Bulletin of Regional Natural History
Formerly Bollettino della Società dei Naturalisti in Napoli

Expansion in the selection of breeding sites by the European Roller (*Coracias garrulus*) in the Caserta area

Danila Mastronardi*, Bruno Dovere, Giuseppe Pesapane, Sergio Tanga, Elio Esse

DOI https://doi.org/10.6093/2724-4393/11736

***Correspondence:**
danila.mastronardi@gmail.com;
https://orcid.org/
0000-0003-4954-0588

Affiliation:
Associazione Studi Ornitologici Italia Meridionale odv, Via Cavalli di Bronzo, 95 – 80046 S. Giorgio a Cremano

Running Title: Nesting from ruins to nest boxes and pylons

Financial Disclosure Statement: the Authors declare that no specific funding was received for this work

Competing interests: The Authors declare that they have no competing interests for this work

Submitted: 25 January 2025
Revised: 27 February 2025
Accepted: 03 March 2025
Published: 31 March 2025

Associate Editor:
Maurizio Fraissinet

Abstract

The Caserta population (Campania-Southern Italy) of the European Roller *Coracias garrulus* has been monitored since 2012, remaining relatively stable in numbers. From that year until 2023, it chose the ruins of the Opera Nazionale Combattenti (ONC) as breeding sites, highlighting the need to often change the breeding site due to mainly anthropogenic pressures. In 2021, in collaboration with TERNA S.p.a., 30 wooden nest boxes were installed, which were ignored by the species until 2023. In 2024, two of them were occupied, and in the same year, two pairs chose a breeding site different from the ONC ruins, occupying cavities in the electric pylons, and one inspected a third concrete nest box installed by the authors near one of the historically occupied ruins. This expansion in the choice of breeding sites raises hope for an increase in the Caserta population.

Key words: *Coracias garrulus*, South Italy, selection breeding site, nest-box.

Riassunto

La popolazione casertana (Campania-Sud Italia) di Ghiandaia marina *Coracias garrulus* viene monitorata dal 2012, mantenendosi piuttosto stabile numericamente. Da quell'anno fino al 2023 ha scelto come siti riproduttivi i ruderi dell'Opera Nazionale Combattenti (ONC), evidenziando la necessità di modificare spesso il sito riproduttivo a causa delle pressioni soprattutto antropiche. Nel 2021 sono state installate, in collaborazione con la società TERNA S.p.a., n. 30 cassette nido in legno che sono state ignorate dalla specie fino al 2023. Nel

2024 due di esse sono state occupate e, nello stesso anno, due coppie hanno scelto un sito riproduttivo diverso dai ruderi dell'ONC, occupando cavità nei tralicci elettrici e una ha ispezionato una terza cassetta nido in cemento installata dagli autori in prossimità di uno dei ruderi storicamente occupati. Questo ampliamento nella scelta dei siti riproduttivi fa sperare in un incremento numerico della popolazione casertana.

Parole chiave: *Coracias garrulus*, sud-Italia, selezione siti riproduttivi, cassette nido.

Introduction

The European Roller (*Coracias garrulus*) is a polytypic species with an Euro-Turanian-Mediterranean distribution, with two recognized subspecies: the nominal one, which occupies a vast area extending west from Morocco to central and southwestern Europe, and east from Asia Minor to Iran and southwestern Siberia; and the subspecies *C.g.semenowi*, which occupies a territory that includes Iraq, Kashmir, and up to western China (Keller *et al*. 2020). It primarily nests in plains or hilly areas, up to 600-700 meters above sea level. Its breeding habitat is characterized by mosaic-shaped vegetation, where it chooses old, abandoned ruins, electrical transformer boxes, artificial nest boxes, barns, and floodplain forests as breeding sites (Cramp 1985; Brichetti and Fracasso 2007). The breeding population in Italy is about 1000 pairs (Meschini 2015, 2022). The wintering range is in sub-Saharan Africa, from Senegal to Cameroon and from Ethiopia to South Africa (Del Hoyo *et al*. 2001). The species is SPEC 2, listed in Annex I of the Birds Directive, and considered 'endangered' in the national Red List (Gustin *et al*. 2019). In the regional Red List, it is classified as a species threatened with extinction (Fraissinet and Russo 2013). Nationally, it is considered to be increasing (Tokody *et al*. 2017), but the negative global trend and the importance of source populations require high attention to its conservation. In Campania region, it was not reported in the Atlas of Breeding Birds in Campania (Fraissinet and Kalby 1989), but was mentioned by Grimmett and Jones (1989) in the gorges of the Calore River in the province of Salerno, and by Scebba (1993), who reported its presence under highway viaducts in the Padula – Lagonegro (SA) section (Landolfo), and nesting in the 1960s along the Volturno River near Grazzanise, in the province of Caserta.
Currently, the European Roller is present during migratory transits and the breeding period, nesting mainly in the Caserta area and sporadically in the Salerno area (Mastronardi *et al*. 2015). The Caserta population, subject to systematic studies, has been estimated at about 18 pairs, including those with certain, probable, and possible nesting, and has remained fundamentally stable over the years (Mastronardi and Esse 2022).

