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# On the history of the green monkey *Chlorocebus sabaeus* (L., 1766) in the Cape Verde Islands, with notes on other introduced mammals

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ABSTRACT

The history of the green monkey *Chlorocebus sabaeus*, a species introduced by man, in the Cape Verde Islands is discussed. The earliest reference to the presence of monkeys on the island of Santiago dates from the late 16th century, when they were said to be abundant, suggesting that their introduction took place during the first 100 years since the first arrival of European navigators in the archipelago around 1460. Brava is the only other island in the Cape Verdes where the green monkey has been introduced. Reports of the former existence of feral monkey populations on other islands (e.g. Santo Antão and Fogo) are unsubstantiated. Today, populations of the green monkey survive on both Santiago and Brava, although – due to heavy persecution because of the damage they caused to plantations – their numbers are now probably less then they may have been in the past. In addition, the occurrence of other mammals introduced to the Cape Verde Islands is discussed. These encompass rodents (house mouse *Mus musculus*, brown rat *Rattus norvegicus*, black rat *R. rattus*) and the rabbit *Oryctolagus cuniculus*. Finally, the history of free-living ungulates, particularly goats, in the archipelago is briefly discussed.

RESUMO

Neste artigo é discutida a história do macaco verde *Chlorocebus sabaeus*, uma espécie introduzida pelo homem nas ilhas de Cabo Verde. A referência mais antiga à sua presença na ilha de Santiago data do final do século XVI. A referência indica que o número de exemplares era abundante, sugerindo que a sua introdução na ilha se terá dado no século seguinte à chegada dos primeiros navegadores europeus ao arquipélago por volta de 1460. A ilha Brava é a outra ilha onde os macacos foram introduzidos. Existem relatos de populações de macacos noutras ilhas (e.g. Santo Antão e Fogo), mas são insubstanciados. Actualmente, sobrevivem populações de macacos em Santiago e Brava, embora o número de exemplares tenha provavelmemte vindo a diminuir em virtude da caça devido aos estragos que trazem à agricultura. O artigo discute ainda outros mamíferos introduzida em Cabo Verde, como roedores (ratinho-caseiro *Mus musculus*, ratazana-castanha *Rattus norvegicus*, ratazana-preta *R. rattus*) e o coelho-bravo *Oryctolagus cuniculus*. Finalmente, é discutida de forma breve a história de mamíferos ungulados em regime de quase completa liberdade no arquipélago, particularmente cabras.

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## INTRODUCTION

The Cape Verde Islands are an oceanic archipelago of volcanic origin situated in the East Atlantic Ocean between 14º48´, 17º22´N and 22º44´, 25º22'W, 500 km west of Senegal, West Africa (Fig. 1). There are nine main islands (ilhas), varying in size from 991 km² (Santiago) to 35 km² (Santa Luzia), as well as a number of smaller islets (ilhéus), some of which are entities of their own (Raso, Branco, ilhéus do Rombo), while others are satellite rocks of the main islands. In this paper, the term 'island' refers to the former, while the term 'islet' refers to the smaller entities.

The Cape Verde Islands are part of the Sahel zone and climate is dry tropical, with monsoon rains occurring from August into November, which – as the islands are situated just north of the Intertropical Convergence Zone – are unpredictable and by no means annual. Rainfall during the monsoon period may vary enormously from year to year and drought periods of up to 18 years have been recorded during the islands' history. The local climate shows great variability and the higher parts of the geologically younger islands of Santiago, Fogo, Brava, Santo Antão and São Nicolau may receive some precipitation at any time from August until March, while the lower parts of these islands, as well as the eroded and geologically older eastern islands of Sal, Boavista and Maio, are extremely arid most of the year. The northwestern and relatively flat islands of São Vicente and Santa Luzia are also very arid.

