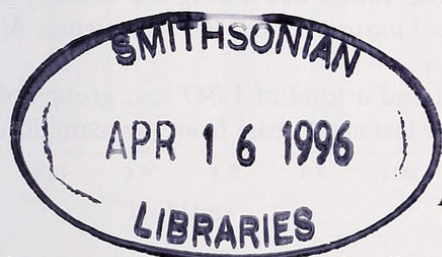


## **A review of the diet of feral domestic cats (*Felis silvestris* f. *catus*) on the Canary Islands, with new data from the laurel forest of La Gomera**

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### **Abstract**

In this study we present a review on the diet of the feral cat on the Canary archipelago, providing the first data from the relict laurel forest (Garajonay National Park). Among the 403 prey items identified in this habitat, rats were most numerous followed by reptiles. A total of 1,047 scat groups has been studied in the last eight years from the main habitats of the Canaries. Most of the 2,963 prey items identified represent introduced mammals (rabbit, *Oryctolagus cuniculus*; mouse, *Mus* cf. *musculus* and rat, *Rattus* sp.). These prey were commonly captured in most habitats with the exception of high mountain scrub. In this habitat, reptiles were taken instead introduced mammals. They were also more commonly included in the diet from open ground and open forest than from the denser forest. Birds were more frequently consumed in the forest than in open areas. Arthropods appeared in significant proportions in the scats from habitats where these items reached high numbers. The results indicate that the diet of feral cats clearly varies according to the different habitats.

### **Introduction**

The domestic cat (*Felis silvestris* f. *catus*) has long been associated with humans and has travelled with them to most parts of the world, including many remote and uninhabited islands (FITZGERALD 1988). The Canary archipelago is no exception and today feral cats are widely distributed over all the major islands, being a top predator in the food chain among the vertebrates (NOGALES et al. 1992).

Most islands contain a high diversity of habitats, and their distribution depends mainly on latitude and altitude. Nevertheless, the majority of the studies concerned with the diet of feral cats carried out on other oceanic islands has been made in single habitats (MARSHALL 1961; VAN AARDE 1980; KARL and BEST 1982; FITZGERALD and VEITCH 1985; RAUZON 1985). Based on these studies, some general tendencies in the frequency of different prey items – according to latitude – have been revealed (see review by FITZGERALD 1988). Nevertheless, this variation can be very confuse and changeable, depending on the types of habitat studied.

Despite the enormous difference in size, latitude and altitude of the islands, no studies have revealed the variation in the spatial patterns of the diets among the different main habitats. In this respect, the Canary Islands provide a suitable framework for such studies, due to the habitats being strongly distributed as a basic function of altitude and orientation. In this study we demonstrate the spatial variation pattern of the diet of feral cats among the main habitats on the Canary Islands.



Although five publications have described the diet of feral cats on the Canaries, none of them has examined statistically the prey items found in the different habitats studied. To date, no information has been published on the diet of feral cats in the relict laurel forest of the North Atlantic islands.

### Material and methods

The Canary Islands are situated in the Atlantic Ocean at the closest point some 100 km from the African continent, lying between 27°37'–29°25' N and 13°20'–29°25' W.

Garajonay National Park is situated in the upper areas of La Gomera Island (highest point: 1,487 m a. s. l.) and its area extends to over 3,974 ha. The dense vegetation is composed of native laurel forest, a relict woodland which formerly covered the margins of the Tethys Sea during the Tertiary. This woodland is composed of some twenty species of trees, such as *Laurus azorica*, *Ilex canariensis*, *Myrica faya*, *Erica arborea*.

135 scat groups from Garajonay N.P. were analysed and a total of 1,047 scat groups of feral cats (including those from Garajonay) have been studied in the last eight years from the main different habitats of the Canary Islands (Tab. 1).

