

Zoologia et AZD Saira (Department of Zoology and Animal Cell Dynamics)
Universidad del País Vasco Euskal Herriko Unibertsitatea (University of the Basque Country)

Home range size and habitat use of male common genets in the Urdaibai biosphere reserve, Northern Spain

By I. ZUBEROGOITIA, J. ZABALA, I. GARIN and J. AIHARTZA, Bilbo

1 Introduction

The common genet (*Genetta genetta*) represents an isolated African element in the European fauna (SCHAUENBERG, 1966). Its European distribution is restricted to Spain, Portugal and France, although it seems to be extending its range, as some individuals have been found in Belgium, Switzerland and Germany (LIVET and ROEDER, 1987). Nevertheless it still remains as one of the less known European carnivores. Studies on the ecology of the common genet are scarce and most of them are restricted to a few Mediterranean locations (PALOMARES and DELIBES, 1988, 1994; CAMACHO et al., 1992).

Studies carried out so far report that genets prefer woodland and shrubland areas (PALOMARES and DELIBES, 1994; ZUBEROGOITIA et al., 2001). Such habitats provide individuals with adequate shelter and areas rich in food, mainly small mammals and passerines, (DELIBES, 1974, 1977, PALOMARES and DELIBES, 1988; HAMDINE et al., 1993; PALOMARES and DELIBES, 1994; CLEVENGER 1995; VIRGOS et al., 1996). Therefore, in an Eurosiberian study area with different habitat types, we should expect genets to prefer habitats resembling those selected in Mediterranean areas. In the present study, we examined patterns of habitat use during the activity and resting times of three male genets.

2 Materials and methods

2.1 Study area

The study was conducted in the Urdaibai Biosphere Reserve (UBR), in the Eurosiberian region of Northern Spain (Fig.). The UBR is a hilly 230 km² area that encompasses the catchment of the river Oka. The altitude range is 0–900 m, and the climate is typically oceanic. Mean temperatures in January and July reach 6 °C and 18 °C, respectively. The average annual rainfall is 1400 mm. The major landscape units are forests (54% of the study area), mainly plantations of exotic species (*Pinus radiata* and *Eucalyptus globulus*) and evergreen holm oak woods (*Quercus ilex*). Holm oak woods, with their associated thick understory (brambles *Rubus* sp and vines *Smilax* sp and *Thamus* sp), are found mainly in rugged terrain. Undergrowth is poorly developed in other forest types, or even non-existent. Meadows and cultivated fields (29%) are also common. Estuarine mudflats and saltmarshes (5%), and urban areas (5%) occupy the rest of the area (ARRIETA et al., 1993; ALDAI and ORMAETXEA, 1998). The human population (ca. 44,000) is mainly clustered in the towns of Gernika and Bermeo.

2.2 Methods

We trapped genets using single entry cage traps of our own design (25 × 25 × 45 cm), baited with sardines. Trapping was carried out during 1199 trap-nights from 11/02/99 to 20/03/99 (see ZABALA et al., 2001).

Three male genets were immobilised with zoletil (Virbac, Carros, France) and then tagged with radio-collars (Biotrack, Dorset, UK).

The genets were tracked usually on foot with a hand-held 3-element Yagi antenna and TRX-1000S receiver (Wildlife Materials Inc. Carbondale, USA). Diurnal radiolocations were obtained by using the homing technique, whereas for nocturnal radiolocations we used both the triangulation and the homing techniques (MECH, 1983). Animals were classed as either active or inactive according to the level of variations in the strength of the radio signal (KENWARD, 1987).