Study Area

In the Caserta province, the occupied area lies within the alluvial plain of the Volturno and Garigliano rivers and currently does not enjoy any degree of protection. The area is mostly cultivated with crops that rotate between forage (especially for buffalo breeding), vegetables, and cereals. Cultivation is primarily traditional with the use of chemical products. The entire area is traversed by both irrigation and drainage canals, as well as tree-lined rows primarily of Eucalyptus trees (*Eucalyptus spp*.) and shrub rows mainly of Bramble (*Rubus ulmifolius*). A smaller area is dedicated to fruit trees. Throughout the investigation area, there are numerous abandoned ruins of the Opera Nazionale Combattenti (ONC). The area occupied by the species covers approximately 370 km² and extends from Falciano del

Massico in the north, Brezza of Grazzanise and San Tammaro in the east, Villa Literno in the south, and the Tyrrhenian coast in the west at a minimum distance from the latter of about 3 km. Isolated pairs at the margins of this area are not excluded.

Methods

The species has been systematically studied in Campania since 2012, following the adhesion of the Associazione Studi Ornitologici Italia Meridionale (ASOIM) to the national Coracias project (Meschini 2015), and investigations have continued uninterrupted to this day. Monitoring begins every year at the end of April and continues until the first decade of August. The entire reproductive range is surveyed, monitoring the pairs and collecting data on ecology and reproductive biology. In particular, the sites chosen for reproduction have been investigated and found to be, until the 2023 breeding season, 100% abandoned tuff ruins with a preference for those with at least part of the roof present. The species has occupied cavities at heights ranging from 4.5 to 6 meters, rarely lower (Mastronardi *et al.* 2014). A total of 96 ruins were checked; there is a high degree of turnover of occupied sites due to numerous abandonments (Mastronardi and Esse 2022). In 2021, thanks to cooperation with the electric company Terna S.p.A., 30 wooden nest boxes were mounted on high-voltage transmission towers, located in the most suitable sites. In the same year, a concrete nest box was built on a high pole next to a ruin occupied by the species in the municipality of Castel Volturno. The nest boxes were installed at heights of 6-7 meters and with SE or NE exposure. The nesting categories are referred to the following classification: possible reproduction (Ps) – sporadic observation of a pair during the breeding period with a suitable site nearby; probable (Pb) presence of the pair at the site throughout the breeding season – nest not identified; certain (C) active nest and/or presence of young of the year near the nest. For the numbering of the sites reported in tables 1 and 2, the same numbering used in the field was preferred, therefore the numbering of the sites does not follow the natural numerical order.

Results

Table 1 reports the known breeding sites of the species in the Caserta area over 13 years of monitoring (2012-2024) and some characteristics of the sites and cavities. Nest height, exposure, and cavity type data are reported only in cases where the nest was identified. The indicated year refers to the first occupation; multiple years are reported in case of different nest cavities in the same ruin were used in different years.

From the analysis of Table 1, it is evident that the breeding sites identified during the years of study are 22, of which 20 are certain nesting sites, one probable, and one possible. In two of these sites, different cavities were occupied in different years for a total of 24 occupied cavities. At site 4, successful nesting occurred in 2012 and 2013, while in 2014, in a different nest cavity, it remained only possible. In subsequent years, the pair was seen near the ruin, but nesting certainty was not achieved. The nest cavities with data on exposure and height are 17, including 12 ruins, 2 electrical poles, and 3 nest boxes.

