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Variability in the choice of reproductive sites of the Caserta area population of Roller *Coracias garrulus* and analysis of pressure at local scale

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Abstract

The study outlines the density and distribution of the Rollers nesting in the province of Caserta. The focus is on the scarce fidelity in choosing the reproductive sites, categorizing the ruins where this species nests based on the fidelity of occupation and highlighting the numerous abandonments of the sites. The study reports the pressures (disturbing actions in progress) noted during the monitoring activities, concluding that the majority of the instances are due to direct anthropic causes.

Keywords: Roller, anthropic disturbance, fidelity to the reproductive site, Caserta province.

Riassunto

Lo studio riporta la consistenza e la distribuzione della Ghiandaia marina nidificante nel casertano evidenziando la scarsa fedeltà ai siti riproduttivi. I ruderi in cui la specie si riproduce vengono categorizzati in base alla fedeltà di occupazione e si evidenziano i numerosi abbandoni dei siti riproduttivi. Lo studio riporta le pressioni (azioni di disturbo in atto nel periodo della ricerca) che gravano sulla popolazione, evidenziate durante il monitoraggio, concludendo che la maggior parte di esse sono dovute a cause antropiche dirette.

Parole chiave: Ghiandaia marina, disturbo antropico, fedeltà al sito riproduttivo, provincia di Caserta.

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Introduction

The Roller (*Coracias garrulus*, Linnaeus 1758) is a polytypic species that populates the Euroturanic-Mediterranean area with two subspecies. Both subspecies winter in Africa, from eastern Senegal to Cameroon and western Ethiopia to Congo and southern Africa (Tokody et al 2017). The largest nesting population is concentrated in Spain, Russia, South Ukraine, Romania, Bulgaria and Turkey. It is extinct in many northern countries: Sweden, Finland, Denmark, Germany, Czech Republic and has suffered considerable losses in Leetonia, Lithuania, Poland, Byelorussia, North Ukraine.

Portugal and NW Spain also suffered local extinctions. These losses have been compensated partially by new colonies or by an increase in the population of NE of Spain, North Italy, South France, South Ukraine, but the global situation shows a net loss of about one-fifth of the European population (Keller et al 2020).

The species is SPEC 2, included in the IUCN Red List in the category "LC" (Least Concern), in the Bonn convention (All. I e II), and in the Berna convention (All.II), in the Attachment I of the Dir. Uccelli (2009/147/EC) is considered to be at risk of extinction in

Campania's Red List (Fraissinet & Russo 2013).

At national level the species is believed to be increasing in numbers (Tokody et al 2017), but the negative global trend and the relevance of the *source* population still demand high attention level. In Italy the monitoring activity promoted by the "Coracias National Project" estimates about 1000 couples at national level, nesting mainly on pylons and buildings (Meschini 2015).

The population of the Campania region is noteworthy since, due to its tight numbers, it is an endangered species.

The first sightings at regional level date back to 1898 when 3 nesting pairs were spotted in Cannello, most probably referring to the municipality of Cannello Arnone in the province of Caserta (Cannaviello 1898). The species is cited as nesting by Grimmet and Jones (1989) in the gorge of the Calore river (province of Salerno), by Scebba (1993) that reports specimen reproducing both in the Salerno area and in the Caserta area.

Mancuso *et al.* (2008) considers the migratory species of the Salerno area, nesting up to the 70s in the holes of the railway bridge that runs across the Tenza river. Recently the studies on this species

focused on the Caserta plane, an area not placed under environmental protection, where the largest population of the region lives.

Occasional sightings are reported also in the Salerno area. Since 2012 the species is studied by ASOIM (Associazione Studi Ornitologici Italia Meridionale) within the Coracias National Project. Up to now it has been outlined the size and structure of the reproductive area and of the anthropic ruins chosen for nesting indicating also other ornithic species that populate the same ruins (Mastronardi *et al* 2015; Mastronardi *et al* 2017).

This work reports data on the numbers of the Caserta province population from 2012 to date, with its distribution on the territory and highlights the variability noticed in the occupation of the reproductive sites and the pressures (initial interferences of a project or

an intervention that generate impacts (Battisti *et al.* 2013) the species undergoes.