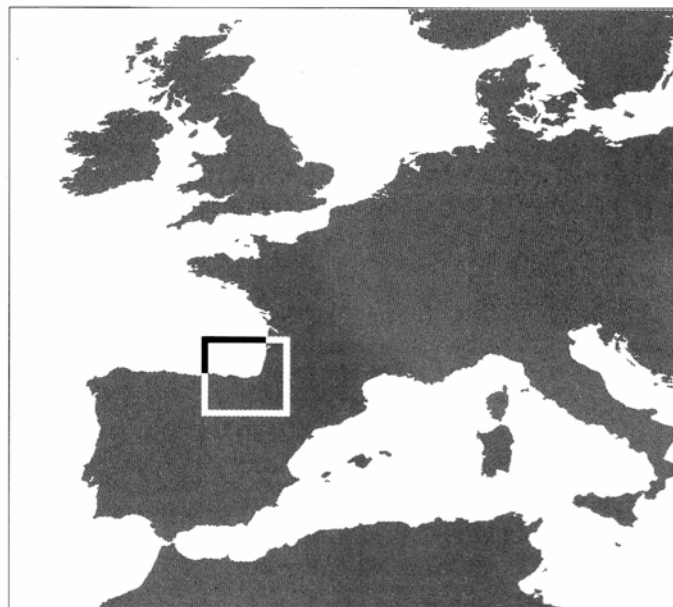


Figure. Location of the study area

Radio-locations were collected once a week. Each season consisted of a 12–16 hour nights surveys during the night. Occasionally, we also located individuals during the day.

To analyse the spacing behaviour, we randomly selected one location per day in a resting site (usually diurnal resting sites) and one location during the active period. The later location was taken 2 to 10 hours after the first active location (see PALOMARES and DELIBES, 1994).

Four habitat types were considered: oak forest (which included evergreen holm oak forest and deciduous forest), pine plantations, eucalyptus plantations and meadows (which included meadows, rushes and gardens). Preference or avoidance of each vegetation type was determined by the method described in NEU et al. (1974), using chi-square analysis and Bonferroni confidence intervals (PALOMARES and DELIBES, 1994). Vegetation types used more frequently or less frequently ($p < 0.05$) than the area available for genets were regarded as preferred or avoided, respectively. Habitat selection was analysed separately for resting and activity periods.

We calculated annual home ranges for each genet using the 95% minimum convex polygon method (WHITE and GARROT, 1990). Areas of each habitat category and home range sizes were measured using a Geographic Information System (GIS) (ESRI, 1996).

3 Results

3.1 Trapping

We trapped 21 genets during the study period. The efficiency was 1.7 genets per 100 trap-nights, excluding recaptures. Three adult males (G1–G3) were radio-tracked for a period of one year (Table 1). Radio-contact to G3 was lost after six months, while G1 and G2 were monitored for one year.

Table 1. Trapping and monitoring data of the three male genets.

	G1	G2	G3
Trapping date	17/02/1999	19/02/1999	13/03/1999
Last monitoring day	07/03/2000	28/03/2000	01/09/1999
Days radiotracked	110	114	46
Number of locations	574	444	146
Number of locations used for habitat selection and home range			
Active	62	68	26
Inactive	82	72	26

3.2 Home ranges and habitat selection

We found considerable variation in the home ranges between individuals (Table 2). The home range of G1 was three times larger than that of the other two males. The habitat composition in genet home ranges was also different.

Table 2. Home-range area (km²), estimated by 95% MCP, and habitat composition (%) for the home range of each genet. The holm oak forests covered largely coherent areas, but the other habitats showed a patchy distribution.

Genet	Home Range	Holm Oak forest	Pine plantation	Eucalyptus plantation	Meadows
G1	10.16	17.94	46.95	2.60	32.50
G2	2.12	55.88	17.07	0	27.05
G3	3.39	19.95	21.64	31.81	26.60

Table 3. Habitat selection for resting sites and during active periods of three male genets.

Probability of the Chi square is shown as: (*) $p < 0.05$; (***) $p < 0.001$.

Selection obtained by Bonferroni confidence intervals is shown as: (+) preferred and (-) avoided.

Genets	G1		G2		G3	
	Resting	Active	Resting	Active	Resting	Active
X ²	37.6 ***	49.4***	39.3 ***	8.8*	30.9 ***	9.4*
Oak forest	+	+	+	+	+	
Pine plantation	-	-	-		-	-
Eucalyptus plantation		-			-	
Meadows			-	-	-	

The three genets showed a strong preference for holm oak forests, both during the active period and during the resting period (Table 3). Moreover, the holm oak forest was the only habitat selected by all individuals during both the resting and activity periods, with the exception of G3's active period.

As regards to plantations themselves, pine forests were avoided in almost all the cases, while eucalyptus plantations use was amenable to its availability.

Two genets (G1 and G3) opportunistically used meadows, gardens and crops near houses.