**Table 1.** Studies carried out in the different habitats of the Canary Islands.

Habitats	≈ Altitude (m a. s. l.)	n° scats analysed	Island	Authors
Xerophytic scrub (islet)	0–300	110	Alegranza	NOGALES et al. (1992)
Xerophytic scrub (island)	0–300	200	Tenerife	MEDINA and NOGALES (1993)
Juniper forest	300–600	248	El Hierro	NOGALES et al. (1988)
Laurel forest	600–800	135	La Gomera	present study
Pine forest	800–1800	133	Gran Canaria	SANTANA et al. (1986)
High mountain scrub	1800–3700	221	Tenerife	NOGALES et al. (1990)

The scat analysis was carried out at a magnification of 16× after previously saturation in water. For more information on the analysis of the scat, see SANTANA et al. (1986) and NOGALES et al. (1988). Due to the fact that scats remain unaltered over a long period before their eventual disintegration, (usually more than one year), the material studied in each habitat corresponded to all seasons. For this reason it is only possible to compare the general patterns of the diet in the different habitats represented in the archipelago. Although the diet of feral cats can change according to the seasons (LIBERG 1984; HUBBS 1951; JONES and COMAN 1982; FITZGERALD and KARL 1979), this aspect was not considered in the present study.

Statistical analyses (Chi-square test) were performed by utilizing frequencies of occurrence in scat groups for each food item. Significant differences were considered at  $p < 0.05$ .

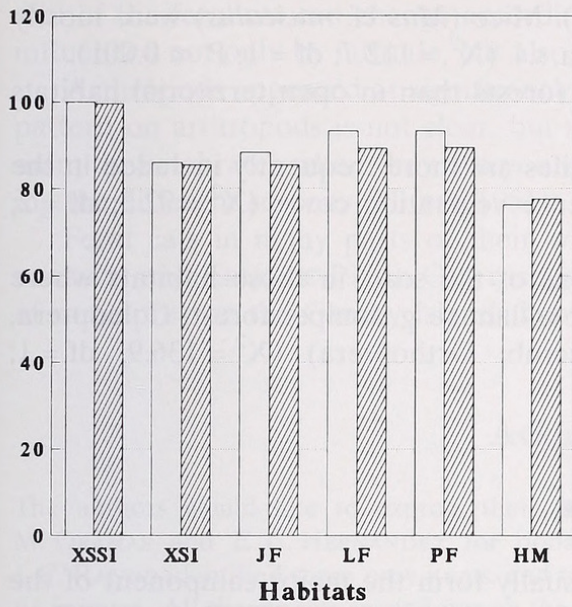
### Results

#### The diet in Garajonay National Park

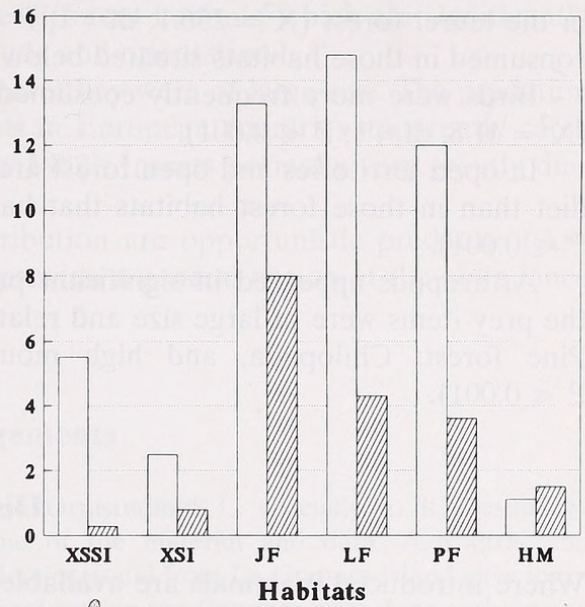
The analyses of scats yielded a total of 403 prey items. Introduced mammals, mainly rats (*Rattus* sp.), appeared most frequently and reptiles ranked second (Fig. 1). Birds and arthropods were less frequent in the diet. From the point of view of biomass introduced mammals were clearly the most important prey.