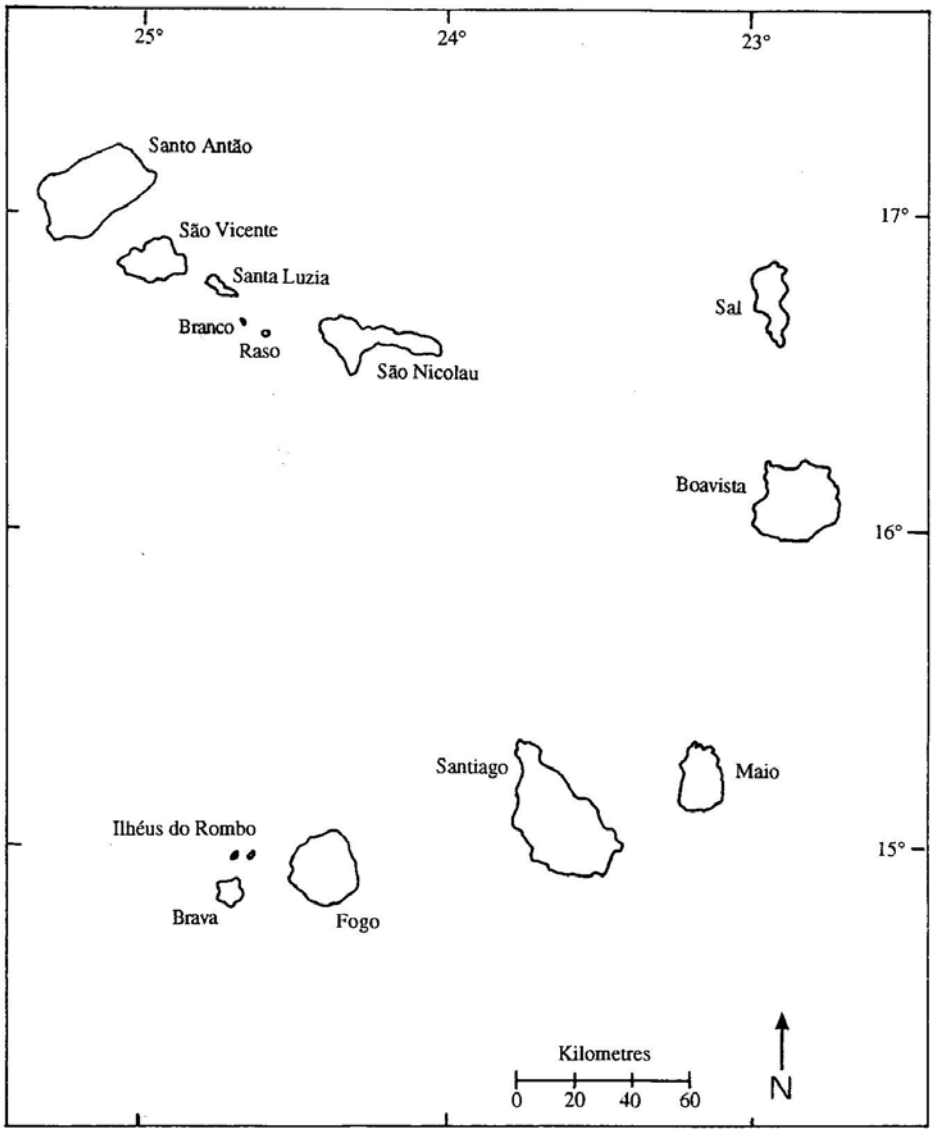


Fig. 1. Map of the Cape Verde Islands.

Typical of many geologically young oceanic islands, no indigenous terrestrial mammals occur in the Cape Verde Islands except for bats (see Azzaroli Puccetti & Zava 1988, Jiménez & Hazevoet 2010), all non-volant land mammals having been introduced by man. As the islands were uninhabited at the time of their discovery, these introductions must have taken place during the past 550 years, i.e. since *ca*. 1460 (the precise year is disputed among historians), when the first European navigators arrived in the archipelago.

There exists hardly any environmental information dating from the earliest period of human settlement, but there can be little doubt that the natural environment of the islands has been highly modified since the arrival of man and his inevitable menagerie of domesticated animals. The following is taken from Hazevoet (1995) and references therein. The Cape Verdes, in their virgin state, did not support any woodland with a closed canopy. At lower elevations, the islands were probably covered with herbaceous savannah or steppe vegetation. The windward slopes at higher elevations were probably mainly covered with *Euphorbia* bushes and scattered dragon *Dracaena draco* and ironwood trees *Sideroxylon marmulano*. The flat and arid eastern islands, as well as São Vicente and Santa Luzia, supported a steppe and semi-desert vegetation. Over the past five centuries, the combined effects of poor agricultural techniques, the introduction of large numbers of alien plants and trees, overgrazing by an abundance of wide-roaming goats and other lifestock and a high population pressure have led to an almost complete destruction of the original vegetation cover. Afforestation started in the 1930s, especially in the interior of Santiago (mainly *Eucalyptus* spp.) and in the higher parts of northern Santo Antão, where large tracts of pines *Pinus* spp were planted. Since independence in 1975, millions of trees (mainly *Prosopis juliflora* and *Parkinsonia aculeata*) were planted in the low and arid areas.

