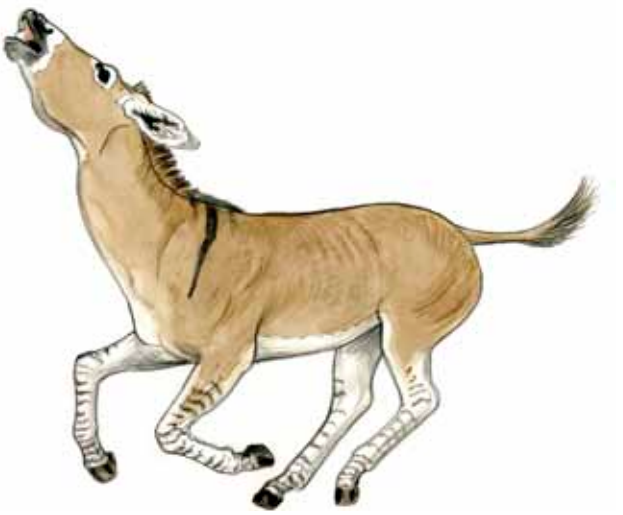
Due to Eritrea's 30-year war for independence, there are no long-term data on African Wild Ass populations for this country. However, recent surveys indicate that viable populations exist in the Northern Red Sea Zone. In this area, the population density is estimated at roughly 47 individuals per 100 km$^2$. This is the highest population density found anywhere in the present range of the species and is similar to population densities recorded in Ethiopia in the early 1970s. Given the absence of guns among rural people and the conservation ethic among local Afar pastoralists, the African Wild Ass has good potential for recovery in Eritrea (Moehlman 2002).

In Somalia, in 1997, local pastoralists said that there were fewer than ten African Wild Asses left in the Nugaal Valley; an earlier ground survey in 1989 in the Nugaal Valley yielded population estimates of roughly 135–205 animals or approximately 2.7–4.1/km$^2$ (Moehlman 1998). Some animals may remain near Meit and Erigavo, but this area has not been surveyed since the 1970s.

**Adaptations** Research on domestic donkeys (descendants of the African Wild Ass) has documented that they are physiologically well adapted to life in arid habitats. They can sustain a water loss of up to 30% of their body weight and can drink enough water in two to five minutes to restore fluid loss (Maloiy 1970). Tomkiewicz (1979), using temperature-sensitive implants, determined that feral asses varied their body temperature from 35.0 to 41.5 °C, depending on air temperature. In hot summer months, ♂♂ had lower mean body temperatures (36.5 °C) than ♀♀ (38.2 °C). Females maintained higher body temperatures and presumably lost less water due to sweating. A 2-degree increase in body temperature could provide a 2% daily water savings in a hydrated 150 kg feral ass. Tomkiewicz (1979) also found that the biological half-life of water for ♀♀ was one day longer than for ♂♂, indicating that their water use was more efficient. Such information indicates that the ancestral species, the African Wild Ass, is probably even more physiologically adapted to life in the deserts of Eritrea, Ethiopia and Somalia. However, the African Wild Ass still needs access to surface water and the movements of lactating ♀♀ are constrained by water availability. During aerial surveys in the Danakil Desert of Ethiopia, most African Wild Asses were observed within 30 km of known water sources.

In a gradient of mesic to arid habitat, the Plains Zebra *Equus quagga* is in the most mesic habitat, Grévy's Zebra *Equus grevyi* is in the drier habitat, and the African Wild Ass survives in the hottest, driest habitat, which also has the lowest plant biomass (Bauer *et al.* 1994). The physiological adaptations of this species allow this equid to live in one of the most extreme habitats in Africa.

**Foraging and Food** In Eritrea and Ethiopia, limited observations indicate that the African Wild Ass is primarily a grazer, but will also utilize browse (Moehlman *et al.* 1998, Kebede 1999). In the Mille-Serdo Wild Ass Reserve the preferred forage is *Aristida* spp., *Chrysopogon plumulosus*, *Dactyloctenium schindicum*, *Digiteria* sp, *Lasiurus scindicus* and *Sporobolus iocladus.*



Male African Wild Ass *Equus africanus* performing 'flehmen' while galloping.

**Social and Reproductive Behaviour** In the deserts of Eritrea and Ethiopia, African Wild Asses live in temporary groups that are small and typically comprise fewer than five individuals. The only stable groups are composed of a ♀ and her offspring. Female foals often stay with their mother and are residents in their natal area. Females do associate with other ♀♀ or with ♂♂, but even temporary groups are small. In temporary groups, the sex and age-group structure varies from single-sex adult groups to mixed groups of ♂♂ and ♀♀ of all ages. Adult ♂♂ are frequently solitary, but also associate with other ♂♂. Some adult ♂♂ are territorial, marking (by means of dung piles) and defending large areas for several weeks, and are dominant over conspecifics; only territorial ♂♂ have been observed copulating with oestrous ♀♀. Thus, African Wild Ass exhibit a social organization typical of equids living in arid habitats (Klingel 1977a, Moehlman 1998).

Individuals will form groups when benefits exceed costs in terms of feeding, predation, disease and reproduction. The density, continuity of distribution, and biomass of forage are key factors in the stability of association and the spacing of equids. When forage and water availability allows ♀♀ to be gregarious and form stable groups, then a ♂ can attempt to control access to these ♀♀. Large stable groups are more likely to form when one individual's foraging does not adversely affect a conspecific's foraging. Consequently, closer spacing and larger aggregations are possible when food is abundant. Conversely, low vegetation biomass and food shortages tend to limit group size and stability. This is the case with the African Wild Ass, which lives in an arid, low primary productivity habitat.

