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Home range structure in *Podarcis sicula*

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Home range features are fairly well known in iguanid lizards (ROSE 1982), but not in lacertid species (see e.g., NICHOLSON & SPELLENBERG 1989). This paper shows preliminary results about home range structure in *Podarcis sicula*, which is perhaps the most relevant species within this widespread genus of small active foraging lizards, showing complex patterns in habitat use, activity levels, social organization and population structure (OLMEDO et al. 1984, MELLADO 1985).

Methods

Home ranges were analyzed in two localities in the Western Mediterranean. The main data set come from an introduced population living in a public garden in the city of Almeria (SE Spain, 36°50' N, 2°27' W) monitored over some two months (16 March to 25 May 1983). A complementary data set was recorded for comparison over a week (7 to 11 June 1986), in the island of Vivara (Flegrean Archipelago) near Naples (S Italy, 40°45' N, 13°58' E). All resident lizards were temporarily painted for control. Random sightings were then obtained with at least one hour interval between consecutive records for each lizard. The convex polygon method was used to estimate home range sizes. The relationships between number of sightings and home range area were analyzed through incremental area analysis (KENWARD 1990).

Results

Excluding non-resident individuals (outliers, floaters, etc.), 14 (5-9) and 16 (7-9) adult lizards were monitored for home range calculation in each site. Tables 1 and 2 provide a statistical summary of home range features in *P. sicula*. Figure 1 shows the relationships between number of sightings and home range area. The data set of Almeria closely fulfils the sample size conditions stated by ROSE (1982) for an accurate description of home range size. According to the empirical models, the number of sightings needed to reach a given percent of the whole area, is almost the same in both cases (7-17-31 vs. 8-18-31 for 50%-80%-100% of the final area, respectively). ROSE (op. cit.) fails however when pooling sex classes, since there are significant differences between the models for each sex, which must be considered separately. The same is true for the smaller data set from Vivara. Although sample size is rather small and home ranges may be somewhat underes-

timated in this case (but see CHRISTIAN & WALDSCHMIDT 1984), no differences were found in the average home range size between Almeria and Vivara.

Home range overlap for resident lizards is mapped in Fig. 2, whereas Fig. 3 shows the distribution frequencies of the amount of overlap between sex classes in

