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Food spectrum of the feral cat (*Felis catus* L., 1758) in the juniper woodland on El Hierro (Canary Islands)[1])

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Abstract. The diet of feral cats inhabiting a juniper woodland on the island of El Hierro (Canary Islands) has been studied by analyzing 248 scats. A total of 1029 prey items have been identified indicating that the introduced mammals (*Oryctolagus cuniculus*, *Mus* sp. and *Rattus* sp.) constitute the basis of the diet appearing in 88.3 % of the samples and representing 85.4 % of the consumed biomass. *Mus* sp. is the most frequently captured prey but in terms of biomass, *Oryctolagus cuniculus* is the fundamental basis of the diet as has similarly been found in other areas studied. Birds can be regarded as alternative prey resources of some importance though they only account for 8 % of the biomass with Cory's shearwater (*Calonectris diomedea*), contributing practically half this value. Reptiles appear in 44.3 % of the scats but only represent 5.9 % of the biomass, *Gallotia galloti caesaris* being the most frequently captured species (64.1 %). Insects, (mainly Orthoptera & Coleoptera), despite their high frequency of apparition (45.5 % of scat groups), are insignificant due to their small size, though worthy of note is the large number of larvas of *Pimelia laevigata*.

Key words. Diet, *Felis catus*, juniper woodland, Canary Islands.

Introduction

Domestic cats have been taken by man to many parts of the world and have frequently become feral. This phenomenon has occurred on islands, even those that are uninhabited.

The introduction of a predator such as the feral cat into an island community can have serious effects on the numerous potential prey as it is well known that cats are generalized predators with a dietary spectrum that, at any specific time ot the year, depends on food availability (Marshall 1961; Coman & Brunner 1972; Heidemann 1973; Jones 1977).

Birds, especially seabirds, have suffered the impact of this alien predator and numerous examples of population declines, local extinctions and some total extinctions of species are documented (Dilks 1979; Moors & Atkinson 1984; Veitch 1985), although Fitzgerald & Karl (1979) have shown that feral house cats are primarily predators of small mammals, mainly rodents and rabbits.

In the Canary Islands, feral cats[2]) inhabit all the main islands (including the smallest, La Graciosa) and unfortunately have recently been introduced on the islet of Alegranza where there exist the highest congregation of breeding seabirds in the archipelago.

[1]) This paper was presented at 5th Colloquium on Ecology and Taxonomy of African Small Mammals, Rogate, England, August 1987.

[2]) It is worth mentioning that in an aboriginal archaeological deposit located in the north of Tenerife, bone fragments, (a left mandible with a canine tooth and an isolated lower right canine tooth), have been found that could possibly correspond to *Felis margarita*, though absolute confirmation is still needed (Sarrion Montañana 1985).

On the nearby archipelago of Madeira, where the composition of the breeding seabird community is similar to that of the Canaries, several species of Procellariiformes such as *Calonectris diomedea*, *Bulweria bulwerii* and *Oceanodroma castro*, have been found to form part of the diet of the feral cats on Deserta Grande (Cook & Yalden 1980).

In this paper, we have attempted to analyze the food spectrum of the feral cat in a slightly modified primigenial habitat on the island of El Hierro.

Study area

The island of El Hierro with an area of 278 km² is the smallest and westernmost of the seven main islands that compose the Canary Archipelago (Fig. 1). This fact together with its recent volcanological genesis — considered the youngest with datations of 3 million years (Schmincke 1976) — endow the island with a marked personal character.

The scat samples utilized in the present study were collected in a juniper woodland (*Juniperus phoenicea*) localized in the western sector of the island (400—600 m a. s. l.) (Fig. 1).

The vegetation of this area corresponds to an open woodland, the juniper trees exhibiting a characteristic bent-over form as a consequence of the high incidence of strong winds that blow in a NE—SW direction. An extensive shrubbery of *Cistus monspeliensis*, *Euphorbia obtusifolia*, *Rubia fruticosa*, *Micromeria hyssopifolia* and *Asphodelus aestivus* constitutes the understory throughout most of the area though towards the lower reaches, one finds floristic elements of the lower xerophytic zone such as *Schizogyne sericea* and *Kleinia neriifolia*.