Among the mammals introduced by man since the discovery of the islands and of which feral populations exist until today is a species of monkey. In this paper, we discuss the historical presence of the green monkey *Chlorocebus sabaeus* (L., 1766) in the Cape Verde Islands. We also comment on the history and occurrence of a number of other introduced mammals, particularly rodents and lagomorphs, and we briefly discuss the role wide-roaming ungulates have played in shaping the present environment in Cape Verde.

## METHODS

Data on the occurrence of introduced mammals in the Cape Verde Islands were collected by 1) searching the literature, especially historical descriptions and narratives of early voyagers, 2) personal observations by the first author and 3) observations provided by correspondents on various islands. Data obtained from the literature were evaluated as for their reliablity. Reports of alleged occurrences mentioned in a number of compilation works and popular guides were deemed useless, as these were evidently not based on first-hand observations, but merely repeating – often erroneous – reports from earlier works. Observations of rodents obtained from the literature or provided by correspondents (see Acknowledgements), but not identified at the species level, were rendered to the next inclusive taxonomic level.

## RESULTS

### **Green monkey** *Chlorocebus sabaeus* (L., 1766)

Although having been introduced in the archipelago by man, the Cape Verde Islands enjoy the distinction of being the type locality of the green monkey. Linnaeus (1766) based his *Simia sabaea* on the ‘St. Jago Monkey’ of Edwards (1758), a specimen of which had

been brought to England from St. Jago (Santiago) island in the Cape Verdes at some time during the 18th century (Fig. 2). Edwards (1758) gave a fairly accurate description of the animal, also commenting on its behaviour, and remarking that "it's often called the green monkey", but "our seamen generally call them St. Jago monkies, they being brought from St. Jago, one of the Cape de Verde Islands" (Edwards 1758: 10).

