Distribution, seasonality and habitat of Ash-coloured Cuckoo *Micrococcyx cinereus* in the state of São Paulo, Brazil

Fabio Schunck, Fábio Luiz Barata and Marco Aurélio Galvão da Silva

Received 8 September 2021; final revision accepted 1 February 2022
Cotinga 44 (2022): 118–125
published online 1 July 2022

O papa-lagarta-cinzento *Micrococcyx cinereus* (Cuculidae) tem ampla distribuição na América do Sul, incluindo o Brasil. É considerado um migrante austral, pois se reproduz no sul de sua distribuição durante o verão e aparece no norte durante o inverno. O baixo número de registros publicados prejudica uma melhor avaliação do seu status de ocorrência, possíveis movimentações sazonais e ações de conservação. Com base neste cenário, realizamos uma revisão dos registros históricos e atuais disponíveis para o Estado de São Paulo, sudeste do Brasil. Foram consultados dados de literatura e plataformas ornitológicas online, além de registros inéditos de campo. Foram obtidos 23 registros produzidos ao longo dos últimos 64 anos, que mostram pela primeira vez, uma ampla ocorrência no Estado de São Paulo, incluindo a região litorânea e o entorno de grandes centros urbanos, com indícios de reprodução. Sua presença é mais representativa durante a primavera-verão, mas o aumento de ocorrências na região leste, principalmente no outono-inverno podem indicar movimentações sazonais longitudinais e o uso de novos ambientes, questões que precisam ser melhor investigadas por estudos mais amplos, que contemplem toda a área de ocorrência dessa espécie na América do Sul.

New World cuckoos in the genera *Coccyzus*, *Coccycua* and *Micrococcyx* number 13 species[15,33]. Ash-coloured Cuckoo *Micrococcyx cinereus* has uniform grey plumage, with a red orbital region and eyes. It inhabits scrub (*capoeira*) and forest edges in more open regions, such as *cerrado* and *caatinga*, but has been recorded also in anthropogenic environments[13,29,30]. The species is widely distributed in South America, in Argentina, Uruguay, Paraguay, Bolivia, Peru, Colombia and Brazil[27]. The fact that it breeds during the austral spring and summer in the south of its distribution, and occurs in the north during winter, has led several authors[29,30,32,34] to consider the species to be a possible austral migrant, a hypothesis yet to be confirmed[27].

In Brazil, *M. cinereus* occurs from Rio Grande do Sul, where it breeds in the summer[1], north to southern Amazonia, where the species appears to occur solely during the austral winter[29,34], with irregular occurrences year-round in other parts of the country[20,30,32]. There were only four published records in São Paulo between 1957 and 2003, in the west and centre-north of the state, where the species is considered a summer visitor[37]. There are just two more recent records (2003–10), one in the centre-east in late summer and the other in the west (date not reported)[3,13]. The small number of records in São Paulo has prevented an analysis of the species' status in the state, where it is classified as Data Deficient[6]. Ash-coloured Cuckoo is in need of further study throughout its entire distribution[27]. Based on this, we reviewed available historical and recent records of the species in São Paulo, and present a new record for the coast of south-east Brazil.

Methods

Study area.—The study area is the state of São Paulo, south-east Brazil (Fig. 1), which is largely deforested, with only 22.9% of native vegetation remaining; 19.3% Atlantic Forest and 1% Cerrado[9,28]. Atlantic Forest is represented by humid forests in the east of the state (dense ombrophilous forest) and drier forests (seasonal semi-deciduous forests) in the centre and west. The Cerrado occupies a small area in the centre-north, whilst the coast has large areas of *restinga* (herbaceous, shrubby and arboreal vegetation on sandy soil) and some mangrove[28].

Data compilation.—Occurrence data were obtained via searches of the literature (scientific, books, and 'grey') and ornithological collections in natural history museums (via the GBIF online platform; https://www.gbif.org) and a request to the Peabody Museum, Yale University (YPM). Online ornithological platforms, WikiAves (https://www.wikiaves.com.br), eBird (https://ebird.org), xeno-canto (https://www.xeno-canto.org) and Táxeus (https://www.taxeus.com.br) were also consulted (up to 5 May 2021). Records without specific locality were assigned to the central point of their respective municipality, and those published on online platforms and subsequently in the literature were cited for both sources, but only counted in the first category. Records were classified as historical (1957–2003) or contemporary (post-2003), with the first period covering both museum data and field observations. Taxonomy follows the Comitê Brasileiro de Registros Ornitológicos[25].