4 Discussion

By using the capture index as an indicator of animal density (WILSON et al., 1996; SUTHERLAND, 1996), we can compare the density of genets in our study area with other studies. The obtained values were high compared to other Spanish regions (PALOMARES and DELIBES, 1992, 1994; TORRES and ZUBEROGOITIA, 1997; ZUBEROGOITIA et al., 1999).

It has been suggested that the size of the home range in solitary carnivore males, at least during the mating season, is mainly determined by the distribution of females, whereas home range size of females would be determined by food availability (ERLINGE and SANDELL, 1986; GENOVESI et al., 1997). Female home ranges recorded in other studies were smaller than those of our males (LODE et al., 1991; CAMACHO et al., 1992; ZUBEROGOITIA et al., 2001). Although the only study considering males and females simultaneously (PALOMARES and DELIBES, 1994) found no differences between sexes, we still regard sex as one of the factors explaining area size. Moreover, one has to consider that mating of the genets in our study area takes place twice a year, at the beginning of spring and at the end of summer (ZUBEROGOITIA et al., 2001).

The key factor for habitat selection during the resting period of genets seems to be the availability of dense undergrowth, where genets find shelter, dens or burrows (PALOMARES and DELIBES, 1994). Even G1, which used to rest in meadows at daytime, rested in dense bramble patches located in those meadows. Holm oak woods have the most luxurious and dense undergrowth of all the habitat types present in the UBR, so that genets can effectively run to safety in the presence of predators such as dogs or cats. Eucalyptus forests at the UBR have dense bramble (*Rubus* spp.) patches as well as open areas. On the other hand, pine forests are managed for timber production, and therefore undergrowth cover that could provide shelter for genets is lacking. Finally, meadows, open landscapes, where genets are surely vulnerable, were not selected at all, this finding being in accordance with the results of PALOMARES and DELIBES (1994).

During activity periods, selection of holm oak woodland was less critical and other habitats were also used. Food availability and genet hunting behaviour may explain the differential habitat use. Nevertheless, it was noticeable that genets also selected holm oak forest during the activity periods. We suggest that genets found two main resources, viz. high food availability and shelter from predators, in the thickets of the oak forest.

Acknowledgements

This study was funded by both the Research and Environment Departments of the Basque Government through the project PU-1998-8. We thank I. GONZALO, A. ESPARZA, S. LEKERIKA, E. DECHARETTE and U. GOITI for field assistance. We are very grateful to F. PALOMARES, T. CLEVENGER and two anonymous referees for their helpful criticisms on the man-

uscript and to J. A. MARTÍNEZ CLIMENT and A. BASURCO for their help in revising the English. The Regional Council of Biscay licensed us for animal handling and tagging.

Summary

We radio-tracked three male common genets (*Genetta genetta*) for a year in the Urdaibai Biosphere Reserve, Basque Country (North of the Iberian Peninsula). Home ranges varied among the three individuals (2.12, 3.39 and 10.16 km² respectively). All three home ranges encompassed the same habitat types, although the proportions of the different habitat categories varied between individual home ranges.

Genets showed a strong preference for holm oak forests both during active and resting periods. This habitat is rocky and has a dense undergrowth of brambles and vines that provides shelter for dens or burrows and protection during the active periods. In contrast, pine forest was mostly avoided. Eucalyptus forest was not preferred, but significantly avoided by one genet during the activity period and by another one during the resting period. Finally, one individual avoided meadows in all periods, a second one only during the resting period. Genets only marginally used gardens and croplands close to houses.

Key words: Common genet (*Genetta genetta*), habitat selection, home range, radio-tracking

Zusammenfassung

Größe des Aktionsraumes und Habitatnutzung männlicher Ginsterkatzen im Urdaibai-Biosphärenreservat

Während eines Jahres wurden drei männliche Ginsterkatzen (*Genetta genetta*) im Urdaibai-Biosphärenreservat, Baskenland (Norden der iberischen Halbinsel) telemetriert. Die Individuen wiesen unterschiedlich große Aktionsräume von 2,12, 3,39 und 10,16 km² Ausdehnung auf. Die drei Streifgebiete beinhalteten die gleichen Habitattypen, deren Anteile an den jeweiligen Aktionsräumen jedoch verschieden waren.

