Home range of *Psammodromus algirus*, a temperate Spanish lizard.

by Dr. Alfredo Ortega-Rubio,
Instituto de Ecologia,
A.P. 18-845 Mex.,
11800 D.F. Mexico.

Present address - Centro de Investigaciones Biologicas de Baja California Sur. A.P. 128. La Paz 23000 BCS, Mexico.

Abstract;

Recapture data of 62 adult individuals from a population of *P.algirus*, at la Sierra de Guadarrama, Spain, were analysed by using the bivariate by components and the convex polygon methods. The polygonal method, but not the probabilistic, showed sensitivity to sample size. Independently of the method used and practically for all number of recaptures, male home ranges were greater than those of females. The results obtained are compared with those reported for a sympatric population of *Podarcis hispanica* in the same temperate forest. The effect of the third dimensionality of the microhabitat is discussed.

Key words; Home range, lizard, *Psammodromus algirus*, Spain temperate forests.

Introduction;

It is well known that from an evolutionary point of view the possession of a home range represents many advantages for resources utilisation and predator avoidance (Ortega, 1986). For this reason it can be studied as an adaptative attribute of individuals directly related to aspects such as social interactions (Stamps, 1977; Schoener & Schoener, 1982) or reproductive success (Ortega, 1986; Rand *et al*, 1989).

Home range, then, is not only a vital need for most of the animal species, but also its study represents a linkage among several fundamental sciences; biology, ecology, ethology and evolution. For instance, home range depends on biological aspects of the individuals, such as sex (Ruby, 1978; Smith, 1985) and age (Davis & Ford, 1983).

Home range is also closely related several aspects of the environment, for instance habitat productivity (Harestad & Bunnell, 1979), and, also, home range is related to population density (Trombulak, 1985) and the interspecific competition within the community (Rose, 1982) to which the individual belongs.

Temperate forest environments can be mild and predictable for endothermic species. For reptiles, however, temperate forests can be harsher and more restrictive than deserts. High lizard species diversity in desert environments (Gonzalez-Romero *et al.*, 1989; Pianka, 1967:1975:1985) relative to temperate forest (Ortega *et al.*, 1982) can be related to ectothermic condition of reptiles. Most home range studies with lizards have been developed at deserts (Al-Johany & Spellerberg, 1989; Jones & Droge, 1980; Hulse, 1985) and relatively few have been carried out at temperate forests, even at the Spanish one (Gil *et al.*, 1988).

Material and methods;

Study area - Field work was carried out at La Sierra de Guadarrama on the southern slope of the Sistema Central, north of Madrid, Spain, along an altitudinal gradient ranging from 900 to 2,200 metres. Climate varies along the altitudinal gradient (Gandullo *et al.*, 1976) from a mediterranean one at the lower parts to a characteristic high-mountain one in the upper parts. The latter includes 5 months with reduced temperatures (below 0°C) and has 1,033 mm of annual precipitation, concentrated in two peaks; April and November. Geologically, the area lies on igneous and metamorphic rocks, mainly granites and gneisses (Gandullo, 1976).

Along the altitudinal gradient four physiognomic-floristic unities occur at the zone (Ruiz del Castillo, 1976). The study site was located at the mountain forests, a floristic unity occurring between 1200 m to 1400 m, and with an oak (*Quercus pyrenaica*) as the dominant species, accompanied by a juniper (*Juniperus communis*) and a shrub (*Sarothanus vulgaris*).

The species;

The lizard community of the study site is composed of four lacertid species; *Lacerta lepida, Psammodromus algirus, P. hispanicus* and *Podarcis hispanica*. However, the more abundant species are *Psammodromus algirus* and *Podarcis hispanica*. *P.algirus* is a medium sized lizard (4.5 - 7.5 SVL at sexual maturity) with a distribution that includes most of the Iberian Peninsular, the southwest of France and the northwest of Africa. This lizard has a wide altitudinal distribution from sea level to 1400 m, and is commonly the more abundant lizard in many parts of the peninsula (Arnold & Burton, 1982).

Methods;

At the study site a permanent quadrant of 4500 m^2 was established by placing rows and columns fixed by stakes 10 m apart. The position of each stake was recorded by assigning letters and numbers to rows and columns respectively. From June 26th to July 18th 1984 over 62 individuals were captured inside the quadrant. They were marked by toe clipping and with colour dots. Individual colour marking was accompanied by using individual dot combinations of oil paint on the backs of the lizards. We carefully searched for active lizards throughout the censuses carried out at different hours during a day, following a different route on each access. For each lizard observed we recorded its location as a bi-coordinate distance to the nearest stake. Data of lizards with less than three recapture locations or inhabiting the marginal areas of the quadrant were excluded from the analysis.

The convex polygon technique (Mohr, 1974; Stickel, 1954) was used to measure the home range. This method is a widely used technique to estimate home range areas, and it has been demonstrated to be a good estimator of the area used by lizards when compared with other methods (Gutierrez & Ortega, 1985). Nevertheless, because a small number of recapture points can severely bias home range estimates (Jorgensen & Tanner, 1963), we used a probabilistic method; the bivariate by components of 68% (Aguirre *et al.*, 1984).

Results;

Table 1 shows the home range estimates obtained for the individuals studied, separated in groups by number of recaptures and sex. As it can be observed, there is a high sensitivity of the polygonal method in relation to sample size; the greater the number of recaptures, the larger the estimated range. Thus, in order to make comparisons with only this method it is necessary to use similar numbers of recaptures obtained in similar periods of time. In spite that there exist methods to correct this deviation (Jenrich & Turner, 1969) these methods also contain failures (Rose, 1982).