We visited two localities in the municipality of Peruíbe, on the central-south coast of São

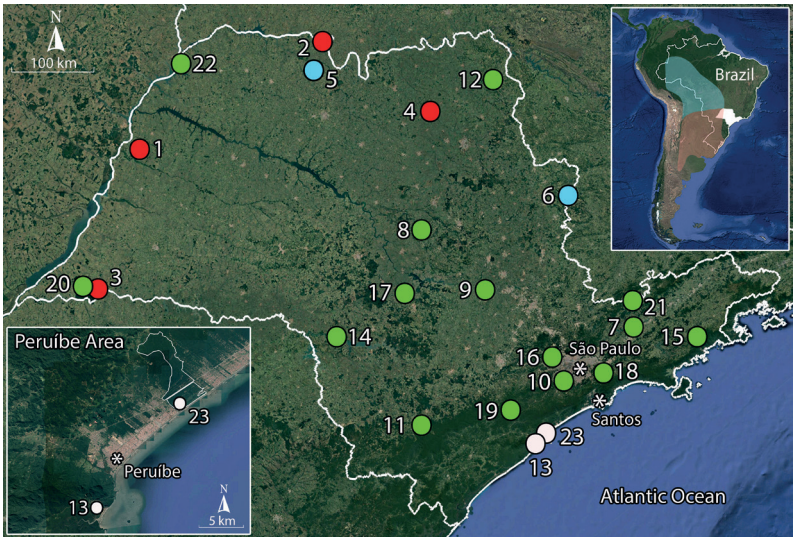

Figure 1. Records of Ash-coloured Cuckoo *Micrococcyx cinereus* in the state of São Paulo, Brazil. Inset: South American distribution, with blue indicating the non-breeding distribution and brown the breeding area[2]. Red dots = historical records (literature); blue = contemporary records (literature); green = contemporary records (online platforms); white = field records. The numbers refer to the localities listed in Table 1. The white polygon on the map of Peruíbe delineates the Terra Indígena Piaçaguera. © Google Earth (Image Landsat/ Copernicus 2020).

Figure 2. Specimens of Ash-coloured Cuckoo *Micrococcyx cinereus* collected by A. M. Olalla at Nova Independência, São Paulo, and held at the Peabody Museum, Yale University; top to bottom, YPM 80408, 80409 and 100067 (Kristof Zyskowski)

Figure 3. Habitat used by Ash-coloured Cuckoo *Micrococcyx cinereus* in Terra Indígena Piaçaguera, formed of medium and tall *restinga* (Fábio Barata)

Figure 4. Adult Ash-coloured Cuckoo *Micrococcyx cinereus*, Terra Indígena Piaçaguera, Peruíbe, São Paulo, 4 May 2021; sequence A–I shows the capture and ingestion of a caterpillar, with the red circle indicating its initial location (Fabio Schunck)

Paulo: (1) Guaraú (24°21'50.4"S 47°01'26.2"W; 15 m elevation), a small urban centre in the lee of the Serra da Juréia; and (2) Terra Indígena Piaçaguera (24°16'3.22"S 46°55'39.08"W; 15 m), belonging to the Guarani ethnic group. Piaçaguera encompasses c.2,773.79 ha and is located in a *restinga* c.250 m from the beach, and near the urban area of Peruíbe (Fig. 1). A ten-hour field survey was undertaken in May 2021 to search for austral winter migrant birds. Three additional visits were made by FB on 8, 12 and 16 May 2021, for a total of three hours. Field work used binoculars and cameras. Complete lists of birds recorded during our observations are available via eBird (Guaraú and Peruíbe general area), with two specific lists (S34813615 and S87207119) of records during this survey.

Results

Some 23 records were obtained for the state of São Paulo; 21 from secondary sources and two field records. Four secondary records are historical and 17 of them are contemporary. Among historical records are three specimens collected by A. M. Olalla in 1957, the only ones for the state of São Paulo (Fig. 2). Among contemporary records, two are from the published literature[3,13], ten from WikiAves, seven from eBird and one from Táxeus, with some duplication on the two online platforms. Only one author mentioned the number of individuals observed—two, one possibly a juvenile[13] (Fig. 1, Table 1).

