Ecography

E6087

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Supplementary material

Appendix 1. Study areas and sampling stations

Study areas

France – the study area includes the eastern side of the Corbières massif and adjacent areas along the Mediterranean coast. On the massif, most of the landscape consists in a mosaic of successional stages of a Mediterranean grassland-to-forest gradient, from *Brachypodium retusum* dry meadows with few shrubs (*Rosmarinus officinalis, Juniperus oxycedrus*) to mature woodlands of evergreen holm oak *Quercus ilex* through garrigue-type habitats. Small vineyards and fallow fragments are interspersed in this habitat matrix. The adjacent littoral plain is devoted to large-scale vineyards (with some other fields cultivated or abandoned) and is limited with lagoons and sand dunes.

Morocco – we concentrated our sampling effort in the western half of the country from the Atlantic coast and the Rif foothills to the Atlas chain, where *Galerida* larks are the most abundant. This area is characterized by semi-arid and to a lesser extent arid climatic regimes (Bons and Geniez 1996). The following biogeographic zones were also covered: the sub-humid and humid areas of the Middle Atlas and of the Rif mountains, the arid (and marginally, Saharan) zones of the Oriental (East of the Middle Atlas) and of the Souss region (south of the High Atlas and west of the Anti-Atlas), and the Saharan climatic zone south of the Atlas mountains. For a description of typical habitats in these biogeographic zones, see Thévenot et al. (2003).

Sampling stations (maps)

I – France

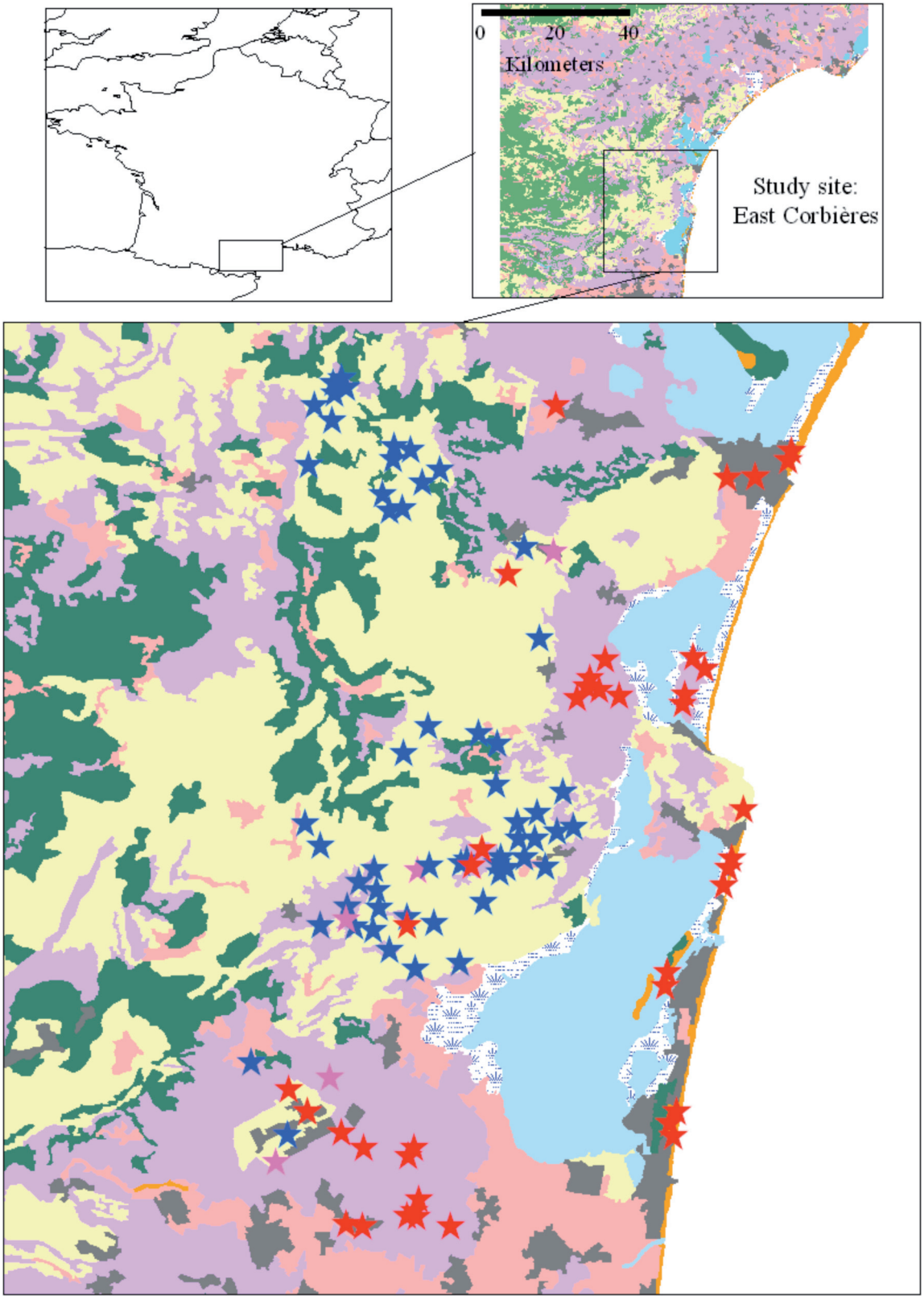
Habitats types were mapped according to Corine land cover 2000 (European Environment Agency): blue = coastal lagoons (with surrounding saltmarshes indicated by rush-like vegetation); grey = Anthropic habitats (An); green = forests; yellow = grasslands and shrublands, including all four classes of garrigue-type habitats (G); violet = open vineyards (oV) and enclosed vineyards (eV) with associated fallow lands (Fa); pink = other croplands; orange = sand dunes and beaches (Du).