In the Canary Islands, the areas of juniper woodland have undergone a notable regression during the last centuries, La Gomera and El Hierro being the only two islands that still conserve formations of any reasonable extension.

Material and methods

The study material comprising 248 scats was collected on the 10th and 11th October, 1986. Because each scat consists of several segments and an individual prey item can appear in various segments, difficulties are encountered in quantifying the actual number of prey (Delibes 1980). Therefore the scats were analyzed according to the groups in which they were found and their contents, in all cases, were treated as a single sample (Jones 1977; Dilks 1979). In total, the 248 scat groups contained 647 segments, the minimum per group being 1 and the maximum 7, the average corresponding to 2.6. Each scat segment was immersed in water and the contents separated out. Individual prey species were identified by comparing the scat material with that of a reference collection deposited in the Zoology Department of La Laguna University. Teeth and various bones were used to identify mammals; bones and feathers for birds; bones and scales for reptiles; mainly mandibles for insects although in some instances, elytra and other distinctive fragments were used.

The results are presented in the form of percentage of total prey, frequency of occurrence of each prey in the scat groups and percentage of biomass. Biomass values were obtained by utitilizing the average weight of a series of trapped individuals for birds, reptiles and insects or, as in the case of mammals, recurring to bibliographic sources (Yalden 1977). However, with respect to large prey species such as rabbits, Cory's shearwaters, rock doves and undetermined nonpasserines that constitute more than the daily food intake, we have followed the criteria of Fitzgerald & Karl (1979) assigning a biomass of 170 g.

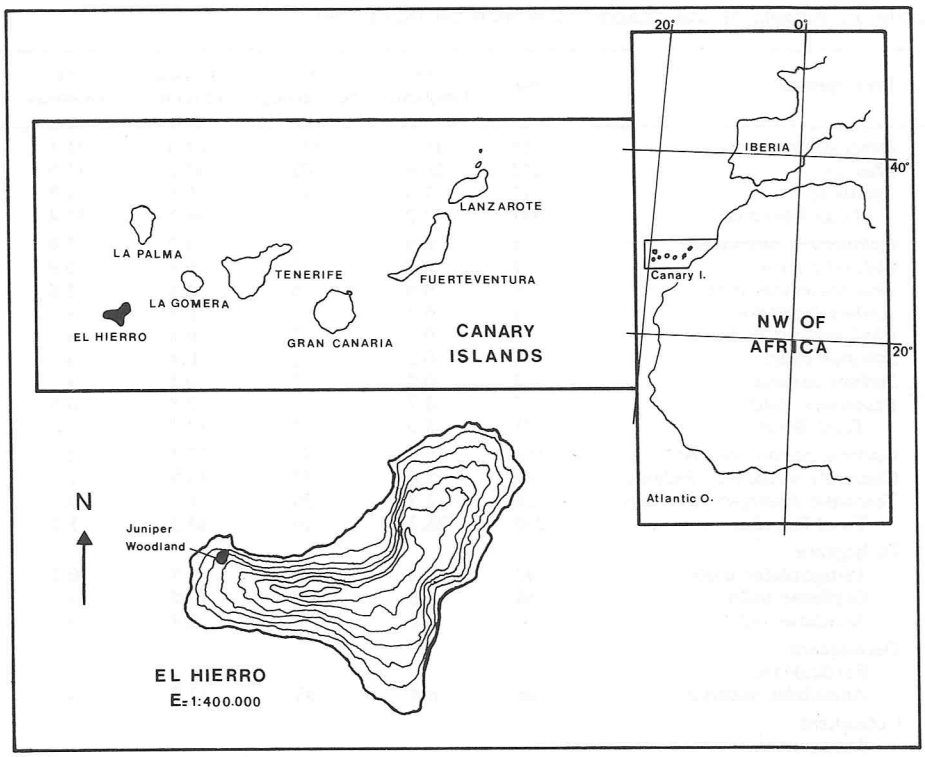

Fig. 1: Localization of the study area.

