THE RED-BACKED SHRIKE (*Lanius collurio*) – AN INDICATOR OF CLIMATE AND VEGETATION TYPE?

Francisco Campos and Alberto Lizarraga

ABSTRACT

Campos F., Lizarraga A. 2000. *The Red-backed Shrike* (*Lanius collurio*) – *an indicator of climate and vegetation type?* Ring 22, 1: 59-64.

In Navarre (northern Spain), a temperate and a Mediterranean climate coexist. The limit between both is established by the supra-Mediterranean zone in which the main vegetation series are those of gall oak woodland *Spiraeo obovatae-Querceto fagineae Sigmetum* and of holm oak woodland *Spiraeo obovatae-Querceto rotundifoliae Sigmetum*. In Navarre, the southernmost limit to the distribution of the Red-backed Shrike is in the supra-Mediterranean zone and coincides with (1) the limit of vegetation series of the gall-oak, and (2) a value of 4.9 on the ombrothermic index of Rivas-Martínez (1999). In the initial stages of the degradation of gall oak woodland, thorny shrubs as *Rosa*, *Prunus*, *Rubus,* and *Crataegus* predominate. In contrast, in the initial stages of degradation of holm oak woodland non-thorny shrubs (*Spiraea* and *Amelanchier*) are mainly present and, to a lesser extent, *Rosa*. In the area under study, the shrubs most commonly used by the Red-backed Shrike for nesting were *Prunus* (33.5%), *Rubus* (32.6%), *Rosa* (11.2%), and *Crataegus* (9.8%). This suggests that the geographical distribution of the species is conditioned both by the vegetation available for nesting and the climate. Therefore, the Red-backed Shrike could be used as a bioindicator of the climate and type of vegetation.

F. Campos, A. Lizarraga, Departamento de Zoología y Ecología, Facultad de Ciencias, Universidad de Navarra, E-31080 Pamplona, Spain. E-mails: fcampos@unav.es, alizarraga@unav.es

---

Key words: bioindicator, climate, *Lanius collurio*, Red-backed Shrike, Spain, vegetation type

INTRODUCTION

The shrikes (*Laniidae*) are predators found in semi-open and agricultural areas, and can therefore serve as useful indicators of the state of these ecosystems (Hands

et al. 1989, Fuisz and Yosef 1998). The Red-backed Shrike is sensitive to changes in the environment brought about by humankind (Bosch 1984, Jakober and Stauber 1987, Tucker and Heath 1994, Malik 1995). However, no attempt has been made to date to trace a correlation between their geographical distribution and the type of vegetation existing in their European breeding range.

In Europe, the distribution of the Red-backed Shrike seems to be restricted primarily by climate, summer rainfall and the temperature in July (Cramp and Perrins 1993, Fornasari *et al*. 1997). In the Iberian Peninsula, the Red-backed Shrike is found in the northern region (Hernández 1997), although it has recently colonized some mountains in central Spain (Gómez and Soto-Largo 1993).

Navarre province (northern Spain) is a strategic area for the study of the Red-backed Shrike, because it is the southernmost limit for the distribution of this species in Spain (Elósegui 1985).

In this study, we suggest a possible relationship between the distribution of the Red-backed Shrike in Navarre and the climate and vegetation, and investigate its potential usefulness as a bioindicator.

STUDY AREA AND METHODS

The study area is the central region of Navarre province. Here, the temperate (Euro-Siberian) and Mediterranean regions meet, the latter consisting of lower supra-Mediterranean and upper meso-Mediterranean zones (Rivas-Martínez 1984). We selected a strip of 120 by 40 km (Fig. 1), which includes the outer limit for