## Mammals



## Birds

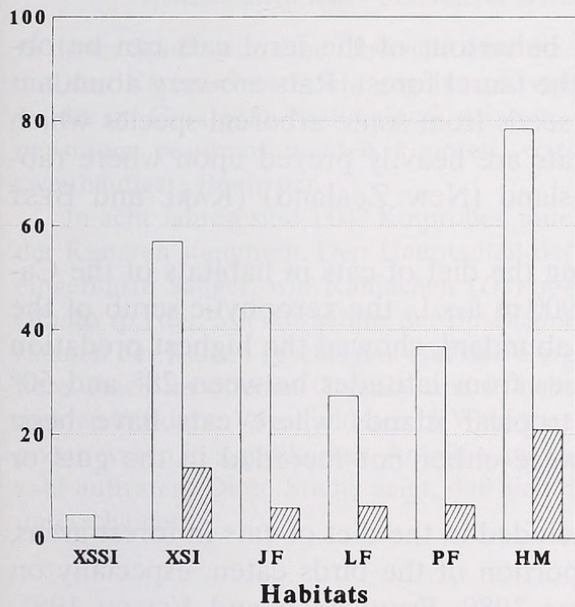


□ % Occurrence    ▨ % Biomass

□ % Occurrence    ▨ % Biomass

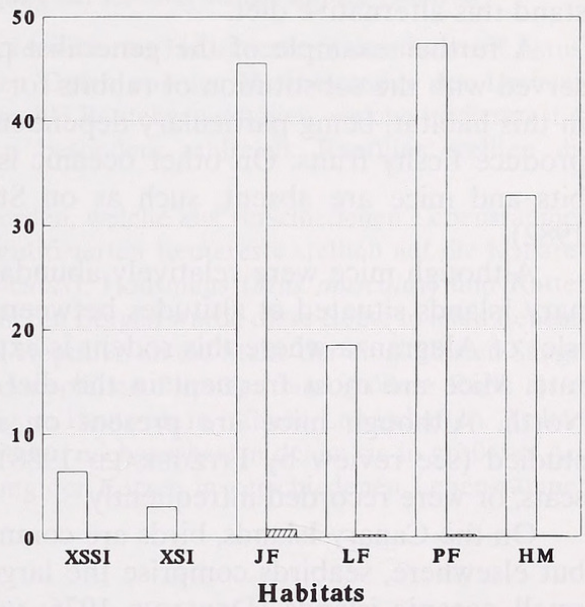


## Reptiles



□ % Occurrence    ▨ % Biomass

## Arthropods



□ % Occurrence    ▨ % Biomass

**Fig. 1.** Results obtained from the scat analyses of feral cats (*Felis silvestris* f. catus) in the different habitats of the Canary Islands. XSSI – Xerophytic scrub (small islet), XSI – Xerophytic scrub (island), JF – Juniper forest, LF – Laurel forest, PF – Pine forest, HM – High mountain scrub.

### Review of the diet on the Canary Islands

A total of 2,963 prey items has been identified in the 1,047 scat groups analysed.

Introduced mammals appeared less frequently in the diet of the high mountain areas compared with the remainder of the habitats ( $X^2 = 32.8$ ;  $df = 1$ ;  $P \ll 0.001$ ). Rabbits (*Or-*



*ycetolagus cuniculus*) showed a lower frequency of occurrence in the laurel forest than in the other habitats ( $X^2 = 91.5$ ;  $df = 1$ ;  $P \ll 0.001$ ), but rats were most frequently consumed in the laurel forest ( $X^2 = 256.1$ ;  $df = 1$ ;  $P \ll 0.001$ ). Mice (*Mus* cf. *musculus*) were mostly consumed in those habitats situated below 900 m a.s.l. ( $X^2 = 112.7$ ;  $df = 1$ ;  $P \ll 0.001$ ).

Birds were more frequently consumed in the forests than in open territorial habitats ( $X^2 = 41.8$ ;  $df = 1$ ;  $P \ll 0.001$ ).

In open territories and open forest areas, reptiles are more frequently included in the diet than in those forest habitats that have a dense vegetation cover ( $X^2 = 92.3$ ;  $df = 2$ ;  $P \ll 0.001$ ).

Arthropods appeared in significant proportions of the scats in those habitats where the prey items were of large size and relatively abundant (e.g. Juniper forest: Coleoptera, Pine forest: Chilopoda, and high mountain scrub: Orthoptera) ( $X^2 = 136.9$ ;  $df = 1$ ;  $P \ll 0.001$ ).

## Discussion

Where introduced mammals are available they usually form the major component of the diet of cats on islands (JONES 1977; DILKS 1979; COOK and YALDEN 1980; KARL and BEST 1982). On the Canary Islands, introduced mammals are the main prey items in most habitats, except in the high mountain scrub. The low numbers of rabbits in this habitat are compensated by lizards of medium size (about 25 g). Taking into account the fact that feral cats are versatile generalist predators (ANDERSSON and ERLINGE 1977; PASCAL 1980; VEITCH 1985), and endemic lizards (eg. *Gallotia galloti*) are very common in the high mountain scrub, and are active virtually throughout the year, it is not difficult to understand this alternative diet.

