

Diet of feral cats *Felis catus* L., 1758 on Santa Luzia, Cape Verde Islands

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ABSTRACT

The diet of feral cats *Felis catus* on Santa Luzia, Cape Verde Islands, was studied. A total of 147 prey items were identified during the analysis of 26 scat groups collected during the summer of 2010. House mouse *Mus musculus* was the most important prey, both in percentage of biomass and number of preys consumed (89.7% and n= 117, respectively). Reptiles were the second most important prey, represented by one skink species (*Chioninia stangeri*) and an unidentified gecko species. The remainder of the identified prey consisted of one bird species (*Passer iagoensis*) and one undetermined Tettigoniidae species (Insecta). No endangered species were identified in scats of this introduced predator, but future surveys must be carried out to further avoid threats to the island's biodiversity.

RESUMO

Foi estudada a dieta de gatos assilvestrados *Felis catus* na ilha de Santa Luzia, Cabo Verde. Foram identificadas 147 presas de um total de 26 dejectos recolhidos no Verão de 2010. A presa mais importante, tanto em percentagem de biomassa como em número de presas consumidas, foi o rato doméstico *Mus musculus* (89.7% e n= 117, respectivamente). Os répteis foram a segunda presa mais importante, maioritariamente lagartos (*Chioninia stangeri*), bem como de uma espécie não identificada de osga. Outras presas identificadas foram uma ave (*Passer iagoensis*) e uma espécie não identificada de Tettigoniidae (Insecta). Não foi detectada nenhuma espécie com estatuto de ameaça na dieta deste predador introduzido, porém outras monitorizações futuras deverão ser implementadas para evitar ameaças à biodiversidade desta ilha.

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INTRODUCTION

Domestic cats *Felis catus* L., 1758 have been introduced to many islands around the world, often causing a dramatic impact on their wildlife (Medina *et al.* 2011). Cats predate on a great variety of prey species, including mammals and invertebrates as well as birds and reptiles, according to their abundance and availability (Bonnaud *et al.* 2011), occasionally causing a severe decline in populations of both native and introduced prey species (Fitzgerald 1988, Medina *et al.* 2011). However, some authors do not consider dietary studies to provide sufficient information to assess the impact of a predator upon a prey population (Townsend *et al.* 2006). Nevertheless, study of the diet of an introduced predator on an oceanic island is a useful tool and the first step towards interpreting and quantifying a predator's impact upon local wildlife (Paltridge *et al.* 1997).

In the Macaronesian region, the diet of feral cats has been extensively studied in the Canary Islands (see review by Nogales & Medina 2009). In this archipelago, introduced mammals (rabbits, rats and mice) constituted the main prey species, although native birds and reptiles also represented a considerable proportion of the consumed biomass. In

Madeira and the Cape Verde Islands, fewer studies have been carried out. The most complete studies were done on Madeira and Fogo (one of the Cape Verde Islands), respectively (Medina *et al.* 2010), and a preliminary study was carried out on Santa Luzia (Donald *et al.* 2005). In these islands, where rabbits are not present, other introduced mammal species (mainly mice) were the main prey consumed, but in Santa Luzia native skinks were the most preyed upon species (Donald *et al.* 2005). These studies showed that several endangered species, such as giant lizards in the Canary Islands and Fea's petrel *Pterodroma feae* on Fogo, were predated by feral cats (Medina & Nogales 2009, Medina *et al.* 2010), lending importance to this type of study as a tool for recognizing threats on island native faunas.

Studies of feral cat diet provide important data for evading the negative impact of these predators on native island wildlife (Bonnaud *et al.* 2011, Medina *et al.* 2011). In the present contribution we provide further data on the diet of feral cats at a poorly studied site in the Cape Verde archipelago (Mateo *et al.* 2004), trying to attain a new approach to their impact upon Santa Luzia's native species.