For t' reason I used the bivariate by components method, which .s a modification of the bivariate by components of Koepl *et al.* (1975). However, the main disadvantage of the last method is that it arbitrarily works with two standard deviations, and this introduces a serious miscalculation, because it includes points located at the periphery representing zones of accidental or scarce utilisation that are not a consistent part of the home range. The modification of Aguirre *et al.* (1984) of taking into account only one standard deviation contributes to reduce the overestimation substantially.

Average home range of males was 187.294 m^2 and 1,236.066 m^2 estimated by the polygonal and the probabilistic methods respectively. Independently of the method used, and practically for all numbers of recaptures, home ranges of males were larger than those of females, which had average home ranges of 99.185 m^2 for the convex polygon, and 761.808 m^2 for the bivariate by component methods.

Discussion;

The difference among male and female home ranges agrees with the majority of the previously studied lizard species (Al-Johany & Spellerberg, 1989; Ortega-Rubio *et al.*, 1990; Rand *et al.*, 1989). This result also agrees with the difference among home ranges of males and females found for a sympatric population of *Podarcis hispanica* (Ortega-Rubio & Romero-Schmidt, 1992). At the same area it was found that the average home range of male *P.hispanica* was 72.778 m^2 and 273.088 m^2, estimated by the polygonal and the probabilistic methods respectively. The females had an average of 46.258 m^2 for the convex polygon and 71.970 m^2 for the bivariate by component methods.

It can be seen that there is a considerable difference in home range size between both species. *P.algirus* males exhibit a home range size 2.57 to 4.53 times larger (depending on the method employed) than *P.hispanica*. For females, differences are similar for the polygonal method (2.14 times larger than *P.algirus*) but even more accentuated for the probabilistic method (10.59 times larger than *P.hispanica*).

The difference in body size between adult individuals of both species (*P.algirus* is on average 0.5 - 1.0 mm SVL larger than *P.hispanica*) cannot explain by itself the differences in home range sizes (Christian & Waldschmidt, 1984; Turner *et al.*, 1969), as suggested by the fact that there is a high overlap between both species in the taxa (Ojk = 0.655) and volumes (Ojk = 0.687) of the insects consumed (Ortega-Rubio, 1991).

However, there is an important behavioural difference between both species; *P.hispanica* shows a strong preference for the use of vertical surfaces in rocky areas, whereas *P.algirus* is clearly a ground-dwelling species (Ortega-Rubio, 1989). Thus, *P.hispanica* individuals accomplish their displacements on a third-dimensional microhabitat, whereas *P.algirus* performs its movements in a two-dimensional microhabitat. Undoubtedly, it is more easy and accurate to estimate the home range size of organisms inhabiting plain surfaces, relative to those inhabiting tridimensional habitats.

Table 1; Home range (m^2) of *P.algirus*, separated in groups by number of recaptures and sex (between parenthesis appear the number of individuals).

No. of recaptures	Sex	(n)	Method convex polygon	Bivariate 68%
3	m	(12)	36.535	862.574
	f	(5)	40.065	324.117
4-7	m	(7)	193.254	2,132.031
	f	(12)	123.542	568.414
8-11	m	(9)	228.486	978.362
	f	(2)	102.541	1,205.423
12-15	m	(6)	234.510	1,402.694
	f	(3)	107.354	987.343
> 15	m	(4)	243.683	804.669
	f	(2)	117.425	723.741

Although some methods have been proposed to accurately estimate the home ranges of vertebrates in canyon walls, trees and rocks (Milstead, 1971; Koepl *et al.*, 1977), there are practical problems not yet resolved (Ortega & Gutierrez, 1987).

It is necessary to develop the deepest studies within this framework in order to elucidate in which degree the observed divergence between both lacertid species is explained only by the tridimensionality of the displacement of *P.hispanica* or if there are other subjacent reasons for the differences in home range size.

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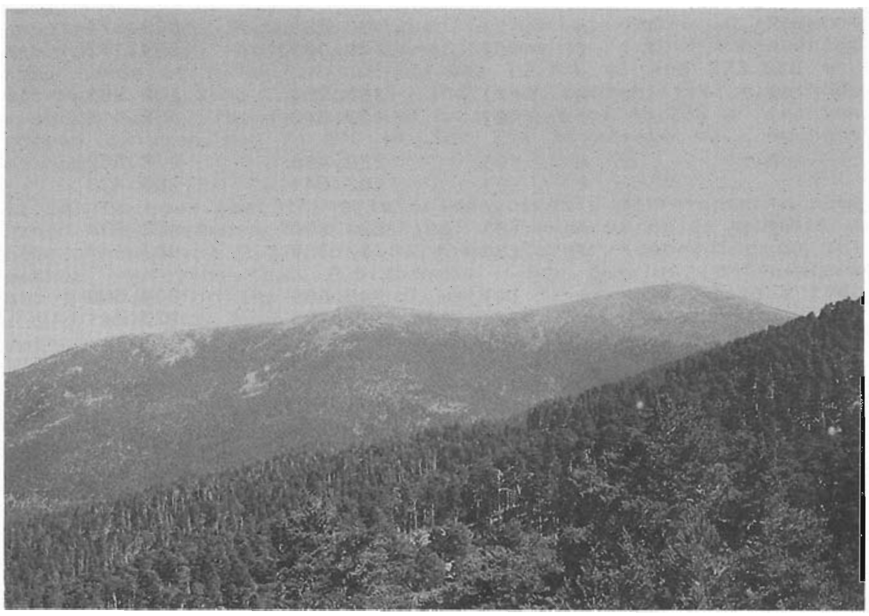

Fig. 1; General view of the study site. Photo by author.
(see Ortega-Rubio, pp 51 - 59)

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