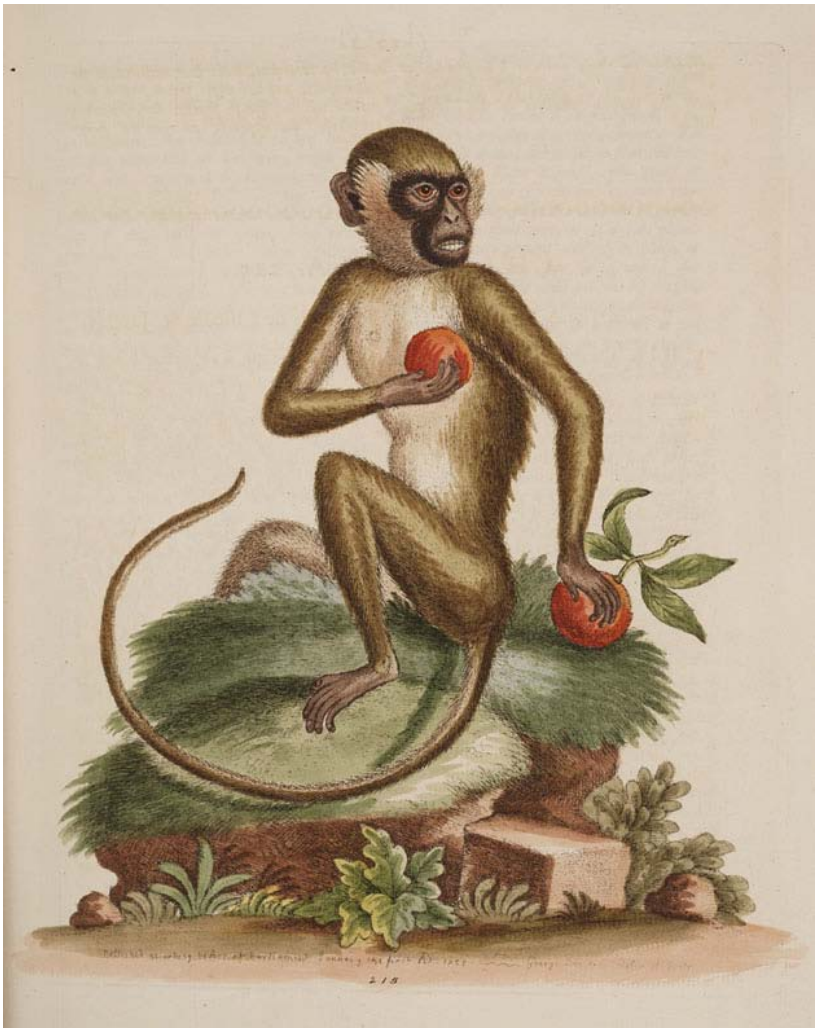

Fig. 2. The St. Jago Monkey, as depicted in Plate 215 of George Edwards' (1758) Gleanings of Natural History, on which Linnaeus (1766) based his *Simea sabaea*.

Formerly placed in *Cercopithecus* L. 1758 and commonly treated as a 'subspecies' of *C. aethiops* (L., 1758), it was separated and placed, along with several other subsaharan monkeys previously placed in *Cercopithecus*, in a resurrected *Chlorocebus* Gray, 1870 by Groves (2001, 2005). In West Africa, the green monkey is widespread in the northern savannahs from Senegal and Sierra Leone in the west to the Volta river in the east (Kingdon 1997, Grove 2001, 2005). It seems likely that the monkeys introduced in the Cape Verde Islands originated from former Portuguese Guinea (now Guinea-Bissau), as there were regular maritime connections between these two Portuguese colonies and for centuries Portuguese Guinea was administered from Cape Verde's capital (first Cidade da Ribeira Grande, later Praia). However, we do not have hard evidence for this and introductions of animals originating elsewhere cannot be excluded with certainty. Moreover, the Casamance region of present day southern Senegal was also under Portuguese colonial rule until well into the 19th century.

Historically, free living populations of green monkeys in the Cape Verde Islands have only existed on the islands of Santiago and Brava. Reports suggesting that monkeys also occurred on other islands appear to have been based on monkeys kept as pets there. The island of Santo Antão has sometimes figured among the islands where feral monkey populations have occurred, but this is clearly in error for Santiago (e.g. Friedlaender 1913), uncritically repeated by later authors and not based on first-hand observations (e.g. Muzio 1925, Masseti & Bruner 2009, Masseti 2010). Indeed, Rocha (1990), in his account on the history of Santo Antão, does not mention the presence of monkeys on that island, although he reported on other wildlife. There are no athenticated records of feral green monkeys from Santo Antão. Masseti & Bruner (2009) and Masseti (2010) included a photo of a pet monkey kept on Fogo, which led these authors to mistakenly infer that a population of feral monkeys previously existed there.

The earliest reference of monkeys in the Cape Verde Islands that we have found is by Carletti (1965) in the narrative of his voyage around the world during the years 1594-1606. The Florentine merchant and voyager, Francesco Carletti, stayed on Santiago island from January to April 1594 and wrote that there were "a large number of monkeys of a kind that we call meerkat, with a long tail, and which are called *bugios* by the Portuguese" (Carletti 1965: 21; translated from the Dutch). Thus, 135 years after the first humans arrived in the archipelago, monkeys were already numerous on Santiago, indicating that their introduction probably took place during the first 100 years of colonization. This clearly contradicts Chevalier (1935: 786-787), who stated that "according to tradition, all the monkeys are descendents of a single pregnant female, imported from Portuguese Guinea, that escaped from captivity about 150 years ago and raised its young in the bush" (translated from the French). Another version of the monkeys' origin comes from de Naurois (1969: 151, 1994: 22) who wrote that "according to our information, the import [of monkeys] has been due to a strange misunderstanding: a Portuguese inhabitant of Santiago asked one of his friends in [Portuguese] Guinea to send him one or two monkeys. The correspondent did not get the words right and thought the request was for 102 of them. He could not obtain that many, but sent 20. When disembarking at Praia, Santiago, and Furna, Brava, the monkeys escaped from their cages" (translated from the French, being a combination of de Naurois' slightly different 1969 and 1994 versions). Still another version was offered by Ferlin (1979: 23), who was of the opinion that the green monkeys "descended from a guenon imported from Portuguese Guinea at the end of the 18th century" (translated from the French). If anything, de Naurois' (1969, 1994) account, in which part of 20 animals escaped at two different ports, does not appear very convincing and probably represents an example of an 'urban legend'. Although the presence of monkeys on Santiago clearly predates any of these renderings, it can of course not be excluded that there has been more than a single importation or escape, especially on the main island of Santiago. Until the development of Porto Grande, on the island of São Vicente, during the first half of the 19th century, the capital Praia (and earlier Cidade da Ribeira Grande) was the main port and centre of commerce in the archipelago.