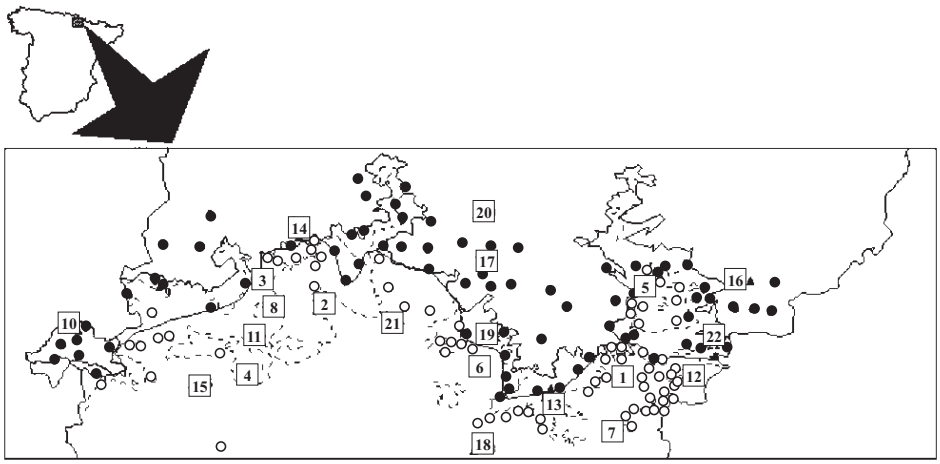

Fig. 1. Presence (black circles) and absence (open circles) of *Lanius collurio* in the study area. The 22 weather stations are shown (squares), with numbers corresponding to those in Table 1. Shaded area: Euro-Siberian region. Unshaded area: Mediterranean region, in which the limit of the vegetation series *Spiraeo obovatae - Querceto fagineae Sigmetum* (discontinuous lines) and limit of distribution of the bird (continuous line) have been drawn.

the geographical distribution of the Shrike and the borders of the Euro-Siberian and Mediterranean regions. The north of this area has a humid temperate climate (following Köppen-Geiger's classification, 1954), as it is close to the Bay of Biscay (about 40 km away). The south has a warm climate with summer drought. Between the two regions there is a transitional zone.

In the north of the study area, two vegetation series predominate – *Carici sylvaticae-Fageto sylvaticae Sigmetum* and *Crataego laevigatae-Querceto roboris Sigmetum*, whereas in the south three series occur – *Spiraeo obovatae-Querceto rotundifoliae Sigmetum, Querceto rotundifoliae Sigmetum* and *Rhamno lycioidis-Querceto cocciferae Sigmetum* (Loidi and Bascones 1995). In the intermediate zone, the two sets of vegetation series mix, and another occurs – the gall oak woodland (*Spiraeo obovatae-Querceto fagineae Sigmetum*). The initial stages of degradation of the series of beech, oak and gall oak contain thorny shrubs such as *Rosa, Prunus, Rubus*, and *Crataegus*, among others. The holm oak series degrades primarily into scrub, consisting of *Amelanchier, Spiraea,* and *Rosa*. Along similar lines, the series of the kermes oak degrades initially into the rosemary family (*Rosmarinus, Ononis, Cistus,* and *Linum*).

Rivas-Martínez (1997, 1999) establishes a relationship on a worldwide level between vegetation series and climate. To do so, he uses: (1) the ombrothermic index (I_o), the formula for which is

$$I_o = (P/T) \times 10,$$

where P is the sum of the mean precipitation (mm) of the months with a mean temperature over 0°C, and T is the sum of the mean monthly temperatures (in tenths of a degree) over 0°C; (2) the continental climate index:

$$I_c = T_{max} - T_{min},$$

where T_{max} is the mean temperature (°C) of the hottest month and T_{min} is the mean temperature (°C) of the coldest month. Values of $I_o > 2.2$ indicate a rainy seasonal continental Mediterranean climate or a rainy seasonal oceanic Mediterranean climate, depending on whether I_c is greater or less than 21, respectively. In our case, P and T were obtained from the data from 23 stations spread over the study area and the immediately surrounding area (Tab. 1).

We measured the distribution of the Red-backed Shrike during July 1997, 1998 and 1999 by noting the presence or absence of reproductive males at 150 observation points scattered over the study area, which had been chosen for their accessibility and geographical location. At every sampling point, all the habitats that were favourable for the species were observed for at least 30 minutes. The observations were made with field glasses and telescopes (magnified ×10 and ×27-80, respectively), in favourable meteorological conditions (slight winds or calm, no precipitation).

RESULTS AND DISCUSSION

The Red-backed Shrike was spotted at 73 of the 143 observation points in the study area (Fig. 1). All of these 73 sites had an index of $I_o \geq 4.9$, which corresponds

to the rainy seasonal oceanic Mediterranean macrobioclimate described by Rivas-Martínez (1999).