Two records were made in the municipality of Peruíbe over 21 years of field observations (visits by the authors and FB's period of residence). The first record, undocumented, was made by FB on 26 February 2017 at Guaraú, when an adult was seen on a high sandbank. The second record was made by all three of us on 4 May 2021 in the Terra Indígena Piaçaguera (15 km north-east of the first record), on the outskirts of Peruíbe (Fig. 1, Table 1). An adult was observed at c.10h30, c.5 m above ground, near a natural pond at the edge of a mid-sized *restinga*. It was feeding on small caterpillars taken from the surface of leaves (Figs. 3–4). Following playback, the bird moved c.50 m to a point at the forest edge, landing in the canopy but not vocalising. Four days later, FB observed what was presumably the same bird, in the same location, feeding on caterpillars in the same tree (Table 1).

The 23 records are from 23 different localities in 20 municipalities, six in the west of the state, five in the centre and 12 in the east. Only three municipalities (including Peruíbe) possess multiple records on different dates, of which only Teodoro

Table 1. Records of Ash-coloured Cuckoo *Micrococcyx cinereus* in the state of São Paulo, Brazil. For the spatial distribution of these records, see Fig. 1. eBird species lists and Macaulay Library photos are identified by the codes S and ML, respectively; WikiAves images are identified by the code WA. YPM = Peabody Museum, Yale University.

No.	Locality	Coordinates	Municipality	Season	Date	Record type	Observer/ collector	Source
1	Near the Paraná River	21°06'28.24"S 51°29'28.27"W	Nova Independência	summer	30 January and 6 February 1957	specimens	A. M. Olalla	Willis & Oniki[36], YPM 80408, 80409 and 100067 (K. Zyskowski *in litt.* 2021).
2	Estação Ecológica Paulo de Faria	19°56'58.88"S 49°31'21.09"W	Paulo de Faria	summer	summer	sight record	E. O. Willis	Willis & Oniki[37]
3	Parque Estadual Morro do Diabo	22°31'59.30"S 52°10'10.26"	Teodoro Sampaio	summer	14 January 1983	sight record	E. O. Willis	Willis & Oniki[36]
4	Fazenda Bela Vista	20°53'S 48°10'W	Pontal	winter	18 June 1991	sight record	J. F. Pacheco	Pacheco[24]
5	Fragmento P7	20°19'26.27"S 49°30'29.34"W	Palestina	winter	26 July 2008	sight record	A. Bispo	Bispo *et al.*[3]
6	Bairro do Marco Divisório	21°50'51"S 46°41'04"W	Águas da Prata	spring	18 March 2010	photo	F. I. de Godoy	Godoy[13] (WA 268308)
7	Banhado Via Oeste	23°12'53.6"S 45°55'18.8"W	São José dos Campos	spring	18 October 2011	photo	M. Eugênio	S44862512, ML 96061871
8	Dourado	22°06'44.35"S 48°18'52.15"W	Dourado	summer	28 February 2013	photo	C. Martins & M. Reppening	WA 898959
9	Piracicaba	22°44'15.21"S 47°38'41.98"W	Piracicaba	autumn	18 April 2013	photo	F. I. de Godoy & V. Robinson	WA 952277
10	Parque Municipal Linear Nove de Julho	23°43'14.62"S 46°42'55.84"W	São Paulo	autumn	8 May 2013	photo	G. Durante	WA 955972
11	Parque Estadual Intervales	24°15'52.4"S 48°25'03.1"W	Ribeirão Grande	spring	18 December 2013	sight record	R. Intervales	S45535700
12	Cidade de Franca	20°32'30.45"S 47°23'55.35"W	Franca		unknown	unknown	Several observers	Garcia *et al.*[12]
13	Guaraú	24°21'50.4"S 47°01'26.2"W	Peruíbe	summer	26 February 2017	sight record	F. Barata	S34813615
14	Estrada do Cascavel	23°11'51.66"S 49°22'57.48"W	Piraju	autumn	10 April 2017	photo	A. G. Salgado & C. G. Bianchini	WA 2522144
15	Núcleo Santa Virgínia do Parque Estadual Serra do Mar	23°21'17.5"S 45°06'17.6"W	São Luiz do Paraitinga	autumn	1 May 2017		D. Bucci	WA 2545761, S36494354