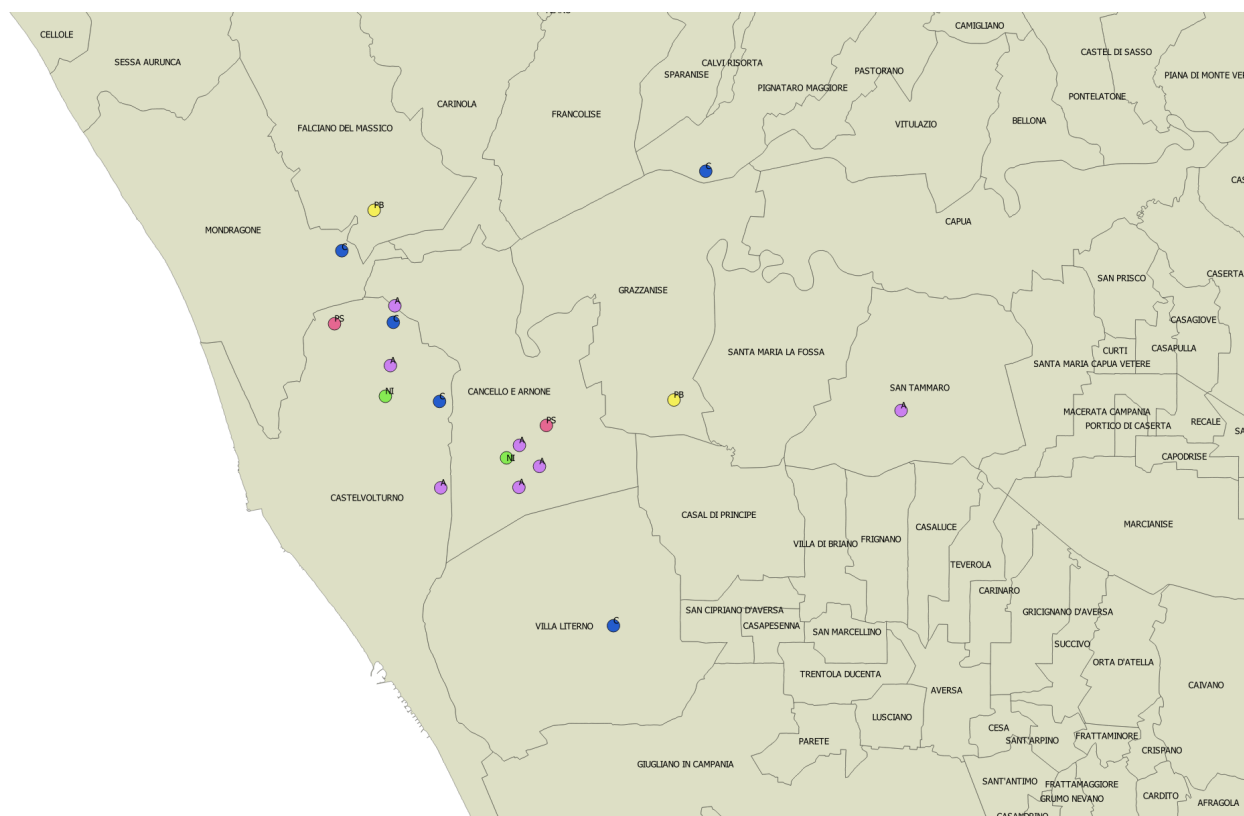
Methods

The reproductive area of the Roller of the Caserta area is in the plane between the Volturno and Garigliano rivers; it spreads entirely at sea level and is characterized by agricultural and arable land and is divided mainly into the fields for buffalo feeding, cereals and vegetable gardens (Fig.1).

The area is crosscut by irrigation pipes, brambles (*Rubus ulmifolius* Schott 1818), wooded areas mainly eucalyptus (*Eucalyptus* sp.). The agricultural fields are dotted by buffalos breeding farms, small urban areas, isolated houses and numerous ruins mostly built by the Opera Nazionale Combattenti (ONC), charity founded during the first world war with the motto "land to the veterans".



Figure 1: Image of the reproductive area in the province of Caserta (Campania Region).



The study begun in the spring of 2012 monitoring, for the first two years, a territory of 64 Km² and, from 2014 to 2021, the whole suitable area of about 375 Km² in the municipalities of Mondragone and Carinola in the north, Ischitella and Carditello in the south (Fig.1). The site visits started in the last decade of the month of April and continued, with a frequency of once or twice a week, through the months of May, June, and July.

In April and May all ruins have been explored to check the occupancy, in June and July the study focused on occupied buildings. Binoculars and long-distance telescopes were used to monitor the nesting pairs. During observation it was reported notes on reproductive biology, the presence of other ornithic species and any possible elements of disturbance. In case of abandonment of a reproductive site, the site

was still monitored for at least 2 weeks to make sure of the absence of the nesting pair.

The following terminology was used for the nesting categories: C- confirmed nesting = active nest and/or full-fledged hatchlings; PB - Probable Presence = nesting pair present in the proximity of the site during the whole reproductive season, PS - possible = repeated but non continuative presence of a pair during the whole reproductive season with suitable site nearby.