A – Presence-only stations (n=102). Red = *G. cristata*; blue = *G. theklae*; pink = *G. cristata* + *G. theklae*.

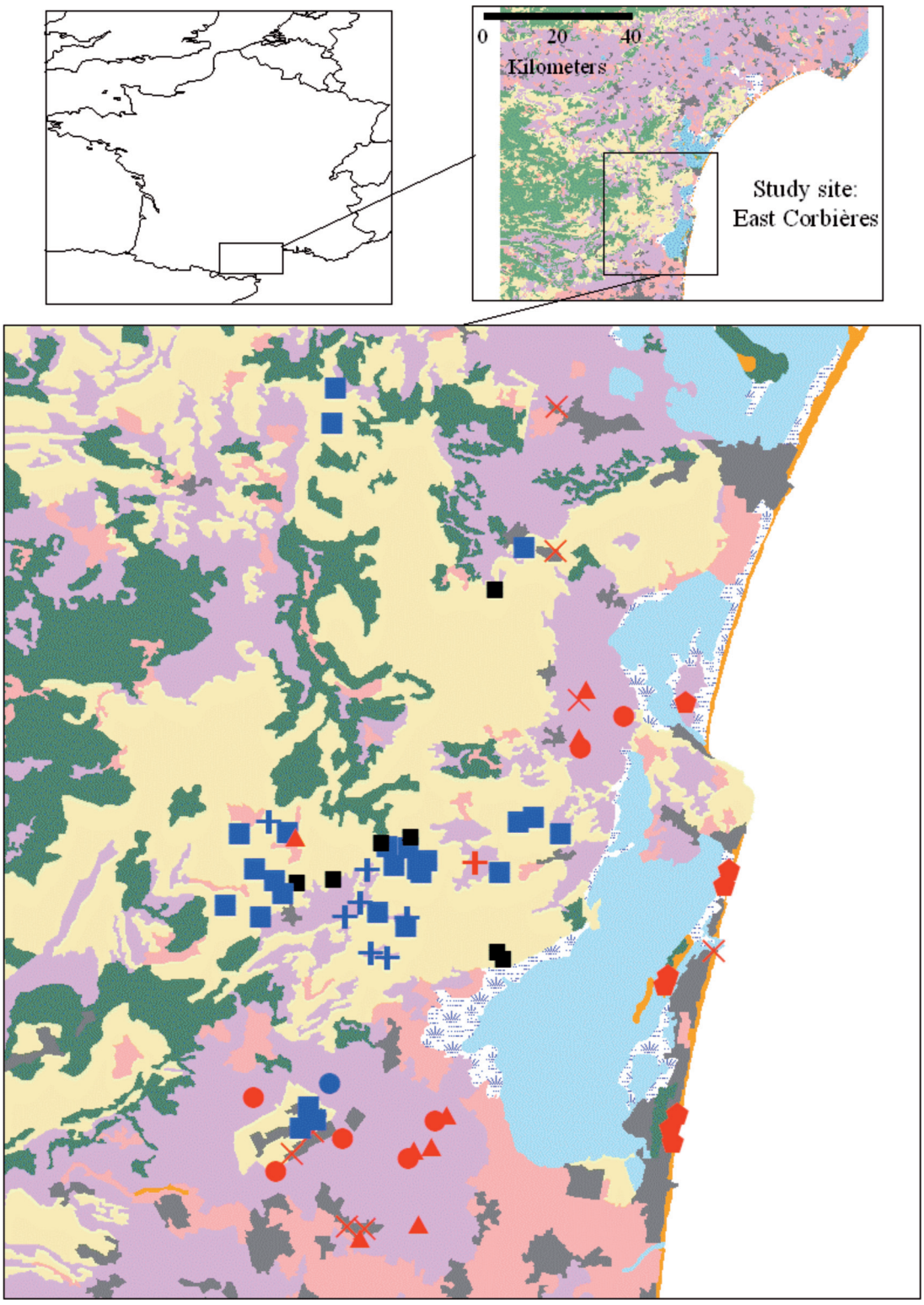
B – Abundance data stations (n=72). × = An; square = G; circle = oV; + = eV; triangle = Fa; pentagon = Du; color (red or blue) refers to the more abundant species (averaging all four samplings, see text for details; black symbols indicate that no *Galerida* was seen).