Table 1
Features of the 23 weather stations in northern Spain used in the present study for the years 1997-1999. I_c - index of continental climate, T - sum of mean monthly temperatures (in tenths of a degree) over ° 0°C. P - sum of mean precipitation (mm) in the months with a mean temperature of over 0°C, I_o – ombrothermic index.

No.	Weather station	Altitude m a.s.l.	Coordinates	I_c	T	P	I_o
1	Aibar	555	42° 35' N 02° 20' W	17.1	1584	643.5	4.1
2	Alloz	475	42° 42' N 01° 44' W	16.5	1595	690.3	4.3
3	Amillano	495	42° 43' N 01° 37' W	15.8	1430	749.9	5.2
4	Artieda	454	42° 43' N 02° 22' W	16.1	1521	680.4	4.5
5	Arróniz	572	42° 36' N 01° 54' W	13.8	1573	611.1	3.9
6	Barásoain	435	42° 31' N 02° 19' W	16.1	1505	543.6	3.6
7	Cáseda	435	42° 31' N 02° 19' W	18.3	1676	592.9	3.5
8	Estella	426	42° 40' N 01° 39' W	15.8	1411	619.1	4.4
9	Galbarra	579	42° 43' N 01° 26' W	17.7	1430	890.3	6.2
10	Genevilla	630	42° 39' N 01° 18' W	16.0	1409	736.6	5.2
11	Igúzquiza	495	42° 39' N 01° 36' W	17.4	1495	561.4	3.8
12	Javier	455	42° 36' N 02° 28' W	17.7	1616	641.4	4.0
13	Lerga	615	42° 34' N 02° 11' W	16.5	1488	1129.6	7.6
15	Lezáun	807	42° 46' N 01° 41' W	17.7	1484	965.7	6.5
16	Los Arcos	446	42° 34' N 01° 30' W	17.1	1580	448.4	2.8
17	Navascués	615	42° 43' N 02° 34' W	17.3	1453	875.9	6.0
18	Noáin	453	42° 46' N 02° 03' W	17.0	1476	718.3	4.9
19	Olite	383	42° 29' N 02° 02' W	17.9	1608	511.1	3.2
20	Olóriz	705	42° 39' N 02° 07' W	16.8	1490	745.8	5.0
21	Pamplona	449	42° 49' N 02° 03' W	15.8	1493	777.7	5.2
22	Pte. la Reina	346	42° 40' N 01° 52' W	17.7	1595	534.5	3.4
23	Yesa	489	42° 37' N 02° 30' W	17.7	1587	790.3	5.0

At 70 out of 80 (88.7%) of the observation points, where Red-backed Shrikes were found, the vegetation was gall oak, oak, or beech, and only 9 were within the series *Querceto rotundifoliae Sigmetum* or *Spiraeo obovatae-Querceto rotundifoliae Sigmetum*, but very close (mean distance: 611 m) to the edge of the gall oak series. We can therefore state that in our study area, the southernmost limit of the distribution of the Red-backed Shrike coincides roughly with that of the vegetation series *Spiraeo obovatae – Querceto fagineae Sigmetum*.

No birds were found in areas of the supra-Mediterranean zone with I_o indices lower than 4.9, nor were they found in areas of the meso-Mediterranean zone. However, birds were found everywhere on the study area belonging to the Euro-Siberian region.

In the supra-Mediterranean zone, thorny shrubs are more abundant in the initial stages of degradation of the gall oak series than of the holm oak series (Loidi

1989). However, in northern Spain, the Red-backed Shrike prefers thorny bushes for nesting (Table 2), as is the case in other areas of its breeding range (Hernández 1994, Lefranc and Worfolk 1997). This suggests that an important factor in explaining the geographical distribution of the Red-backed Shrike in the study area could be the availability of nesting sites.