Results and discussion

The analysis of the scats yielded a total of 1029 prey items (Tab. 1).

The dietary spectrum of the feral cats in the study area is based mainly on introduced mammals (rabbits, mice & rats) which appear in 88.3 % of the scat groups and represent 85.4 % of the consumed biomass.

With a frequency of occurrence of 61.3 %, the rabbit constitutes the fundamental prey accounting for 71.1 % of the total diet biomass.

The dietary dependance of feral cats on *Oryctolagus cuniculus* when this species is abundant, has been indicated in various publications. For example on Macquarie Island (Subantarctic), rabbit remains were found in 82 % of scats and 71 % of gut samples (Jones 1977). Rabbits are also important components of the diet of *Felis catus* in semideveloped and developed areas of agricultural land of Victoria (Australia) (Coman & Brunner 1972) and in the pine forest of Gran Canaria, Canary Islands (Santana et al. 1986). On Kerguelen (Subantarctic), rabbits appeared in 35 % (1970), 71.9 % (1976) and 49.2 % (1977) of the stomachs analyzed (Derenne 1976; Pascal 1980).

As regards the Muridae, it is interesting to note that mice (*Mus* sp., probably *musculus*) represent an important complementary contribution to the biomass (11.5 %) being furthermore, the most frequently captured species (20.6 %) appearing

Table 1: Results of scat analysis (* biomass less than 0.1 %).

Prey species	No.	% Frequency	No. Scat groups	Group frequency	% Biomass
Oryctolagus cuniculus	154	15.0	152	61.3	71.1
Mus sp.	212	20.6	122	49.2	11.5
Rattus sp.	17	1.6	17	6.8	2.8
Total Mammals	383	37.2	219	88.3	85.4
Calonectris diomedea	8	0.8	8	3.2	3.6
Columba livia	2	0.2	2	0.8	0.9
Non-passerines indet.	6	0.6	6	2.4	2.8
Anthus bertheloti	1	0.1	1	0.4	*
Phylloscopus collybita	3	0.3	2	0.8	*
Sylvidae indet.	2	0.2	2	0.8	*
Serinus canaria	2	0.2	2	0.8	*
Passerines indet.	7	0.7	7	2.8	0.3
Total Birds	31	3.0	33	13.3	8.0
Gallotia galloti caesaris	154	15.0	93	37.5	4.2
Chalcides viridanus viridanus	60	5.8	37	14.9	1.2
Tarentola boettgeri hierrensis	26	2.5	20	8.1	0.5
Total Reptiles	240	23.3	110	44.3	5.9
Orthoptera:					
Tettigoniidae indet.	43	4.2	24	9.7	0.2
Gryllidae indet.	68	6.6	41	16.5	*
Acrididae indet.	6	0.6	6	2.4	*
Dermaptera:					
Forficulidae:					
Anisolabis maxima	66	6.4	33	13.3	*
Coleoptera:					
Scarabaeidae:					
Oryctes nasicornis	2	0.2	2	0.8	*
Pachydema sp.	1	0.1	1	0.4	*
Scarabaeidae indet.	2	0.2	2	0.8	*
Tenebrionidae:					
Pimelia laevigata costipennis					
(Ad)	19	1.8	10	4.0	*
(larvas)	155	15.1	26	10.5	0.4
Hegeter sp.	2	0.2	2	0.8	*
Lepidoptera indet.	9	0.9	9	3.6	*
Hymenoptera indet.	2	0.2	2	0.8	*
Total Insects	375	36.4	113	45.5	0.8

in half of the total number of scats. On the other hand, rats (probably *Rattus rattus*) are infrequent prey (1.6 %) accounting for less than 3 % of the biomass.