II – Morocco (n=238)

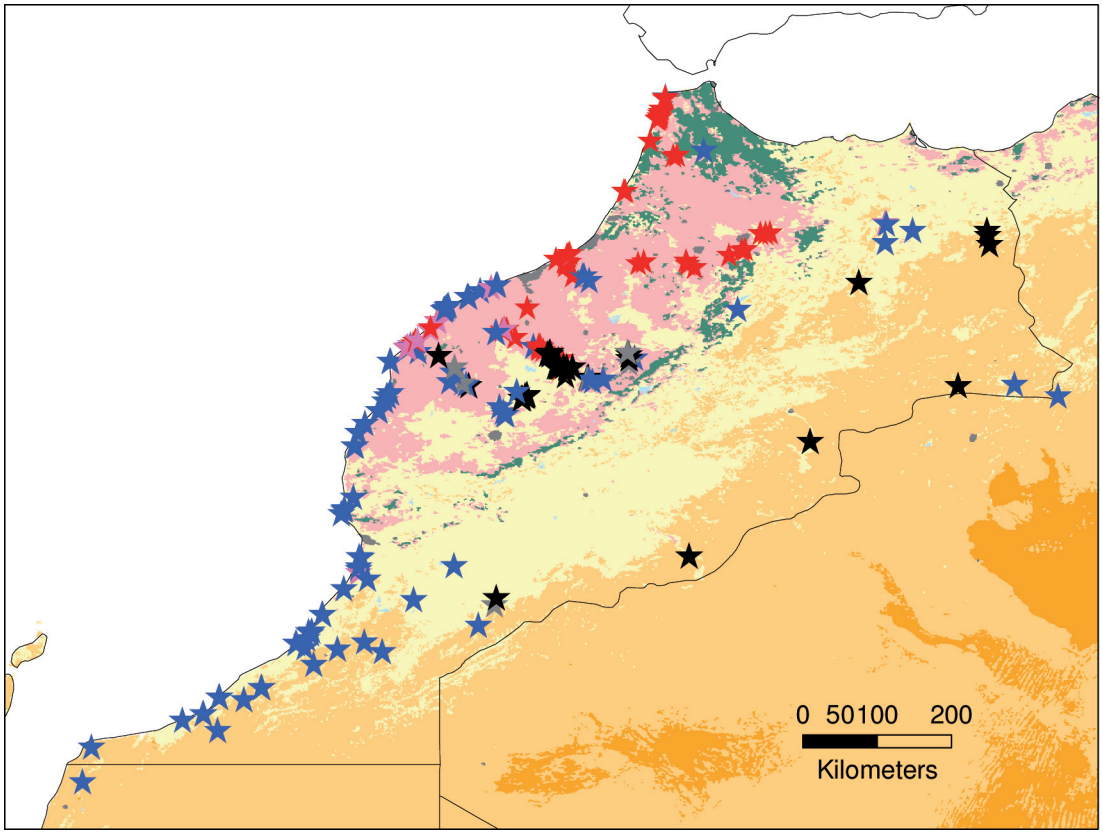
Habitats types were mapped according to Global Land Cover 2000 Project (<www-gem.jrc.it/glc2000>) using the same color chart as in France, with the addition of stony desert (pale orange). Red = *G. cristata*; blue = *G. theklae*; pink = *G. cristata* + *G. theklae*; black = *G. macrorhyncha*; grey = *G. macrorhyncha* + *G. theklae*.