As regards the fidelity of occupation of the site in relation to the confirmed nesting (C category), the following categories apply: C/A- (abandoned) nesting site occupied for at least 2 years and then abandoned; C/IB (inconstant breeding) - confirmed nesting but absence some years; C/CB (constant breeding)- site where the nesting has been confirmed and continuous for the whole period of the study.

As regards the disturbances, we have identified the following causes: direct anthropic (DA) caused by direct human intervention, indirect anthropic (IA) whose cause is attributable to man but in an indirect way, and natural (N).

Results

Considering the confirmed, probable and possible nesting, the reproductive sites are 18 (density 0,048 pairs/Km²) out of which 14 are confirmed, 2 are probable and 2 are possible and are all located in ruins made of tuff in the ONC.

The 2 probable nesting sites refer to 2 ruins

Figure 3 highlights the occupation of the ruins through the years. Thus, category IB was excluded while category A is relayed to the sites abandoned in the same year the study took place. It is to be noted that the sites with several degrees of occupation went from 3 pairs to 11. The number of confirmed pairs increased between 2012 and 2014 through studying a larger area, and then decreased between 2015 and 2017 due to 2 abandonments in 2015 and 3 in 2016. After the lowest recorded numbers is in 2017, the tendency has been an increase, stable for confirmed pairs, from 2018 to 2020.

In 2021 the confirmed pairs decreased due to 1 abandonment; however 2021 also saw

Figure 2: Distribution of the reproductive site detected during the given period. C/CB (blue); PB (yellow); C/A (pink); PS (red) ; C/IB (green).

noted in 2021, that will be monitored in the next years. No ruin has shown the presence of more than one pair. The largest category is the (C/A) 38% of the total, followed by the (C/CB) 27,7%, PB, PS and C/IB categories at 11,1% each (Fig. 2).

Figure 2 shows the distribution of the sites noted during the study, highlighting the relevant categories. It shows that the core area is the site comprised within the municipalities of Castel Volturno, Cancellorone, Mondragone, Falciano del Massico, while some isolated nesting has been noted also in the municipalities of Pignataro Maggiore, Villa Literno, San Tammaro, Grazzanise. The shorter distance between two occupied sites is 1260 m.

an increase of possible and probable pairs that will be monitored in the upcoming years.

Figure 4 highlights the number of reproductive sites occupied for the first time in the year the study took place and the number of abandoned ruins compared to the previous years. From the analysis it can be gathered that the number of occupied sites fluctuates between 2 and 4 with a minimum in 2020 when only one new reproductive site was noted, and a peak in 2021.

Except for 2014, the study records the abandonment of sites occupied in the previous years. The number fluctuates between 1 and 4, with higher numbers in 2016, 2017 and 2020. In particular, 2017 shows the highest number of abandoned