The nest cavity height ranges between 3 and 6 meters, with 7 cases in the 3-4 meter range, 3 in the 4.1-5 meter range, and 7 cases in the 5.1-6 meter range.

Three nests were exposed to the NE, 3 to the SE, 2 to the NW, 4 to the SW, 3 to the W, 1 to the E, and one was not assessable because the entrance was located at the top, in the insulator of the electric pole.

Table 2 shows that only one site has experienced continuous nesting from 2012 to

Table 1. Occupied Sites. The data on nest height, exposure, and type of cavity are reported only in cases where it was possible to identify the nest. The year refers to the first occupation. Different years for the same site are reported if different cavities were occupied. C= certain nesting; Pb= probable nesting; Ps= possible nesting.

Breeding sites	Occupation year	Artefact	Nest height in meters	Nest exposure	Types of cavity	
Site 1	2012	Ruin	6	W	Piping hole	C
	2021	Ruin	3	SW	Hole in tuff bricks	C
Site 3	2012	Ruin	5	SW	Hole in tuff bricks	C
Site 4	2012	Ruin	6	SW	Hole in tuff bricks	C
Site 4	2014	Ruin	4,5	W	Hole in tuff bricks	Ps
Site 5	2013	Ruin	3,5	NW	Hole in tuff bricks	C
Site 6	2014	Ruin	/	/	/	C
Site 8	2014	Ruin	/	/	/	C
Site 9	2014	Ruin	6	NE	Hole in tuff bricks	C
Site 10	2014	Ruin	6	SW	Hole in tuff bricks	C
Site 14	2015	Ruin	3	SE	Hole in tuff bricks	C
Site 15	2015	Ruin	/	/	/	C
Site 19	2018	Ruin	/	/	/	C
Site 20	2018	Ruin	5	W	Lamp holder hole	C
Site 22	2019	Ruin	4	E	Hole in tuff bricks	C
Site 23	2020	Ruin	/	/	/	C
Site 26	2021	Ruin	/	/	/	C
Site 27	2021	Ruin	4	NW	Hole in tuff bricks	C
Site 29	2022	Ruin				Pb
Site 33	2024	Inactive electric pole	4	NE	Hole in tuff bricks	C
Site 34	2024	Medium voltage electric pole	6	Not valuable	Hole in insulator electric pole	C
Site 35	2024	Nest box	6	NE	Nest box n. 182	C
Site 36	2024	Nest box	6	SE	Nest-box n. 192	C
Site 37	2024	Concrete nest box	4	SE	Concrete nest box	Ps

the present, although it is not excluded that sites 6 and 15 were also occupied in 2017, the only year the pair was not found, but for entirely random reasons, the pairs were not seen that year. In other cases, the absence was confirmed by numerous visits to the nest, or abandonment was documented.

From the same table, it emerges that in 2024 there were 5 pairs that occupied sites different from the ruins, behavior not observed in previous years.

In 2024, specifically on June 10, a Roller was seen leaving nest box no. 179, mounted at 7 meters with NE orientation in the municipality of Castel Volturno, on the roof of which an Italian Sparrow male, *Passer italiae*, was calling. The Roller was still present on the roof of the nest box on June 17, while on June 24, it had moved to a box mounted on a transmission tower about a hundred meters away (nest box no. 182) and was seen several times until the end of the breeding season.

On the same day, a Roller was seen leaving the concrete box mounted near site 15. Subsequent checks did not confirm the occupancy of the nest box.

On June 30, 2024, a pair was seen repeatedly entering and leaving nest box no. 192, mounted at a height of 6 meters with SE orientation on a transmission tower in the

Table 2. site occupation over the years.