Table 2
Number (*N*) and percentage (%) of nests of *Lanius collurio* found in shrubs and trees from Navarre, in northern Spain, between the years 1997-1999

Species	*N*	%
Prunus spinosa	75	33.5
Rubus spp.	73	32.6
Rosa spp.	25	11.2
Crataegus spp.	22	9.8
Thorny shrub total	**195**	**87.1**
Cornus sanguinea	9	4.1
Ligustrum vulgare	8	3.7
Buxus sempervirens	4	1.8
Lonicera xylosteum	2	0.9
Pteridium aquilinum	1	0.4
Sambucus nigra	1	0.4
Quercus humilis	1	0.4
Sorbus aria	1	0.4
Cytisus cantabricus	1	0.4
Euonymus europaeus	1	0.4
Non thorny shrub total	**29**	**12.9**
TOTAL	224	100.0

The Red-backed Shrike could therefore be regarded as an indicator of the climate in our area, and of the initial stages of degradation of the vegetation series of the gall oak, oak, and beech. However, before definitive conclusions can be drawn it will be necessary to see whether this phenomenon occurs in other areas of the breeding distribution of the Red-backed Shrike.

REFERENCES

Bosch J. 1984. *Bestandsaufnahme einer Population des Neuntöters Lanius collurio in Unterfranken.* Anz. orn. Ges. Bayern 23: 215-224.

Cramp S., Perrins C. M. (Eds). 1993. *The Birds of the Western Palearctic*. Vol. 7. Oxford.

Elósegui J. 1985. *Navarra. Atlas de aves nidificantes (1982-1984).* CAN. Pamplona.

Fornasari L., Kurlavicius P., Massa R. 1997. *Red-backed Shrike.* In: Hagemeijer W., Blair M. (Eds). *The EBCC Atlas of European Breeding Birds.* T & A D Poyser. London.

Fuisz T., Yosef R. 1998. *Habitat choice of post-breeding Red-backed Shrikes (Lanius collurio) in northeastern Hungary.* IBCE Tech. Publ. 7: 26-29.

Gómez M., Soto-Largo E. 1993. *Noticiario Ornitológico: Alcaudón Dorsirrrojo (Lanius collurio).* Ardeola 40: 102.

Hands H. M., Drobney R. D., Ryan M. R. 1989. *Status of the Loggerhead Shrike in the northcentral United States.* Missouri Coop. Fish. Wild. Res. Unit., Univ. Missouri, Columbia.

Hernández A. 1994. *Selección de hábitat en tres especies simpátricas de alcaudones (real, Lanius excubitor L., dorsirrojo Lanius collurio L., y común, Lanius senator L.): segregación interespecífica.* Ecología 8: 395-413.

Hernández A. 1997. *Alcaudón dorsirrojo.* In: Purroy F. (Coord.). *Atlas de las aves de España (1975-1995).* Lynx Edicions. Barcelone.

Jakober H., Stauber W. 1987. Zur *Populationsdynamik des Neuntöters (Lanius collurio).* Beih. Veröff. Naturschutz Landschaftspflege Bad.-Württ. 48: 71-78.

Köppen W., Geiger R. 1954. *Klima der Erde.* Justus Perthes, Darmstadt.

Lefranc N., Worfolk T. 1997. *Shrikes. A Guide to the Shrikes of the World.* Pica Press. Sussex.

Loidi J. 1989. *Los espinares de orla de los carrascales supramediterráneos castellano-cantábricos.* Lazaroa 11: 77-83.

Loidi J., Bascones J.C. 1995. *Memoria del Mapa de Series de Vegetación de Navarra.* Gobierno de Navarra. Pamplona.

Malik J. 1995. *Landuse changes and distribution of Red-backed Shrikes in Slovakia.* Proc. West. Found. Vertebr. Zool. 6: 105-106.

Rivas-Martínez S. 1984. *Pisos bioclimáticos de España.* Lazaroa 5: 33-43.

Rivas-Martínez S. 1997. *Syntaxonomical synopsis of the potential natural plant communities of North America, I.* Itinera Geobotanica 10: 5-148.

Rivas-Martínez S. 1999. *Syntaxonomical synopsis of the potential natural plant communities of North America, II: North American boreal and western temperate forest vegetation.* Itinera Geobotanica 12: 5-151.

Tucker G. M., Heath M. F. 1994. *Birds in Europe: Their conservation status*. Birdlife International. Cambridge.