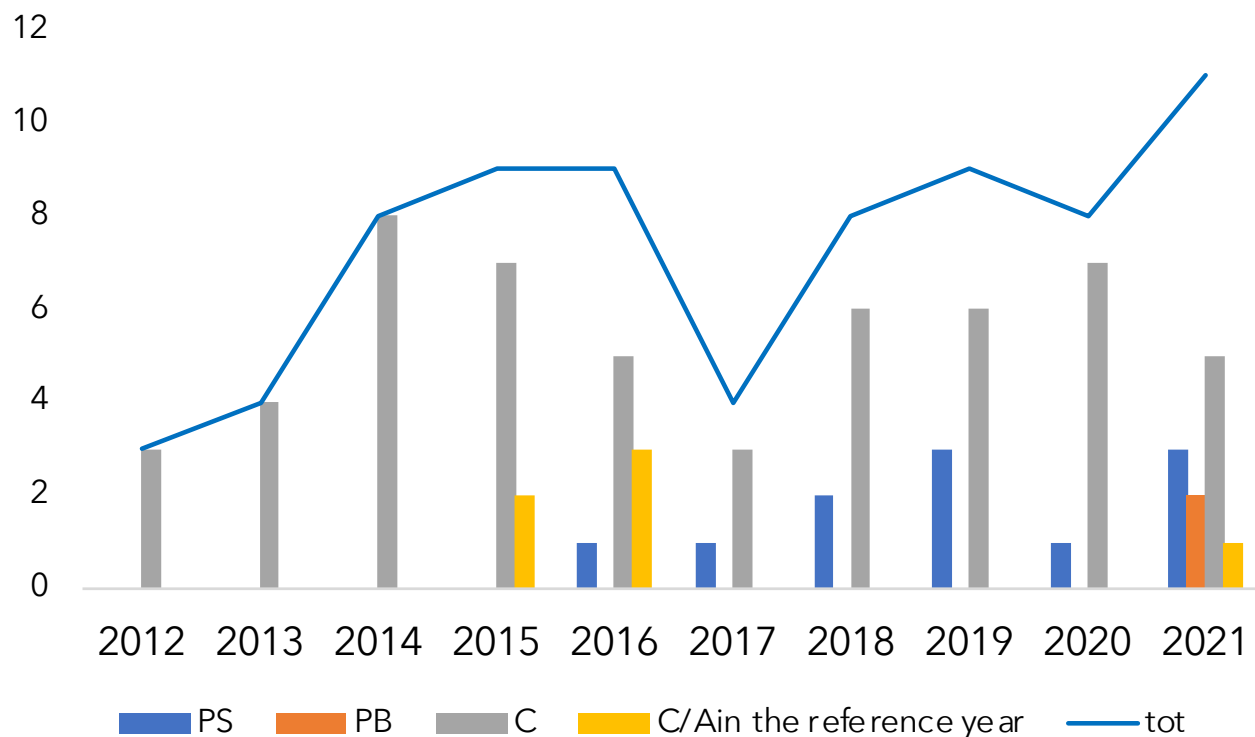


Figure 3: Number of occupied sites through the years and its group of reference.

sites while at the same time there is no record of new occupied sites.

The year 2012, being the year the study begun, cannot be taken in consideration. The large number of days in the field allowed us to ascertain some causes of disturbance that led to the abandonment of the reproductive sites (Tab. 1). It shows that the direct anthropic causes (DA) represent 83,3% of the verified instances, the indirect anthropic causes (IA) and the natural ones (N) represent 8% each.

There are 4 main events related to changes in the habitat or of the ruin: the first instance is the shift from farmed fields to pastures to irrigated horticulture or to extended cornfields; in the second instance it was the collapse of the ruin, especially of the roof, that was an important factor in the colonization of the ruins (Mastronardi *et al.* 2017).

Six episodes are related to direct disturbance due to reckless behavior (meddlers, unprofessional photographers, etc) including stealing from the nest which we ascertained in 3 cases, and the impact of passing vehicles with 2 proven instances; the species seems to tolerate the disturbance caused by farming activities, unlike to what has been observed in other regions (Ianiro & Norante 2020).

The sole source of indirect anthropic disturbance is predation by rats, observed directly by the authors. The sole ascertained natural cause for the abandonment of the nest is the competition to the Eurasian Jackdaw *Corvus monedula*. In a site abandoned due to this type of competition, the authors witnessed a few years later the attempt by the Roller to occupy the ruins when the Eurasian Jackdaw chicks had already left the nest, but without success.