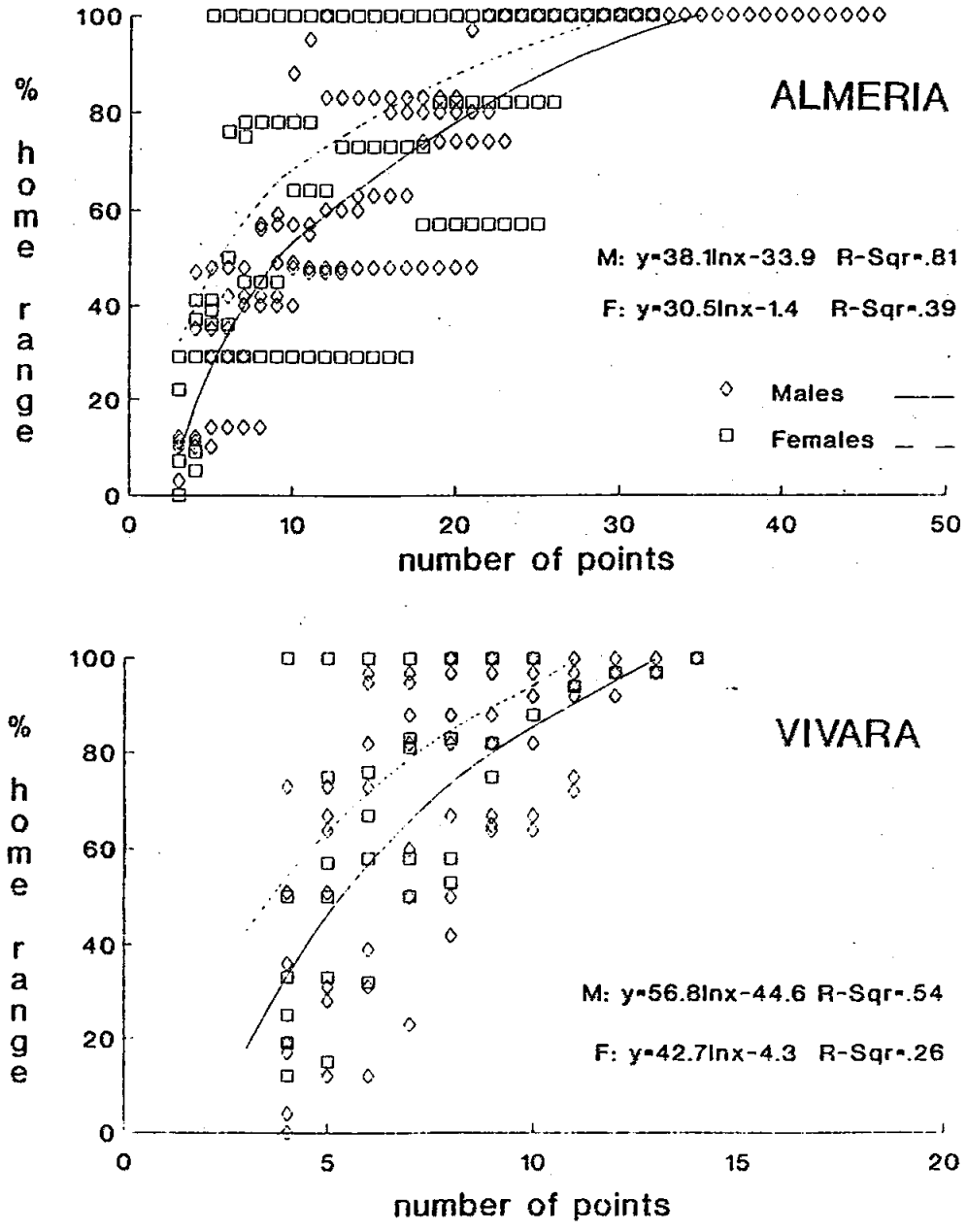

Fig. 1. Incremental area analysis. Cumulative area as percent of final home range size is plotted against sequential number of sightings. Individual data pooled in the analysis. The fitting of the model is statistically significant in all instances ($p<0.001$). The regression lines are different between sexes (males: $F(2, 201)= 70.0$; females: $F(2, 207) = 12.7$; $p<0.001$ in all instances) and sites (Almeria: $F(2, 295)= 17.6$; Vivara: $F(2, 113)= 5.3$)