In more arid environments, limited food availability (both spatially and temporally) usually does not permit ♀♀ to forage in close proximity and/or to be associated consistently. In dry habitats, equids exhibit the same nutritional and reproductive characteristics (e.g., ♀♀ provide nutrition and ♀♀ tend to come into oestrus asynchronously), which allow ♂♂ to attempt multiple matings, but 'indirectly' control access to the ♀♀. In most cases, they actually control access to a critical resource, i.e., water. In these territorial mating systems, the only stable social group is a ♀ and her offspring.

Thus, the African Wild Ass has a resource-defence polygynous mating system (Klingel 1977a, Moehlman 1998).

**Reproduction and Population Structure** The African Wild Ass is polyoestrus and foals are usually born from Oct to Apr after a gestation period of 12–13 months. Natality and foal survivorship correlate positively and significantly with rainfall. A known-age African Wild Ass had her first live foal at six years, although ♀♀ are sexually mature much earlier. Females typically have a surviving foal every other year and natality correlates with rainfall during the period of gestation. In captivity the African Wild Ass can live up to 28.5 years (Weigl 2005).

**Predators, Parasites and Diseases** Spotted Hyaenas *Crocuta crocuta* and Lions *Panthera leo* are potential predators, particularly of foals and yearlings. There are no known data on parasites and disease, although *Strongyle* spp. have been recorded in faecal samples collected in the Danakil Desert.

**Conservation** IUCN Category: Critically Endangered C2a(i). CITES: Appendix I.

The major threat to the African Wild Ass is hunting for food and medicinal purposes, particularly in Ethiopia and Somalia. According to local pastoralists in these areas, body parts and soup made from bones are used for treating tuberculosis, constipation, rheumatism, backache and boneache. The soup is also fed to their livestock to alleviate mineral deficiencies (Moehlman *et al.* 1998). In Eritrea, the Afar pastoralists do not shoot wildlife and guns are strictly controlled. If African Wild Asses were to be adequately protected, then the major remaining threat would be access to water and sufficient forage. Reproductive ♀♀ and their less than three-month old foals are most at risk. Hence, it will continue to be important to determine critical water supplies and basic forage requirements, thus allowing management authorities to determine (in consultation with local pastoralists) how to conserve the African Wild Ass. In Eritrea, Ethiopia and Somalia, all elders that have been consulted have expressed concern that the African Wild Ass be protected and conserved. A third major threat to the survival of the African Wild Ass is possible interbreeding with the domestic donkey.

In Ethiopia, the Yangudi-Rassa N. P. (4731 km²) and the Mille-Serdo Wild Ass Reserve (8766 km²) were established in 1969. However, the former has never been formally gazetted, and both areas are utilized by large numbers of pastoralists and their livestock. These areas are remote and extremely arid, and the Ethiopian Wildlife Conservation Organization (EWCO) has not had sufficient funds or personnel for appropriate management (Kebede 1999). In Eritrea, the government designated the African Wild Ass area between the Buri Peninsula and the Dalool Depression as a high-priority area for conservation protection as a nature reserve. There are no protected areas in the range of the species in Somalia.

Populations of Somali Wild Ass are maintained in captivity.

Meas**urements**
*Equus africanus*
HB: 1950–2050 mm
T: 400–450 mm
HF: n. d.
E: n. d.
Sh. ht: 1150–1250 mm
WT: 270.0–280.0 kg
Kingdon 1997; sample number not given

**Key References** Kebede 1999; Klingel 1977a; Moehlman 1998, 2002; Moehlman *et al.* 1998.

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## Subgenus *Hippotigris*
## Zebras

*Hippotigris* Hamilton Smith, 1841. *Jardine's Naturalist's Library*, Mamm. 12: 321, pl. 21–25.

The subgenus *Hippotigris* is currently taken to embrace all the African zebras, the main distinction of which is being wholly or partially striped. The taxonomic name implies a common striped ancestor and an assumption that the various zebra species represent variations derived from that inheritance (whether inclusive of *Equus* and *Asinus* or not; Bard 1977).

Striping, whether complete or partial, poses questions of great biological importance so this profile is primarily a discussion as to the possible origins of a visual pattern that is uniquely extreme among mammals, yet is shared to some degree by zebra duikers, zebra finches, zebra fishes and even zebroid insects. The fact that areas of strongly contrasting black and white patterning are found across such a wide range of organisms and presumed functions, reveals that this common, highly conspicuous, visual phenomenon can serve many needs at many different scales. Any universal function for black and white stripes must lie in the peculiar behavioural history of each striped organism and how that behaviour has enlisted optical neurophysiology in the service of that behaviour. The unstriped relatives of striped animals provide clues to the meaning of striping, and in relation to zebras and horses there are two crucial questions. The first is whether striping is an eccentric embellishment, possibly a convergent one, in a few outlying, even marginal species. The second asks whether striping represents a primary and biologically significant adaptation among an entire lineage of animals, in this case living equids.

Historically, horses and asses were the animal models with which scientifically minded cultures were first familiar; zebras only became an exotic curiosity much later. Even today, zebras remain aberrant animals in minds and vocabularies and single-stranded, uncorroborated hypotheses have engendered a popular folklore that has inhibited serious scientific investigation of an important phenomenon. This legacy is evident in numerous attempts (most of them casual, some even cavalier) to link striping with supposed or real environmental oddities of Africa (Ruxton 2002). Striping, across many taxa of vertebrates and invertebrates, has evolved to be registered in the eyes of whatever animal is most likely to be a beholder; furthermore, for most striped fauna, 'beholders' (or visual signal receptors) are much less likely