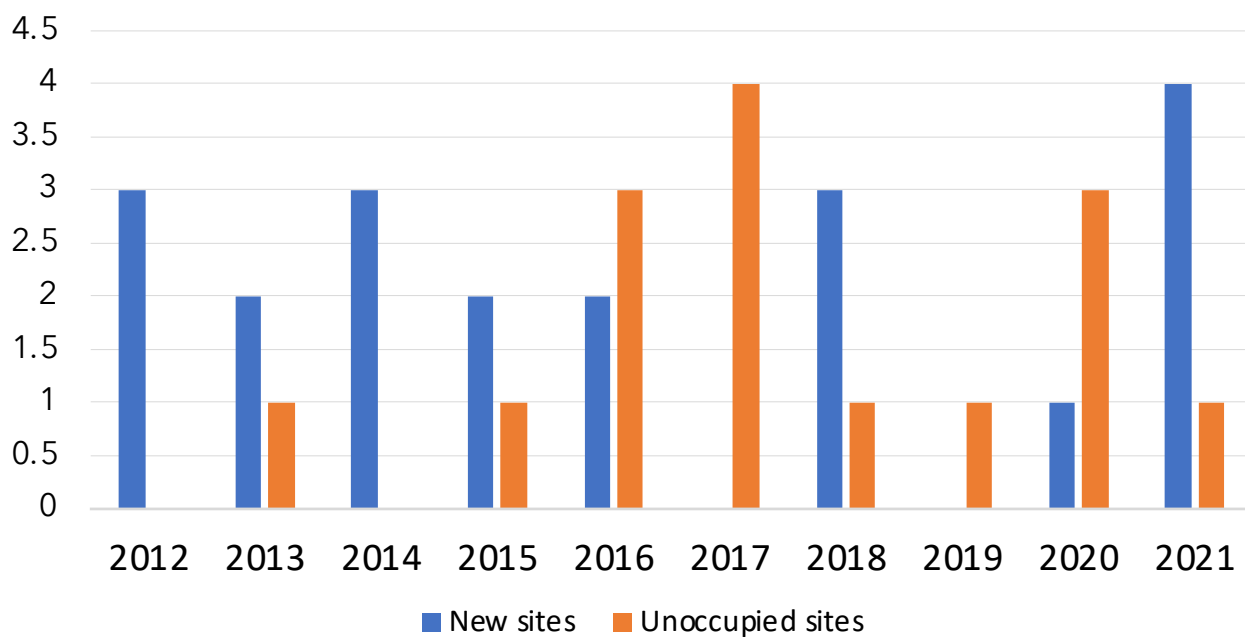


Figure 4: Number of new reproductive sites and number of unoccupied sites vs previous years.

At national level the anthropic disturbance is one of the main causes of threat with over 50 records, half of it is due to predation while stealing from the nests was reported less than 10 times (Meschini *et al.* 2015).

The sources of disturbance recorded in Campania Region are in line with those recorded in publications at regional level (Muscianese *et. al* 2014; Ianiro & Norante 2020, Marini *et al.* 2015).

The European Commission considers the competition with the western Jackdaw one of the reasons for the decline of the species (https://ec.europa.eu/environment/nature/conservation/wildbirds/threatened/c/coracias_garrulus_en.htm) and is cited by several national and international authors (Marini *et al.* 2015; Kiss *et al.* 2014.). Conversely Pezzo & Cianchi (2015) report of couples of Roller successfully nesting in nestbox occupied by the Eurasian Jackdaw when the Eurasian Jackdaw had completed

its reproductive cycle, delaying laying the eggs.

Table 1: Pressure recorded in the years of study (AD= direct anthropic pressure; AI= indirect anthropic pressure; N= pressure due to natural causes).

	n. events	category
Stealing from the nests	3	AD
Predation by rats	1	AI
Removal of vegetation through fire	2	AD
Demolition of the ruins	1	AD
Change in the habitat	1	AD
Anthropic disturbance	1	AD
Competition to the western jackdaw	1	N
Vehicular incidence	2	AD

Discussion

From this study it is clear that the nesting pairs of Rollers in the Caserta area are forced to constant changes of sites as highlighted by the continuous abandonment of the ruins occupied before. So far it has never been recorded movements in the same reproductive region, even if this hypothesis cannot be ruled out due to the impossibility to identify each pair individually and due to the large extension of the focus area.

The reasons for the abandonments are to be found in the disturbance the species is subject to, disturbance that, as said, is quite substantial and is due largely to direct anthropic action that, sometimes, clearly are offences.

Of course the number of events recorded in Table 1 refers to actions that the authors witnessed personally, thus we assume that more similar actions happened during the years of the study. Given this scenario the challenges faced by the Roller to increase its numbers are clear and possibly even cause fear for a decrease in its population.

The list of pressures is not meant to be exhaustive, but just records the findings made during the years of observation; in the near future the authors intend to examine in depth other aspects, especially the environmental ones, mainly because the area where the species is present is agricultural land, thus it is not subject to any protective measure. This leads us to believe that there will be more changes in the agricultural scope of the area, substituting pastures with large cornfields or irrigated horticulture that make the area not fit for

hunting by the species, as already noted over the past years, changes that led to the abandonment of the traditionally occupied sites and the move to hunting ground far from the nest. The lack of conservation measures shows its effect also on the state of the ruins that, year after year, become more unstable, and less suitable as reproductive sites. To protect the Roller in the Caserta area, the management of agricultural areas should provide the adoption of the “*set-aside*”, a transformation to biological practices, planting of hedges, a different turnover that doesn't allow the planting of corn when the eggs are hatching; measures that, if implemented, would bring clear advantages not only to the subject species, but also to the faunal and human community. At the same time it is desirable a tighter control by the authorities against the removal of nestlings. It is also necessary to increase the knowledge on the population of the Caserta area collecting data on the reproductive success, on the extension of the *home range*, on the type of prey.

The ASOIM team so far has tried to contrast the decrease of the population of the Caserta area applying to the Campania Region for the creation of a new ZPS in the area of nesting and is still waiting for feedback, and installing, thanks to financing by Terna s.p.a, (an Italian company operating the electricity transmission networks) 30 nest boxes placed on trellis in an attempt to increase the number of reproductive sites. We feel mandatory to undertake all possible strategies to keep this lively population of Roller, a species with such a high conservation value.

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