Breeding sites	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Site 1	x	x	x	x	x	x	x	x	x	x	x	x	x
Site 3	x	x	x	x									
Site 4	x	x	x		x			x		x			
Site 5		x	x	x	x								
Site 6			x	x	x		x	x	x	x	x	x	x
Site 8			x	x				x					
Site 9			x	x	x	x	x	x	x	x			
Site 10			x	x	x	x	x		x	x			
Site 14				x	x		x						
Site 15				x	x		x	x	x	x	x	x	x
Site 19							x	x					
Site 20					x	x	x	x	x	x	x	x	
Site 21					x			x	x	x		x	
Site 22									x		x		
Site 26										x			
Site 27										x		x	x
Site 29											x		
Site 33													x
Site 34													x
Site 35													x
Site 36													x
Site 37													x
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024

municipality of Cancello e Arnone, seen with food on July 4, and still in the area until the end of the breeding season.

In the same year, besides the nest boxes, holes in concrete electric poles were occupied. On June 20, 2024, the presence of a pair in a medium voltage pole a few kilometers from site 20 was confirmed. The individuals perched and used the structure at the level of the insulators. The pair was seen numerous times throughout the breeding season.

On the same day, the presence of another nesting pair in a light pole was confirmed; it was an inactive medium-voltage pole with holes in the concrete pole. In two holes at the same height but on different sides, an Italian Sparrow was seen entering one side, and a Roller with food on the other.

The light pole was located near a historic nesting ruin of the species (site 20), where competition with the Jackdaw is very strong. In this case too, the pair was seen several times during the breeding season, while site 20 in the ruin cavity was occupied by the Western Jackdaw.

It is very likely that the pair that used the hole in the disused electric pole was the same that previously occupied site 20. However, in the case of the pairs found in the nest boxes and on the active medium-voltage transmission tower, they were not pairs that moved from nearby ruins to these different structures, as the nearby ruins still hosted the species.

Discussion

The European Roller in Campania is subject to numerous pressures, mainly of anthropic origin (Mastronardi *et al*. 2022), which cause continuous movements from one site to

another within the same year or in different years. A natural cause is competition with the Western jackdaw, which in various sites has prevented the reproduction of the European Roller by occupying the cavities early (Mastronardi *et al*. 2022). This behavior has also been observed in other regions of Italy (Muscianese *et al*. 2014; Ianiro & Norante 2020). Competition with the Western Jackdaw has been considered one of the main causes of species decline in Europe (https://ec.europa.eu/environment/nature/conservation/wildbirds/threatened/c/coracias_garrulus_en.htm) and has been cited by numerous national and international authors (Kiss *et al*, 2014; Marini *et al*. 2015).

Many are the anthropogenic pressures in a socially and economically depressed territory and have been analyzed in detail in the recent work by Mastronardi *et al*. (2022), to which reference is made. Regarding the type of breeding sites chosen by the species, it is interesting to note that, until 2023, the European Roller had exclusively occupied cavities in the tuff ruins of the ONC, ignoring the various opportunities that the territory offered, in particular the 30 nest-boxes installed in 2021. This work aims to highlight the fact that for 13 years the European Roller in the Caserta area had only occupied the tuff ruins, while in 2024, without apparent environmental modifications, as many as 5 pairs occupied (in one case it was only a possible nesting) different structures. The causes that have determined this different behaviour can be varied and difficult to investigate. It is hoped that further information will be obtained in the coming years of research. The occupation of artificial nest boxes is encouraging, with a probable increase in the Campania population that will need to be verified with future monitoring. This method is efficient in the conservation of secondary-nesters and may contribute to the increase of population size in threatened species (Avilés and Parejo 2004; Kiss et al. 2017; Monti *et al*. 2019). These will also need to confirm the species' tendency to expand its choice of anthropogenic structures other than ruins. It is hoped that the installation of nest boxes and the expansion of site selection observed in 2024 will lead to an increase in the species in the Caserta area.

Author contributions

Conceptualisation: D.M.
Data Curation: D.M. & G.P.
Investigation: B.D. & S.T. & E.E & D.M.
Project Administration: D.M.
Methodology: D.M. & E.E.
Resources: D.M. & B.D. & E.E.
Writing: D.M. & G.P.

References

Avilès J.M., Parejo D. (2004). Farming practices and roller Coracias garrulus conservation in south-west Spain. *Bird Conservation International*, **14**, 173-181. https://doi.org/10.1017/S095927090400022X.

Cramp S. (1985). *The Birds of the Western Palearctic*. Vol. IV. Terns to Woodpeckers. Oxford University Press, Oxford, UK.