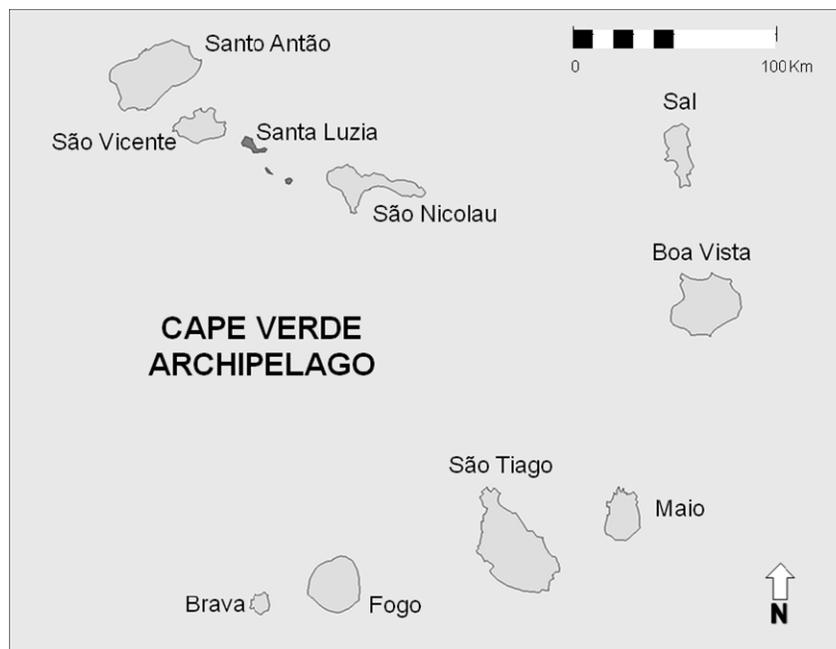


Fig. 1. Map of the Cape Verde archipelago showing the location of Santa Luzia island.

STUDY AREA

The archipelago of Cape Verde is situated in the eastern Atlantic Ocean, *ca.* 570 km off the western coast of continental Africa. It consists of 10 main islands and several uninhabited islets (Fig. 1). The three eastern islands are rather flat with a small number of peaks, reaching only a few hundred metres. The western islands are mountainous, locally reaching heights of 1,500 m (almost 3,000 m on Fogo), reflecting their younger geological age. Climate is warm and dry of a sahelian-tropical type and irregular monsoon rains reach the islands mainly in summer and autumn (for further information on the geology, climate and environment of the Cape Verde Islands, see Mitchell-Thomé 1976, Hazevoet 1995 and Duarte & Romeiras 2009).

Santa Luzia (35 km²) is the smallest of the main islands of the Cape Verde archipelago. Together with the nearby islets of Branco and Raso, it is often referred to as one

of the Desertas. It is uninhabited (but a family of goatherds lived there until the mid 1960s) and its highest point reaches 395 m a.s.l. Vegetation is characterized by the presence of only a single floristic zone (Duarte *et al.* 2008), dominated by drought resistant species such as *Cistanche phelipaea*, *Polycarpha nivea*, *Zygophyllum simplex*, *Heliotropium ramosissimum*, *Frankenia ericifolia* and *Euphorbia tuckeyana* (Schleich & Wuttke 1983, Diniz & Matos 1994, Sánchez Pinto *et al.* 2005). Santa Luzia's fauna has been poorly studied and only 57 terrestrial invertebrates, three terrestrial reptiles, *ca.* 8 breeding birds and one mammal species have been reported (Hazevoet 1995, Arechavaleta *et al.* 2005, Siverio *et al.* 2007, Masseti 2010, Hazevoet & Masseti 2011, Hazevoet 2012). Two other reptile species, presumed to have occurred on the island in the past, are now considered extinct (Siverio *et al.* 2007).

METHODS

The diet of feral cats on Santa Luzia was determined by analysing scats, a commonly used method in the research of mammalian carnivore diet (Delibes 1980, Trites & Joy 2005). In July 2010, a total of 26 scat groups were collected at different localities of the island. In contrast to other mammalian predators, feral cats frequently bury their faeces (Bradshaw 1992), making it often difficult to estimate the date of deposition. Therefore, the collected material (which included both old and fresh scats) probably covered all seasons, as scats remain unaltered over a long period before disintegrating (Medina *et al.* 2006). This complicates the study of feeding ecology of feral cats, as seasonal prey availability becomes difficult to interpret. Scats were broken up at the laboratory after having been saturated in water. Prey items, magnified 16x using a binocular microscope, were identified at the species level whenever possible, using hairs, bones, feathers, arthropod exoskeletons and

reference collections. Although it is difficult to quantify the number of individual prey from scats, because the same prey may appear in more than one dropping (Delibes 1980), the minimum number of preys was estimated by counting bone remains, jaws and, especially, opposite mandibles and teeth (incisors). The ingested biomass was calculated from values obtained from bibliographic resources. In the case of invertebrates, only preys weighing more than 0.05 g were considered in order to avoid counting indirect prey items, previously ingested by lizards (Medina *et al.* 2006, Medina & García 2007).

Statistical analysis involved a chi-square test to compare the quantity of different prey types consumed, using the number of prey items in the scats. Analysis consisted of comparing the number of a certain prey item with respect to the total number of the remaining prey identified (Medina *et al.* 2006).