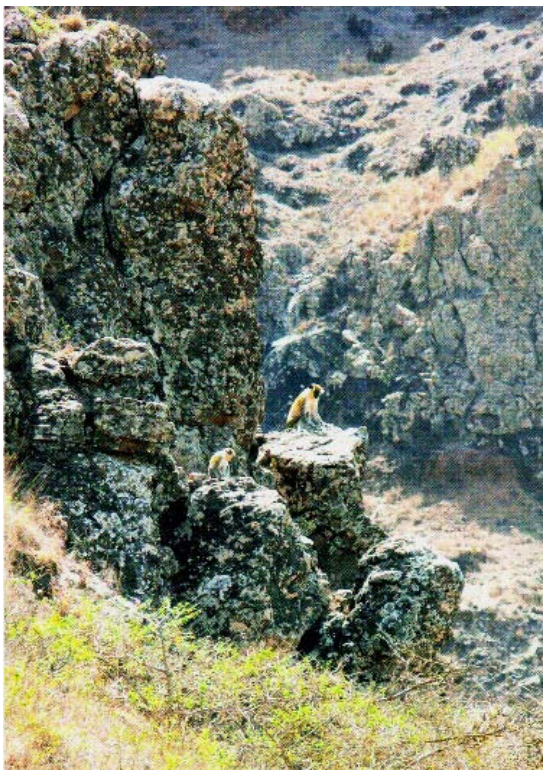

Fig 3. Green monkeys *Chlorocebus sabaeus*, Achada Mula, Santa Catarina region, Santiago (Pitt Reitmaier/after a postcard).

In 1673, John Fryer (*in* Crooke 1909) saw natives selling monkeys at the beach on Santiago and William Dampier, who was at the old capital, Cidade da Ribeira Grande (now Cidade Velha), in 1699, mentioned that there were 'black-fac'd long-tail'd monkeys' (Dampier 1981 [1729]). We have not found a reference of monkeys in Cape Verde from the 18th century. António Pusich (*in* Ribeiro 1956), who stayed in the islands during the first decades of the 19th century, wrote that the mountain ranges of Santiago "are arid and sterile and only inhabited by an innumerable number of monkeys" (translated from the Portuguese). The first to mention the presence of 'stealing monkeys' ('*singes voleur*') on both Santiago and Brava appears to have been D'Avezac (1848), who also noted that these were the only two islands where they occurred. The British ornithologist, Boyd Alexander, stayed in the Cape Verde Islands for more than six months in 1897 and wrote about the monkeys on Santiago: "In all the steep valleys are colonies of black-faced West-African monkeys. From our tents we constantly caught sight of them chasing each other in and out of the rocks, while some, bolder than others, would gain the crest-line, where their figures showed clear against the horizon" (Alexander 1898: 79). While on Brava he noted that "In the larger valleys monkeys abound, doing much havoc among the sugar-cane" (Alexander 1898: 90). Robert Rockwell, who stayed on Brava in January-April 1924 as a member of the ill-fated Blossom expedition, remarked about the monkeys there that "these wily creatures were a scourge and a curse, due to their persistent raids on the few vegetable and fruit gardens" (Rockwell 1956: 126). While mentioning their occurrence on both Santiago and Brava, the French botanist, Auguste Chevalier, also noted the harm monkeys caused to the plantations, for which reason a decree prohibited the displacement of monkeys to any of the other islands (Chevalier 1935, Corrêa 1954). Adding to this, de Naurois (1969) mentioned that a premium was paid by the colonial government for any monkey killed in order to promote their extermination. While on Santiago in February 1966, the British ornithologists, David and Mary Bannerman, saw monkeys near São Domingos and at São Jorge dos Orgãos, commenting that "once common, [they] have been driven by persecution to live on the most inaccessible heights in the island" (Bannerman & Bannerman 1968: 88-89).