In other regions studied, the proportion of mice is usually low (Heidemann 1973; Jones op. cit.; Van Aarde 1980; Santana et al. op. cit.), or either of variable importance owing to annual fluctuations (Fitzgerald & Karl 1979) or to the degree of alteration of the habitat (Coman & Brunner op. cit.). Rats apart from some exceptions (Jones op. cit.; Santana et al. op. cit.), can constitute the principal prey (Marshall 1961; Dilks 1979; Fitzgerald & Karl op. cit.). On Stewart Island (New Zealand) where there is neither *Mus* nor *Oryctolagus cuniculus*, rats (*Rattus exulans*, *R. rattus* and *R. norvegicus*) were found in 93 % of the scats collected and represented 79.7 % of the total weight of food taken (Karl & Best 1982).

Bird remains have been found in 13.3 % of the scats accounting for 8 % of the consumed biomass of which nearly half corresponds to *Calonectris diomedea*. These results are similar to those found by Fitzgerald & Karl (op. cit.), although it is well known that birds, especially seabirds, can be heavily predated (Jones op. cit.; Marshall op. cit.; Stonehouse 1962; Derenne op. cit.; Fitzgerald & Veitch 1985; Rauzon 1985; Veitch 1985).

Reptiles (all endemic) are captured more frequently than birds, appearing in 44.3 % of the scat groups. However, due to their small size, their contribution to the biomass is small, 5.9 %. The species most frequently captured is the lizard *Gallotia galloti*, though skinks and geckos are also eaten. Furthermore, it is interesting to mention that cats have been considered to be one of the principal potential predators of the large endemic lizard, *Gallotia* aff. *simonyi* whose small and restricted population is seriously endangered (Machado 1985).

In other areas studied, reptiles usually appear in the diet of feral cats in low proportions (Coman & Brunner op. cit.; Heidemann 1973; Fitzgerald & Veitch op. cit.; Rauzon op. cit.), moreover, their frequency of occurrence being related to a latitudinal gradient (Fitzgerald in litt.).

Insects are frequently captured (36.4 % of the total prey) appearing in 45.5 % of the scat groups but owing to their very small size, their contribution to the biomass (0.8 %) is insignificant. Orthoptera and tenebrionid Coleoptera, especially larvas of *Pimelia laevigata* (41.3 % of the insect total), are the most heavily predated groups.

Finally, it is of interest to point out the presence of vegetal material; plant fibres in 42.7 % of the samples analyzed and seeds in 16.9 %. The majority of the latter correspond to those of *Juniperus phoenicea* and *Rubia fruticosa*.

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Zusammenfassung

Die Nahrung von Hauskatzen in einem natürlichen Wacholderbestand der Insel Hierro (Kanarische Inseln) wurde durch Analyse von 248 Kotproben ermittelt. Insgesamt wurden 1029 Beuteobjekte identifiziert. Sie zeigen, daß eingeschleppte Säugetiere (*Oryctolagus cuniculus*, *Mus* sp., *Rattus* sp.) mit einem Anteil von 88.3 % bzw. 85.4 % der Biomasse die Nahrungsgrundlage der Katzen darstellen. Mäuse werden am häufigsten gefangen, aber in Bezug auf die Biomasse ist das Kaninchen die wichtigste Beute, ähnlich wie in anderen untersuchten Inselregionen. Vögel haben eine gewisse Bedeutung als Alternativbeute, machen aber nur 8 % der Biomasse aus, davon die Hälfte *Calonectris diomedea*. Reptilien, hauptsächlich *Gallotia galloti caesaris*, wurden in 44.3 % der Kotproben gefunden und stellen 5.9 % der Biomasse. Insekten (überwiegend Orthoptera und Coleoptera) sind trotz häufigen Auftretens (in 45.5 % der Proben) aufgrund ihrer Kleinheit unbedeutend, doch ist die große Zahl der verzehrten Larven des Käfers *Pimelia laevigata* bemerkenswert.

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