Sowohl während der Aktivitäts- wie der Ruhephasen zeigten die Ginsterkatzen eine starke Präferenz für Steineichen-Wälder. Dieser Habitattyp ist felsig und besitzt einen dichten Unterwuchs aus Brombeer- und Weinpflanzen, der sowohl einen Schutz für die Baue als auch Schutz während der Aktivitätsphasen bietet. Kiefernwälder wurden demgegenüber zumeist gemieden. Eucalyptuswälder wurden nicht präferiert, sondern von einer Ginsterkatze während der Aktivitätsphase und von einer anderen während der Ruhephase signifikant gemieden. Ein Individuum mied Wiesen zu allen Zeiten, ein zweites nur während der Ruhephase. Gärten und Felder in der Nähe von Häusern wurden von den Ginsterkatzen nur in sehr geringem Maße genutzt.

Schlüsselwörter: Ginsterkatze (*Genetta genetta*), Habitatwahl, Aktionsraum, Radiotelemetrie

Résumé

Taille de l'espace vital et utilisation de l'habitat de sujets mâles de la Genette commune dans la réserve de biosphère d'Urdaibai

Trois sujets mâles de la Genette commune (*Genetta genetta*) ont été suivies par radio-télémetrie pendant un an dans la réserve de biosphère d'Urdaibai dans la région Basque (Nord de la péninsule ibérique). Pour les trois animaux marqués, les espaces vitaux s'avèrent différents avec respectivement 2.12, 3.39 et 10.16 km². Les trois espaces vitaux couvraient les mêmes types d'habitat, bien que les proportions de ces derniers n'étaient pas les mêmes au sein des espaces vitaux de chaque animal étudié.

Les genettes montrèrent une très nette prédilection pour les chênaies à Chêne yeuse tant pour les phases d'activité que pour les phases de repos. Cet habitat rupestre présente un sous-étage dense constitué de ronciers et de vignes; ce sous-étage procure à la fois un couvert pour les terriers et une protec-

tion pendant les phases d'activité. Les pineraies, au contraire, sont généralement évitées. Les forêts d'Eucalyptus n'étaient pas recherchées mais significativement évitées par une genette au cours de sa période active et par une autre au cours de la phase de repos. Finalement, un individu se tenait constamment à l'écart des pâtures tandis qu'un second ne les évitait qu'au cours de la phase de repos. Les genettes ne firent qu'un usage marginal des jardins et des cultures situés à proximité des habitations.

Mots clefs: Genette commune (*Genetta genetta*), sélection d'habitat, espace vital, suivi radio-téléométrique.