Today, green monkeys are still widespread on Santiago, particularly in the central mountain ranges of the Serra do Pico da Antónia and Serra Malagueta. During the years 1988-1995, parties of up to 15 animals were regularly seen in the afforestations above São Jorge dos Orgãos in the Serra do Pico da Antónia (CJH pers. obs.), although, according to local inhabitants, during the 1970s hunting had greatly reduced their numbers there (Groh 1982). Green monkeys also occur in the Santa Catarina region in central Santiago (Fig. 3), while Cesarini *et al.* (2008) noted their presence in the Serra Malagueta during the years 2006-2007. A considerable party of these little primates resides in the palm grove behind the beach at Tarrafal, in the north of Santiago island (Fig. 4; YouTube). Until recently, it was thought that green monkeys had gone extinct on Brava (e.g. Hazevoet 1995), but there is a recent observation (of an unspecified number) at Monte Gambia (elevation 500 m), 10 February 2011 (Eyjolf Aistleitner *in litt.*), demonstrating their survival on the island. Apparently, the ban on transporting monkeys to other islands, as mentioned above, is not enforced any longer, as pet monkeys were seen on Sal in 1995, Fogo in 1998 and São Vicente in 2010 (CJH pers. obs.) and are now commonly kept at the tourist resorts near Santa Maria, Sal (Fig. 5; YouTube).

## Other introduced mammals

RODENTS The house mouse *Mus musculus* L., 1758 is present on all islands and is common near human habitation. Much of the published information on mice in Cape Verde comes from analyses of the feeding habits of owls (Bourne 1955, Heim de Balsac 1965, de Naurois 1969, 1982, Rabaça & Mendes 1987, Siverio *et al.* 2007, 2008), as well as those of herons (Bourne 1955, de Naurois 1966) and raptors (Bourne 1955, de Naurois 1973, 1987, Ontiveros 2005). Lobin & Groh (1979) and Groh (1982) first reported *M. musculus* from the island of Sal. The presence of mice on all islands during the years 2007-2011 was

Fig. 4. Green monkey *Chlorocebus sabaeus*, Tarrafal, Santiago, July 2005 (Juan Roch).

Fig. 5. Green monkey *Chlorocebus sabaeus* kept as a pet, Santa Maria, Sal, 24 March 2008 (flickr).

confirmed by our correspondents (see Acknowledgements; Fig. 6), as well as through personal observations by the first author on Santiago, São Nicolau and São Vicente.

On the arid island of Santa Luzia, now abandoned but inhabited by a single family until the mid 1960s, mice were abundant at the ruins of the only house there in September-October 1981 (Schleich & Wuttke 1983) and February-March 1986 (CJH pers. obs.). An active nest of the Cape Verde barn owl *Tyto alba detorta* Hartert, 1913 was found on Santa Luzia, 20 October 1999 (Siverio *et al.* 2007). As a result of prolonged deposition of owl pellets, a crevice below the nest was filled with bone remains, revealing a change in prey items through time. While the lower levels only contained remains of lizards Scincidae and geckos Gekkonidae, mouse bones appeared towards the higher levels (Siverio *et al.* 2007), indicating an accumulation of owl pellets for several centuries, i.e. starting before the arrival of humans on the island. In his large work on the African islands, the 17th century Dutch geographer, Olfert Dapper, already mentioned the abundance of mice on Santa Luzia (Dapper 1668). During a three-day visit to Santa Luzia in January 2003, no mice were seen, although mouse remains were found in scats of feral cats (Donald *et al.* 2005), but mice were still found to be abundant there in July 2010 (José Melo *in litt.)*.

During the 1980s and 1990s, there were no mice on the uninhabited islets of Raso and Branco (CJH pers. obs.) and still not during the years 2001-2010 (M. Brooke and P. Donald *in litt.*). Neither were there mice on uninhabited ilhéu de Cima (one of the ilhéus do Rombo) in 1989 (CJH pers. obs.). We have no data on the presence or absence of mice on ilhéu Grande (also known as ilhéu de Baixo), the largest islet in the Rombo group, which was never inhabited, but at times was populated by a large number of goats. As these were frequently culled by their owners from nearby Brava, who then stayed on the islet for several days, mice may have been introduced along the way.