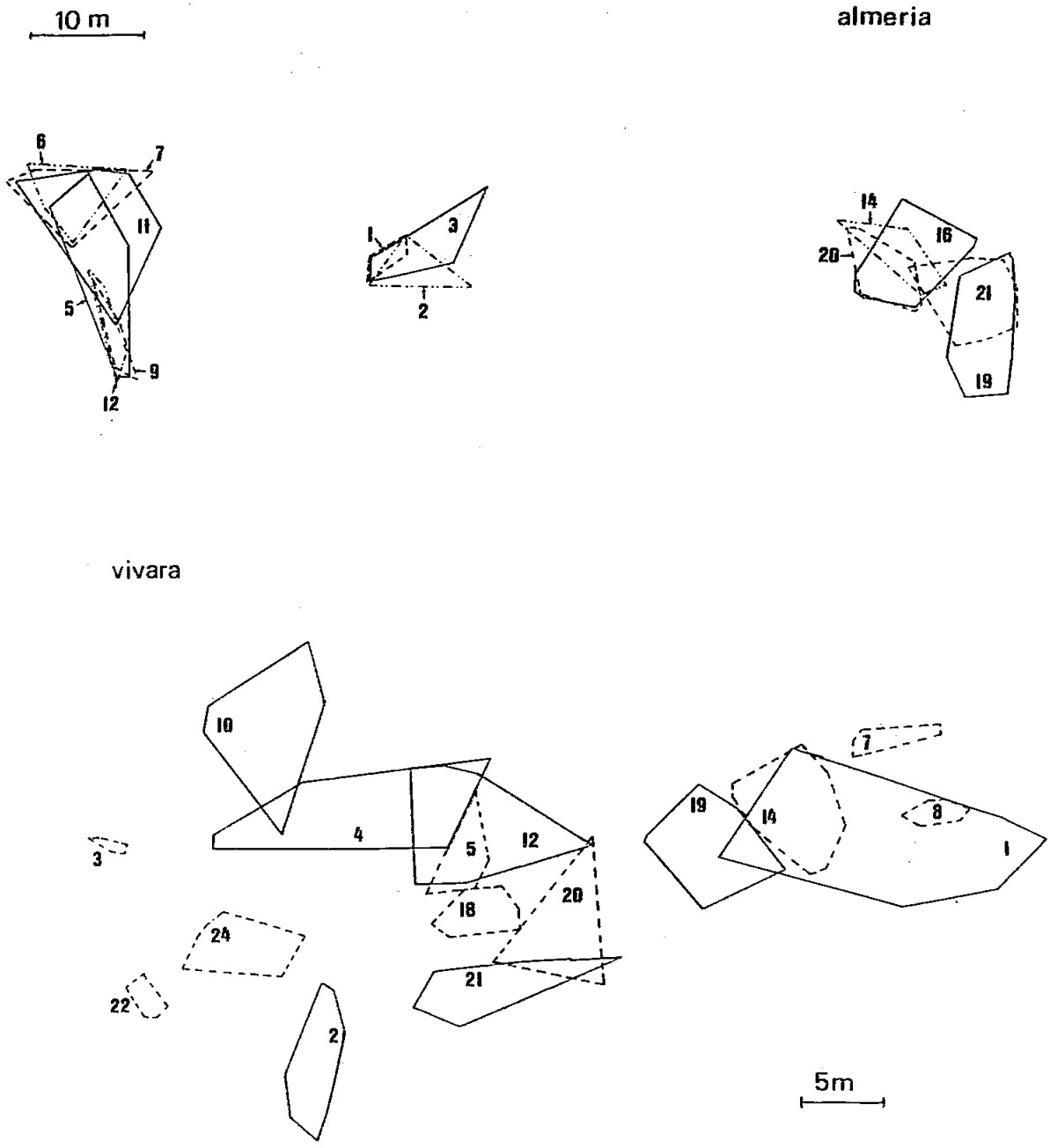

Fig. 2. Home range distribution of the resident lizards within the plots. Males: solid lines. Females: dashed lines

Table 1. Descriptive statistics of the lizard home ranges calculated by the convex polygon method

Site/Sex	N	No. of sightings Mean 95% C.I.	Home ranges (m^2) Mean 95% C.I.
Almeria			
Males	5	29 (16-42)	62 (35-88)
Females	9	21 (14-27)	25 (13-37)
Vivara			
Males	7	13 (11-14)	52 (23-80)
Females	9	8 (6-10)	14 (5-23)

Table 2. Comparisons of home range estimates by sex and site. The normal approximation of the MANN-WHITNEY test was used

	Between sex		Between sites	
	Almeria	Vivara	Males	Females
z	2.73	2.91	1.06	1.54
p	0.006	0.004	0.291	0.122

both populations. There are important differences between sites. Overall, more lizards overlap their home ranges in Almeria than in Vivara for all combinations of sex classes, and they share more area. By sex classes, overlapping is quite similar between sites for males, but females broadly overlap in Almeria but nothing in Vivara. Regarding social organization, harems with male hom ranges containing most of the home range of one or two females (which broadly overlap between them) are well established in Almeria. This kind of organization does not exist in Vivara at the time of the study.

Discussion

Home range size in *P. sicula* is extremely small when compared with the literature records for other lizard species of similar size. Thus, iguanid home ranges average some 560 m^2 (14 populations of 9 species included in Table 2 of ROSE, op. cit., excepting the large *Sauromalus obesus*), being at least ten times larger than the average size of male home ranges in *P. sicula*. This difference seems too big and unexpected if we consider than widely foraging species (*P. sicula*) must have larger home ranges than sit-and-wait lizards. However, these results refer to basal areas,