RESULTS AND DISCUSSION

A total of 147 preys was identified from the analysis of 26 scat groups collected on Santa

Luzia (Table 1). The small number of faeces sampled may reflect the rather small feral cat

	No. Prey	% Prey	FO (%)	% Biomass
MAMMALS	117	79.6	100	89.7
<i>Mus musculus</i>				
BIRDS	3	2.0	11.5	2.2
<i>Passer iagoensis</i>				
REPTILES	25	17.0	53.8	8.0
Scincidae				
<i>Chioninia stangeri</i>	17	11.6	46.2	5.5
Gekkonidae indet.	8	5.4	23.1	2.5
INVERTEBRATES	2	1.4	7.7	0.1
Tettigoniidae indet.				
PLANT MATERIAL			53.8	

Table 1. Results of the analysis of feral cat *Felis catus* scats from Santa Luzia, Cape Verde Islands (n= 26).

population on the island (cf. Donald *et al.* 2005). House mouse *Mus musculus* was the only mammal prey detected, constituting more than 89% of the total consumed biomass and being the main prey consumed ($\chi^2= 51.49$; $df= 1$; $p < 0.001$). Reptiles were represented by two different families, Scincidae (*Chioninia stangeri*) (n= 17) and Gekkonidae (eight individuals not identified at the species level). Only one bird species, iago sparrow *Passer iagoensis*, and one unidentified Tettigoniidae (Insecta) species made up the remainder of the feral cat diet on Santa Luzia (Table 1).

On oceanic islands where other mammal species (usually mice, rats and rabbits) have also been introduced, these constitute the main prey for feral cats (Fitzgerald & Turner 2000, Nogales & Medina 2009, Bonnaud *et al.* 2011). On Santa Luzia, mice are the only available mammal prey of feral cats (Masseti 2010, Hazevoet & Masseti 2011). Mice also constituted the main prey of feral cats on Fogo island (Medina *et al.* 2010) and generally is an important prey in open shrub environments (Nogales & Medina 2009), which is the principal ecosystem on Santa Luzia (Duarte *et al.* 2008). However, Donald *et al.* (2005) found skinks, not mice, to be the main prey on Santa Luzia. This may be due to seasonal variations in population size and activity patterns of both prey species, as studies were performed in different seasons, i.e. winter (Donald *et al.* 2005) and summer (this study). Feral cats are known to change their diet according to seasonal variation of prey availability (Konecny 1987). Birds are important prey species on islands with import-

ant colonies of seabirds (Bonnaud *et al.* 2011). On Santa Luzia, where only a small number of bird species breed, only remains of one passerine species were found in scats. In other studies of feral cat diet in the Cape Verde archipelago (i.e. Santa Luzia: Donald *et al.* 2005, Fogo: Medina *et al.* 2010), birds also only formed a small part of feral cat diet. However, elsewhere in Cape Verde, on Boavista island, feral cats have been identified as important predators of breeding red-billed tropicbirds *Phaethon aethereus* (P. López Suárez *in litt*). In our study, reptiles were the second most important prey of feral cats on Santa Luzia, these being well known as an important prey in open habitats (Nogales & Medina 2009) and at low latitudes (Fitzgerald 1988). Although reptiles rarely represent a significant percentage of the biomass consumed by cats on islands (Bonnaud *et al.* 2011), they were the most important prey for cats on Santa Luzia in winter (Donald *et al.* 2005). In contrast, reptiles were the second most important prey group, both in number and frequency of occurrence, on Fogo in winter (Medina *et al.* 2010). If available, large insects, such as *Coleoptera* or *Acrididae*, are frequently preyed upon by feral cats (Fitzgerald & Turner 2000, Nogales & Medina 2009, Bonnaud *et al.* 2011).

It is difficult to assess the bearing of an introduced species on the decline of another species (Townsend *et al.* 2006), but the study of diet is considered the first step towards interpreting the impact of feral cats on prey populations (Paltridge *et al.* 1997). Although the iago sparrow is listed as a Least Concern

species in the IUCN Red List (IUCN 2012), it is endemic to the Cape Verde Islands and included in the diet of feral cats on Santa Luzia. In insular environments, feral cats are known to become the top predator on the food chain (Nogales *et al.* 1992), threatening a large number of species on islands worldwide (Fitzgerald & Turner 2000, Medina & Nogales 2009, Medina *et al.* 2011). Remains of the giant skink *Chioninia* (= *Macrosclincus*) *coctei*, long considered extinct, have been claimed to have been identified in cat scats from Santa Luzia (Mateo *et al.* 2004), although this has not yet been substantiated beyond reasonable doubt. Future surveys should be carried out to obtain definitive data on the possible survival of this skink, formerly thought to have been endemic to the islets of Raso and Branco only.

Santa Luzia has been suggested as a suit-

able place for natural re-colonization or deliberate introduction of the Raso lark *Alauda razae* (Donald *et al.* 2005), a Critically Endangered species (IUCN 2012) endemic to Raso islet. However, cat presence on Santa Luzia is considered a negative factor in this connection. Though feral cat eradication is considered feasible on a small and uninhabited island (Campbell *et al.* 2011) such as Santa Luzia, removing this introduced predator could cause an increase in the mouse population that could in turn negatively affect native (or, in the case of the Raso lark, introduced) species on the island. Therefore, if a feral cat eradication project is to be carried out on Santa Luzia, in order to avoid the mesopredator release effect (Courchamp *et al.* 1999), the simultaneous eradication of both the introduced predator (cats) and its principal introduced prey (mice) should be considered.

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