A further example of the generalist predator behaviour of the feral cats can be observed with the substitution of rabbits for rats in the laurel forest. Rats are very abundant in this habitat, being particularly dependent upon seeds from some arboreal species which produce fleshy fruits. On other oceanic islands, rats are heavily preyed upon where rabbits and mice are absent, such as on Stewart Island (New Zealand) (KARL and BEST 1982).

Although mice were relatively abundant among the diet of cats in habitats of the Canary Islands situated at altitudes between 0 and 900 m a.s.l., the xerophytic scrub of the islet of Alegranza where this rodent is extremely abundant, showed the highest predation rate. Mice are most frequent in the diet in studies from latitudes between 28° and 50° North. Although mice are present on several tropical islands where cats have been studied (see review by FITZGERALD 1988), they were either not recorded in the guts or scats, or were recorded infrequently.

On the Canary Islands, birds are commonly included in the diet of cats in forest areas, but elsewhere, seabirds comprise the largest proportion of the birds eaten, especially on small oceanic islands (DERENNE 1976; VAN AARDE 1980; FITZGERALD and VEITCH 1985; RAUZON 1985; KIRKPATRICK and RAUZON 1986). Land birds predominate as the major component of the diet of rats only on the New Zealand mainland and offshore Stewart Island, and on the North Atlantic islands of the Canary archipelago, Heisker (Scotland) and Helgoland (Germany).

Reptiles were frequently consumed in open habitats, even in the juniper forest, which may probably be due to their higher vulnerability in these areas while thermoregulating. The frequency of reptiles in the diet of cats on islands shows a similar pattern to that on the continent, with high frequencies of occurrence at low latitudes (see KONECNY 1983; LAURIE 1983; FITZGERALD 1988). This interpretation should be considered carefully because the highest frequency of occurrence in the world has now been recorded in the high



mountain scrub of the Tenerife Island (Canaries), which is situated in a subtropical region (NOGALES et al. 1990). For this reason, it is necessary to take into account the fact that the diet of the feral cat can change according to the different habitats, which are significantly influenced not only by latitude, but also by altitude and orientation.

Arthropods appeared at significant ratios where they were of large size. The predation pattern on arthropods is not clear, but some cats in European countries apparently catch many invertebrates when they are young (HOWE 1982). Insects normally vary greatly during the different seasons (HUBBS 1951).

Feral cats in many parts of their wide distribution are opportunistic predators (ANDERSSON and ERLINGE 1977). Our results could provide a general notion of the abundance of some prey on the Canary Islands habitats.

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### Zusammenfassung

#### *Ein Überblick über die Nahrung von verwilderten Hauskatzen (*Felis silvestris* f. *catus*) auf den Kanarischen Inseln unter besonderer Berücksichtigung der Lorbeerwälder auf La Gomera*

In dieser Studie wird eine Übersicht über die Nahrung verwilderter Hauskatzen (*Felis silvestris* f. *catus*) auf den Kanarischen Inseln gegeben. Erstmals werden Daten aus den Restbeständen der Lorbeerwälder im Garajonay Nationalpark geboten. Unter den 403 Beutebestandteilen, welche in diesem Lebensraum bestimmt werden konnten, waren Ratten besonders zahlreich. Reptilien stellten die zweithäufigste Beute dar.

In acht Jahren sind 1047 Kotproben untersucht worden, welche aus verschiedenen Lebensräumen der Kanaren stammten. Den Hauptanteil der 2963 identifizierten Beutereste stellten auf die Kanaren eingeführte Säuger, wie Kaninchen (*Oryctolagus cuniculus*), Hausmaus (*Mus musculus*) und Ratten (*Rattus* sp.) dar. Mit Ausnahme der Buschzonen auf höheren Bergen wurde diese Beute in allen Lebensräumen der Katzen geschlagen. Auf den Bergen traten Reptilien an die Stelle der eingeführten Säugtiere. Auch im offenen Gelände und in lichten Wäldern spielten Reptilien eine größere Rolle als in dichten Wäldern. Vögel bildeten in Wäldern eine häufigere Beute als in offenen Landschaften. Arthropoden waren in signifikanten Anteilen aus jenen Habitaten nachweisbar, in denen sie in größerer Anzahl auftraten. Diese Studie zeigt, daß sich die Nahrung der Katzen in verschiedenen Lebensräumen unterscheidet.

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