No.	Locality	Coordinates	Municipality	Season	Date	Record type	Observer/ collector	Source
16	Condomínio Fazendinha	23°33'14.9"S 46°51'31.5"W	Carapicuiba	summer	16 February 2018	sight record	F. Lotto	S42853683
17	São Manoel	22°44'45.0"S 48°34'07.0"W	São Manoel	spring	27 September 2018	photo	J. S. & A. Janas	WA 3127236, S48848994
18	Mogi das Cruzes	23°39'18.2"S 46°11'03.2"W	Mogi das Cruzes	spring	16 November 2018	sight record	K. Barbosa	S49967369
19	Legado das Águas—sede	24°01'48.7"S 47°21'08.9"W	Miracatu	autumn	22 March 2019	photo	D. Bucci, C. Azevedo, C. & R. Hatt	WA 3312886, S54118537
20	Parque Estadual Morro do Diabo—SP 613	22°31'28.26"S 52°18'19.23"W	Teodoro Sampaio	autumn	2 May 2019	photo	H. Faria	WA 3346512
21	Terras Altas, Serra dos Poncianos, São Francisco Xavier	22°52'41.8"S 45°58'10.3"W	São José dos Campos	spring	21 October 2019	photo	E. Muscat & E. Laura	WA 3538642, S60823992
22	Rubinéia	20°10'28.16"S 51°00'05.24"W	Rubinéia	summer	12–24 March 2021	photo	Several authors	WA 4231658
23	Terra Indígena Piaçaguera	24°16'03.22"S 46°55'39.08"W	Peruíbe	autumn	4 May 2021	photo	F. Schunck, F. Barata & M. Silva	present study, WA 4297496, S87207119
				autumn	8 May 2021	sight record	F. Barata	present study, S87457743

Sampaio has both historical and contemporary records (Fig. 1, Table 1).

The total number of records by date / season involves six occurrences in spring (22 September–21 December), seven in summer (21 December–20 March), seven in autumn (20 March–21 June) and two in winter (21 June–22 September). Seasonal occurrence by region within the state (west, centre and east) is strongly biased to regions with more records, namely the west and east, but well balanced in the centre, where there were fewer records (Fig. 5, Table 1).

Discussion

Twenty-three records over the last 64 years might appear rather few, but are relevant given the relatively uncommon presence of *M. cinereus* in interior Brazil. Until recently, the species was known in São Paulo from only four records over a period of 46 years (1957–2003), and it was considered to be restricted to the west of the state and to occur only in summer[37]. However, Willis & Oniki[37] overlooked a 1991 winter record[24]. From 2003 to 2010, only two new records were made, one in winter in the west[3] and one in the centre-east at the end of summer[13], expanding the area of occurrence, but still insufficient to infer anything concerning austral migration. This scenario has changed in the last ten years (2011–21), with 17 new records being obtained, or 74% of the available data. Twelve records were made by birdwatchers and photographers who uploaded their observations to online public platforms, showing the importance of these for relevant ornithological data. All of these records, made since 2011, were made available on such platforms, allowing a technical assessment, whose results contribute to the expansion of knowledge[14].

The current dataset shows that *M. cinereus* is widely distributed geographically in the state of São Paulo. Its presence in the west and centre has been known, but presence in the east is novel. The species' occurrence in eastern São Paulo might be related to the increasing number of birdwatchers over the last decade[10,35]. However, given that this region is in the better-studied part of São Paulo, with hundreds of published studies[37] and visits by birdwatchers since the 1950s[11,21], the absence

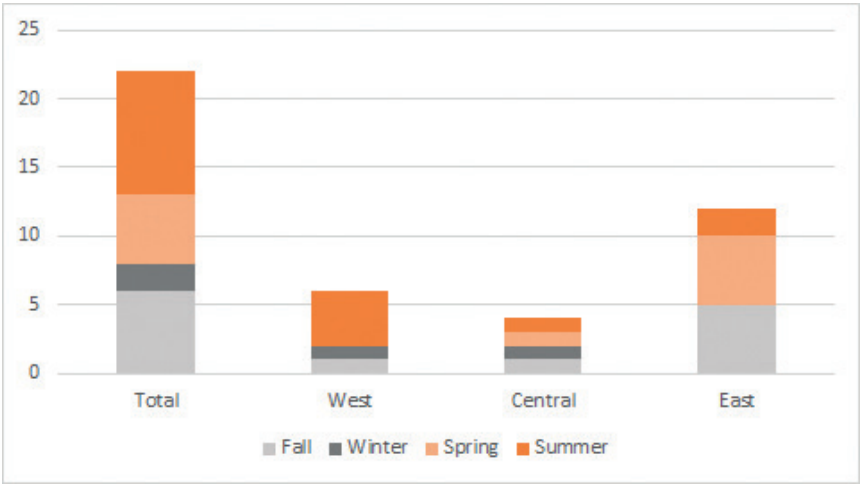

Figure 5. Numbers of records (y axis) of Ash-coloured Cuckoo *Micrococcyx cinereus* by region and season in the state of São Paulo, Brazil.

of previous data leads us to consider a second hypothesis. The growing number of records over the last ten years may indicate a possible geographic variation in habitat use. First, degradation of natural environments in the state's interior, where the species occurred historically (more recently in small forest fragments), has led individuals to seek resources in larger fragments further east. Recent years have witnessed changes in the migratory routes of some bird species in different regions of the world due to anthropogenic factors and climate change[8,26], which possibility might also apply to *M. cinereus*?