Based on morphometric analysis of molar shape, Michaux *et al.* (2007) identified mouse remains from Santa Luzia as *M. m. domesticus* Schwarz and Schwarz, 1943, the commensal house mouse of western Europe, which has spread all over the world in the wake of European colonization. It is highly probable that the mice on other Cape Verde islands are *M. m. domesticus* as well.

Rats *Rattus* sp. have been reported from several islands, but it has not always been clear whether this concerned the black rat *R. rattus* (L., 1758) or the brown rat *R. norvegicus* (Berkenhout, 1769). On Santiago, the presence of brown rats was confirmed in the capital Praia during the 1990s (CJH pers. obs.) and in the Serra Malagueta during the years 2006-2007 (Cesarini *et al.* 2008). It is likely that brown rats also occur elsewhere on the island. During the years 1988-2010, brown rats were occasionally seen in the harbour region of Mindelo on São Vicente (CJH pers. obs.). The presence of black rats has been confirmed on Santiago, i.e. at Trindade (Heim de Balsac 1965, de Naurois 1969, 1982), São Domingos (Rabaça & Mendes 1997) and in the Serra Malagueta (Cesarini *et al.* 2008). Unidentified rats *Rattus* sp. have been reported from Brava, Santo Antão, São Nicolau, Boavista and Maio by our correspondents (see Acknowledgements) and from Fogo by Siverio *et al.* (2008).

Fig. 6. House mouse *Mus musculus*, adult and young, Porto Novo, Santo Antão, 28 April 2008 (Simon Baliteau).

LAGOMORPHS There have been scarce reports of free living populations of rabbits *Oryctolagus cuniculus* (L., 1758) in the Cape Verde Islands. D'Avezac (1848) reported their presence on Santiago, where they were heavily persecuted because of the damage

caused to the plantations. While rabbits had greatly multiplied on some islands, they subsequently disappeared completely (Chevalier 1935, de Naurois 1969, 1994). Whether this was a consequence of relentless persecution, the result of droughts or a combination of these factors is unclear. Corrêa (1954) blamed 'the harsh natural conditions' for the rabbit's disappearance, while Matznetter (1960) thought drought to be the cause. It is not known at present on which islands, apart from Santiago, free living populations of rabbits occurred. Today, rabbits are occasionally seen in the semi-arid area north of Porto Novo, Santo Antão, where they are, however, by no means plentiful (Simon Baliteau *in litt.*).

UNGULATES Soon after their discovery, large numbers of goats were set free in the Cape Verdes, especially on the only scarcely populated islands of Sal, Boavista, Maio and São Vicente. These goats belonged to the Portuguese crown. Dapper (1668: 89) wrote that goats were "exceedingly abundant" on São Vicente and were "culled every now and then because of their hides, which are send to Portugal in large quantities". On Maio, there also were large numbers of goats and "every year 5,000 hides are send to Portugal from the island" (Dapper 1668: 89; translated from the Dutch). Dapper's work was a compilation of information obtained from manuscripts by different 16th and 17th century navigators. According to João da Silva Feijó (*in* Carreira 1986), who was in Cape Verde in the 1780s and 1790s, there were 45,000 'wild goats' on Boavista in 1785. Large numbers of donkeys, cattle and horses also lived in a semi-feral state, particularly on Boavista and Maio. However, during times of drought their numbers dropped dramatically. For instance, as the result of prolonged drought, the number of goats on Boavista decreased from 50,000 in 1809 to 1,200 in 1811, while the number of donkeys plunged from 20,000 to 200, cattle from 6,000 to 42 and horses from 4,000 to a mere 4 (Kasper 1987). During the years 1875-1982, the number of goats present on Boavista ranged from a maximum of 15,215 in 1875 to only 719 in 1950 (Kasper 1987). Today, considerable numbers of wide-ranging goats are still present on Boavista and Maio and on ilhéu Grande (ilhéus do Rombo).

## DISCUSSION

Excluding goats and other domesticated lifestock, five introduced species of mammals occur in the Cape Verde Islands, i.e. green monkey, house mouse, black rat, brown rat and rabbit.