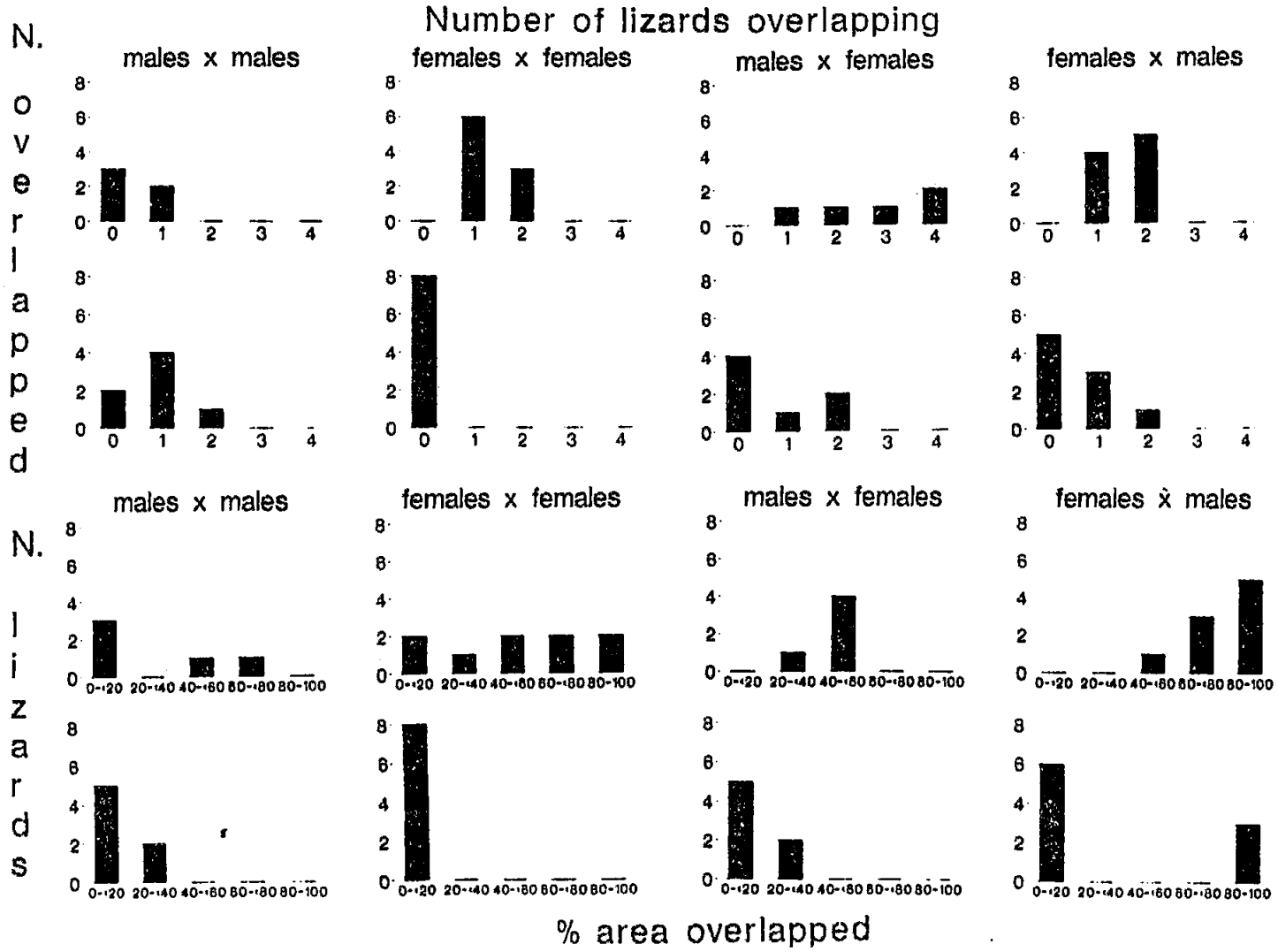

Fig. 3. Home range overlap. The distribution of individuals overlapping a lizard home range is shown above. The number of lizards with varying percent of its home range overlapped by any other individual is shown below. Within each sex comparison, the first member in the pair is the overlapped class and the second is the overlapping one. (A) Almería; (V) Vivara

which were the actual home range of most ground-dwelling iguanid lizards, whereas *P. sicula* show an important use of vertical surfaces (MELLADO 1985, OLMEDO & MELLADO in prep.). In fact, the actual area may be between 2 and 6 time the basal one in Almeria, a site with relatively simple vertical structure. So, basal areas does not accurately represent actual home ranges in *P. sicula*. Anyway, male home ranges are larger (2 to 4 times) and more variable (2 to 7 times) than those of females. Moreover, the relationships between number of sightings and area are different, not only between sex classes but also between different localities for the same sex. Thus, in spite of the apparent similarity between the empirical models repported above, empirical functions derived from a singular data set must not be suitable for different data sets. The results of home range overlap are most intriguing. The differences found between Almeria and Vivara suggest a great variability in social organization and spacing patterns. Most likely, these differences could be explained by the different seasons at which data were recorded (at the peak of the activity season in Almeria and at the end of this period in Vivara). Decreased activily levels in the females of Vivara, related to reduced home ranges (the difference with Almeria are nearly significant: $p = 0.122$) need further research in order to explain the low level of overall home range overlap found in Vivara.

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