The presence of a species typical of interior São Paulo in coastal habitats, where it had not previously been seen[4,7,23,31,37] is also remarkable. However, this cuckoo had already been found on the south-east coast of Brazil in June 1989, when one was collected in open shrubby *restinga* in Rio de Janeiro (Maricá)[22]. The occurrence of *M. cinereus* on the Brazilian coast is still little known, but the increase in records in recent years[10,35] indicates that *restinga* and other coastal environments are also used by the species at some seasons, although this pattern requires further investigation.

The species' presence in São Paulo in the coldest and driest period of the year (autumn / winter) has not been reported previously. However, most records were during the warmest period (spring–summer), partially corroborating the hypothesis of the species being 'summer birds'[37]. As western São Paulo is south of the known winter-only range of *M. cinereus* and on the edge of the area designated as 'breeding'[2] (Fig. 1), its presence during the warmest season was expected. In 2010, the discovery of an adult accompanied by a 'smaller individual'[13] with different plumage led Godoy[13] to consider the latter a possible immature, suggesting that the species might breed in São Paulo. Of the nine records from autumn / winter, five are in the east of the state, two in the central region and two in the west, supporting the hypothesis of some type of longitudinal movement, whereby birds would move east in the coolest season, as suggested for Dinelli's Doradito *Pseudocolopteryx dinelliana* and Dark-throated Seedeater *Sporophila ruficollis* in South America[5,19]. Occurrence of *M. cinereus* during autumn / winter in eastern Brazil needs further investigation.

M. cinereus is a typical forest edge species, but contemporary evidence, mainly from eastern São Paulo state, shows occurrence in different habitats, including well-preserved forest, such as in the Serra do Mar (two localities), and the immediate environs of cities, such as the Metropolitan Region of São Paulo (three localities), the largest urban sprawl in South America with c.21.5 million inhabitants[16] (Fig. 1). Its occurrence in largely forested regions had not yet been reported for São Paulo, as records were concentrated in the west of the state where only fragments remain, but it has been found in forests in southern Amazonia[34]. Use of anthropogenic areas by the species was already reported[13], but it seems to be more regular in south-east Brazil.

Only two contemporary localities where the species has been detected over a few consecutive days are available: Rubinéia and Peruíbe (Fig. 1, Table 1). At the former, one stayed c.12 days in the region, whilst at the latter we observed another over an interval of four days, always in the same tree.

This work updates distributional data of *M. cinereus* in the state of São Paulo, but a broader review of the entire geographic distribution of this species in South America is needed, based on historical and current data sources, so that its area of occurrence can be updated and possible seasonal shifts, if they do occur, can be better understood. The migration of many bird species in

South America is still poorly known and the need for modern studies, employing tracking technology, is clear[17,18].

Acknowledgements

We are grateful to the following institutions and people: José Fernando Pacheco and Arthur Bispo for relevant information; Kristof Zyskowski for information concerning, and images of, the specimens at the Peabody Museum, Yale University; T. V. V. Costa, S. R. Posso and A. Gomes for their reviews of the manuscript; and Paulo Rogério for adjusting some of the images.

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Fabio Schunck
Comitê Brasileiro de Registros Ornitológicos, Avenida Eugênio Bartolomai 386, CEP 04785-040, São Paulo, SP, Brazil. E-mail: fabio_schunck@yahoo.com.br.

Fábio Luiz Barata
Mochileiros—Hostel e Observação de Aves, Rua Manoel Raimundo 495, CEP 11750-000, Guaraú, Peruíbe, SP, Brazil. E-mail: pousadamochileiros@gmail.com.

Marco Aurélio Galvão da Silva
Sociedade para a Conservação das Aves do Brasil —Save Brasil, Rua Fernão Dias 219, cj. 2, CEP 05427-010, Pinheiros, São Paulo, SP, Brazil. E-mail: marcosama@gmail.com.