The Cape Verde Islands have sometimes been included in the distributional range of the slender mongoose *Galerella sanguinea* (Rüppell, 1835) (e.g. Funaioli 1971, Wozencraft 2005). However, this is mistakenly based on a specimen collected at Cap Vert, Senegal, at some time during the 19th century, the collecting locality of which was spelled 'Cape Verd' (without 'Islands' or an abbreviation of that word) on the original specimen label (Roberto Portelo Miguez *in litt.*). The same spelling was subsequently used by Lydekker (1896) and Wroughton (1907), the latter basing his *Mungos melanurus canus* on the specimen. This may have misled some later authors, who interpreted 'Cape Verd' as referring to the archipelago rather than to the peninsula of that name. However, Rosevear (1974) described the slender mongoose's range in West Africa as being from 'Cape Verde to Nigeria', clearly referring to the Senegal locality rather than to the islands, while Taylor (1975) correctly gave the type locality of *Herpestes sanguineus canus* (Wroughton, 1907) as 'Cape Verde', without implying the islands.

The history of the green monkey on the island of Santiago goes back to at least the second half of the 16th century and possibly earlier. It most likely descended from animals imported from former Portuguese Guinea (which until the mid 19th century included present-day southern Senegal), but whether this pertained to a single or multiple importations or escape events is unknown. The timing of its introduction on the island of Brava is equally unknown. There are no authenticated records of the green monkey's occurrence in a feral state from any of the other islands. Further study of historical sources, such as navigators' narratives, may bring to light more details about the green monkey's history in the Cape Verde Islands.

Although there do not exist even remotely precise data on its past numbers, the scarce information available suggests that green monkeys were more common on Santiago in the past than they are today. Apart from the damage inflicted on plantations and gardens on Santiago and Brava, predation of eggs and young by monkeys may also have affected local (including endemic) bird populations. The green monkey's ecology in Cape Verde has as yet not been studied and neither have any studies on population dynamics been carried out.

Of rodents, the house mouse is widespread and occurs on all inhabited islands, as well as on the (formerly inhabited) island of Santa Luzia. Rats are equally widespread, having so far been reported from all islands except Sal and Santa Luzia, but are much less abundant than mice. The seemingly rather marginal occurrence of the brown rat may be related to the fact that most of Cape Verde's environment does not meet its water requirements. On Santiago, both black and brown rat have been identified, while on São Vicente the presence of the brown rat has been ascertained in the harbour area. The taxonomic identity of the rats found on other islands is still to be established. While the brown rat typically occurs in urban and harbour areas, the habitat choice of the black rat in Cape Verde is less clear, as knowledge of its presence is almost exclusively based on its identification as a prey item of birds, particularly the barn owl. Cesarini *et al.* (2008) mentioned the occurrence of both black and brown rats in the Serra Malagueta on Santiago, but did not provide further details.

Rabbits are said to have been common on several islands in the past, but now only occur on Santo Antão, although the scale of their present distribution there has not yet been determined. It is commonly believed that rabbits disappeared on most islands as a consequence of prolonged droughts. Whether the rabbit's current presence on Santo Antão is a holdover from the past or the result of a recent introduction is unknown.

Although the goats and other lifestock that widely roamed many of the Cape Verde Islands in the past were not feral in the strict sense, as they were owned and exploited (be it probably only marginally so during the early centuries of Cape Verde's history), their impact on the natural vegetation of the islands may have been profound. Free ranging goats (and other lifestock) are responsible for denuding soil, resulting in erosion and water loss, as well as the compaction of soil, hindering the regeneration of plants. Such effects can be particularly severe in fragile habitats such as the steppe and semi-desert vegetation that probably existed in the Cape Verde Islands in their virgin state, giving rise to large scale desertification (cf. Clutton-Brock 1999).

Apart from the species discussed above, feral cats and dogs can be found on most islands. On Santa Luzia, together with the islets of Branco and Raso now a nature reserve protected by law, a cat eridication programme is being implemented (José Melo *in litt.*). On Boavista (and possibly elsewhere), predation by feral cats threatens local populations of the red-billed tropicbird *Phaethon aethereus* L., 1758 (Pedro López Suárez *in litt.*). During the past decade, sterilization programmes of feral dogs and cats have been carried out in a number of urban areas in Cape Verde.

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