Del Hoyo J., Elliott A., Christie D.A. (2006). *Handbook of the Birds of the World*. Lynx Edicions. Barcelona. 535 pp.

Gustin M., Nardelli R., Brichetti P., Battistoni A., Rondinini C., Teofili C. (compilatori) (2019). Lista Rossa IUCN degli uccelli nidificanti in Italia. Comitato Italiano IUCN e Ministero dell'Ambiente e della Tutela del Territorio e del Mare, Roma.

Grimmett R.F.A., Jones T.A. (1989). *Important Bird Areas in Europe*. International Council for Bird Preservation, Cambridge, U.K.

Ianiro A., Norante N. (2020). Aggiornamenti sullo status e distribuzione della Ghiandaia marina *Coracias garrulus* in Molise. Uccelli d'Italia. **45**: 82:88.

Keller V., Herrando S., Vorisek P., Franch M., Kipson M., Milanesi P., Martì D., Anton M., Klvanova A., Kalyakin M.V., Bauer H-G., Foppen R.P.B. (2020). *European Breeding Bird Atlas 2: Distribution, Abundance and Change*. European Bird Census Council & Lynx Edicions, Barcelona, 967 pp.

Kiss O., Zoltán E.& Moskát C. (2014). High breeding performance of European Rollers Coracias *garrulus* in heterogeneous farmland habitat in southern Hungary, *Bird Study*, **61** (4) 496-505, D O I: 10.1080/00063657.2014.969191.

Kiss O., Tokody B., Ludnai T. and Moskat C. (2017). The effectiveness of nest-box supplementation for the conservation of European Roller. *Acta Zoologica*, **63**, 123-135.
DOI: 10.17109/AZH.63.1.123.2017

Marini G., Pascucci M., Feriozzi D. (2015). Prime nidificazioni di Ghiandaia marina *Coracias garrulus* nelle Marche. *Alula*, **XXII** (1-2), 29:33.

Mastronardi D., Capasso S., De Vita M., Digilio A., De Martino G., Esse E., Fraissinet M., Giustino S., Grimaldi S., Piciocchi S., Tatino F., Usai A. (2015). Distribuzione ed ecologia riproduttiva della Ghiandaia marina *Coracias garrulus* nella provincia di Caserta: primo anno di studio. *Alula* XXII (1-2): 71-77.

Mastronardi D., Esse E. (2022). Variability in the choice of reproductive sites of the Caserta area population of Roller *Coracias garrulus* and analysis of pressure at local scale. *Bulletin of The Regional Natural History*, **2**, n. 2 DOI 10.693/2724-4393/9424

Meschini A. (2015). Coracias: progetto di conservazione e ricerca. Risultati generali e analisi al 2013. *Alula*, **XXII** (1-2), 11-16

Meschini A. (2022). Ghiandaia marina, pp. 304-305. In: *Atlante degli uccelli nidificanti in Italia*. In: Lardelli R., Bogliani G., Brichetti P., Caprio E., Celada C., Conca G., Fraticelli F., Gustin M., Janni O., Pedrini P., Puglisi L., Rubolini D., Ruggieri L., Spina F., Tinarelli R., Calvi G., Brambilla M. (a cura di). Edizioni Belvedere (Latina), Historia Natura\\e (11), 704 pp.

Monti F., Nelli L., Catoni C., Dell'Omo G. (2019). Nest box selection and reproduction of European Rollers in Central Italy: a 7-year studi. *Avian Research*, **10,** 13. https://doi.org/10.1186/s40657-019-0150-0

Muscianese E., Pucci M., Sottile F. (2014). Dati preliminari su distribuzione ed ecologia della Ghiandaia marina *Coracias garrulus* in Calabria. Alula XXI (1-2).

Scebba S. (1999). *Gli uccelli della Campania*. Ed. Esselibri. Napoli, 278 pp.

Tokody B., Butler S.J., Finch T., Folch A., Schmeider T.C., Schwartz T., Valera F., Kiss O. (2017). The Flyway Action Plan for the European Roller (*Coracias garrulus*). BirdLife Hungary

Acknowledgements

We thank the numerous ornithologist friends who contributed to data collection by informing the authors about the movements of the species, and everyone who joined us in nature. We also thank the anonymous referees.