I – A (Presence-only stations in France)



I – B (Abundance data stations in France)



II (Presence-only stations in Morocco)

Appendix 2. Details on some Methods sections

1) Here is the description of the two tests conducted to control for proportional population changes between habitats across seasons. Firstly, we calculated the mean and standard deviation of the increase in non-shared habitats. Then, we drawn 10 000 values from a normal distribution with these parameters to obtain the distribution of the demographic change expected in the shared habitat under the hypothesis that it is not affected by the presence of the other species. Secondly, we designed a randomization test to account for a possible migration between habitats across seasons: 1) all specimens observed during the winter were randomly shuffled into each habitat type with a probability corresponding to their prevalence in these habitats during the breeding period; 2) the resulting number of specimens in the shared habitat was counted; 3) steps 1 and 2 were repeated 10 000 times to obtain a distribution of values to which the actual value was compared. In both tests, the p-value is the proportion of times we observe in the shared habitat a value (of demographic change for test 1, of individuals number for test 2) inferior or equal to the actual value.

2) Spatial autocorrelation for *DA1* was investigated by drawing a correlogram in which Moran's spatial autocorrelation coefficient *I* (Moran 1950) was plotted against classes of equidistant stations. A correlogram is considered significant if at least one of its Moran's *I* values is significant at the 5% level, after Bonferroni correction.

3) We applied Endler's neutral diffusion model to investigate whether the width of the contact zone is compatible with the hypothesis that the two species only recently entered into contact. Under this model, the width of the cline depends on *T*, the time since neutral secondary contact (measured in generations) and *l*, the dispersal distance per generation, according to the relationships $W = 1.68 \times l \times \sqrt{T}$ (Hafner et al. 1998). We assumed a generation time (*G*) of two years (but we also explored the consequences of G=4), based on the formula $G = \alpha + s/(1 - s)$ (Saether et al. 2005), where α is the age at first reproduction, taken to be one year (Cramp 1988) and *s* is adult survival taken to be around 50% (based on other passerine species: Saether et al. 2005, Clark and Martin 2007). Since the dispersal distance is not known for *Galerida*, we used the root-mean-square (SD) natal dispersal estimated for the skylark *Alauda arvensis* as a standpoint (23.1 km, Paradis et al. 1998), but also explored the whole range of estimates obtained from 47 passerine species (5–69 km, Paradis et al. 1998). Finally, because *G. macrorhyncha* is the native species in Morocco (Guillaumet et al. 2008), *T* was conservatively estimated as the time since the description of the short-billed subspecies of *G. cristata* in the area, namely *G. c. riggenbachi* in 1902 (Del Hoyo et al. 2004).

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