Trad. : S. A. DE CROMBRUGGHE

References

- ALDAI, P.; ORMAETXEA, O., 1998: Urdaibai Biosfera Erreserba: giza ingurunearen eta paisajearen gida historikoa. Eusko Jaularitza, Gasteiz.
- ARRIETA, I.; GONZÁLEZ-PÉREZ, E.; LANDA J., 1993: Urdaibai Biosfera-Erreserbaren erabilpenerako eta kudeaketarako egitamu gidaria. Eusko Jaularitza, Gasteiz.
- CAMACHO, E.; RUIZ-OLMO, J.; GONZÁLEZ-ECHAVE, A., 1992: Actividad de dos ginetas hembras en el norte de España. IV Congreso Nacional y I Iberoamericano de Etología. 28 septiembre - 2 octubre 1992. Cáceres (España).
- CLEVENGER A. P., 1995: Seasonality and relationships of food resource use of *Martes martes*, *Genetta genetta* and *Felis catus* in the Balearic Islands. *Rev. Ecol. (Terre Vie)* 50, 109-131.
- DELIBES, M., 1974: Sobre la alimentación y biología de la Gineta (*Genetta genetta* L.) en España. *Doñ. Acta vert.* 1, 143-199.
- DELIBES, M., 1977: Sobre las ginetas de la isla de Ibiza (*Genetta genetta isabellae* n. ssp). *Doñ. Acta Vert.* 4, 139-160.
- ERLINGE, S.; SANDELL, M., 1986: Seasonal changes in the social organization of male stoats, *Mustela erminea*: an effect of shifts between two decisive sources. *Oikos* 47, 57-62.
- ESRI, 1996: ArcView GIS. 3.2. Redlands, California.
- GENOVESI, P.; SINIBALDI, I.; BOITANI, L., 1997: Spacing patterns and territoriality of the stone Marten. *Can. J. Zool.* 75, 1966-1971.
- HAMDINE, W.; THÉVENOT, M.; SELLAMI, M.; DE SMET, K., 1993: Régime alimentaire de la Genette (*Genetta genetta* Linné, 1758) dans le Parc National du Djurdjura, Algérie. *Mammalia* 57, 9-18.
- KENWARD, R. (ed), 1987: Wildlife radio tagging. Equipment, field techniques and data analysis. London: Academic Press.
- LIVET, F.; ROEDER, J. J., 1987: La Genette. In ARTOIS, M.; DELATTRE, P. (eds.) *Encyclopédie des carnivores de France. Société Française pour l'Etude et la Protection des Mammifères (S.F.E.P.M.)*.
- LODE, T.; LECHAT, I.; LE JACQUES, D., 1991: Le régime alimentaire de la genette en limite nord-ouest de son aire de répartition. *Rev. Ecol. (Terre Vie)* 46, 339-348.
- MECH, L. D. (ed), 1983. *Handbook of animal radio-tracking*. Minneapolis: University of Minnesota Press.
- NEU, C.W.; BYERS, C. R.; PECK, J. M., 1974: A technique for analysis of utilization-availability data. *J. Wildl. Manage.* 38, 541-545.
- PALOMARES, F.; DELIBES, M., 1988: Time and space use by two common genets (*Genetta genetta*) in the Doñana National Park, Spain. *J. Mammal.* 69, 635-637.
- PALOMARES, F.; DELIBES, M., 1992: An evaluation of techniques for capturing and radio-collaring large grey mongooses. *South African J. Wildl. Res.* 22, 76-79.
- PALOMARES, F.; DELIBES, M., 1994: Spatio-temporal ecology and behavior of European Genets in Southwestern Spain. *J. Mammal.* 75, 714-724.
- SCHAUBENBERG, P., 1966: La genette vulgaire (*Genetta genetta* L.), repartition géographique en Europe. *Mammalia* 30, 371-396.
- SUTHERLAND, W. J. (ed.), 1996: *Ecological census techniques*. Cambridge: Press syndicate of the University of Cambridge.
- TORRES, J. J.; ZUBEROGOITIA, I., 1997: Distribución de los mesocarnívoros en el río Ebro a su paso por la Comunidad Autónoma de La Rioja. *Aegyptus* 14, 31-34.
- VIRGOS, E.; CASANOVAS, J. G.; BLÁZQUEZ, T., 1996: Genet (*Genetta genetta* L., 1758). Diet shift in mountains of central Spain. *Z. Säugetierkunde* 61, 221-227.
- WHITE, G. C.; GARROTT, R. A. (eds.), 1990: *Analysis of wildlife radio-tracking data*. San Diego: Academic Press.

- WILSON, D. E.; COLE, F. R.; NICHOLS, J. D.; RUDRAN, R.; FOSTER, M. S. (eds.), 1996: Measuring and monitoring biological diversity. Standard methods for mammals. Washington: Smithsonian Institution Press.
- ZABALA, J.; ZUBEROGOITIA, I.; GARIN, I.; AIHARTZA, J., 2001: Small carnivore trappability: Seasonal changes and mortality. A case study on European mink *Mustela lutreola* and Spotted genet *Genetta genetta*. *Small Carnivore Conserv.* **25**, 9–11.
- ZUBEROGOITIA, I.; TORRES, J. J.; CAMPOS, L. F.; CAMPOS, M. A.; ONRUBIA, A.; SAENZ DE BURUAGA, M., 1999: Situación de los carnívoros en el Parque Natural de Urkiola. *Sustrai*, **54–55**: 35–39.
- ZUBEROGOITIA, I.; TORRES, J. J.; ZABALA, J.; CAMPOS, M. A. (eds), 2001: Carnívoros de Bizkaia. Colección Temas Vizcainos, BBK. Bilbo.
- Address of authors:* I. ZUBEROGOITIA, J. ZABALA, Dr. I. GARIN and Dr. J. AIHARTZA, Lab. Zoología, Dpto Zoología y Dinámica Celular Animal. Universidad del País Vasco. Apdo 644, E-48080 Bilbo. Spain. E-Mail: Inigo.zuberogoitia@wanadoo.es