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Review of non-Amazonian records of Blackpoll Warbler *Setophaga striata* in Brazil, including a case of wintering in the largest urban area in South America

by Fabio Schunck & Vagner Cavarzere

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SUMMARY.—Blackpoll Warbler *Setophaga striata* migrates between its breeding grounds in northern North America and non-breeding areas in northern South America, mainly Amazonia, but the presence of apparently small numbers in southern South America suggests the existence of an additional wintering area. We investigated this possibility by reviewing available records, and report a new wintering record in South America's largest conurbation. Data from the literature, online platforms and field observations reveal 44 records over the last 52 years. Records are available from throughout the Atlantic Forest domain of south-east and southern Brazil, at all seasons, but mainly the austral summer and autumn. The concentration of records and permanence of some birds for several months at the same localities indicate a second wintering area for the species in south-east and south Brazil, north-east Argentina and south-east Paraguay.

The Parulidae comprises 18 genera and 110 species, and is widely distributed across the Americas. Almost half of the species are long-distance migrants that breed in North America. Many of these possess a strikingly coloured breeding plumage in North America and a much drabber plumage in the non-breeding season (in South America). Among these long-distance migrants is Blackpoll Warbler *Setophaga striata*. During the breeding season, males have black upperparts with a noticeable malar streak, whilst females are olive-grey with streaked upper- and underparts, plumages that vary according to age and period of migration (Pyle 1997). The species has an extensive breeding range in northern North America, migrating to winter in northern South America, with isolated records in the south of the continent (Paynter 1995). Records in 1958 and 1959 in Misiones, Argentina, led Partridge (1961) to moot the possibility of a wintering region south of the Amazon, a hypothesis supported by DeLuca *et al.* (2020), who suggested that small numbers spend the non-breeding season from south-east Brazil to north-east Argentina and south-east Paraguay. The species has also been recorded in Chile, which is the southernmost occurrence (Landbeck 1864).

In Brazil, Blackpoll Warbler occurs at forest edges and in clearings, as well as areas with sparse trees, including parks and wooded urban areas (Sick 1971, Sigrist 2006). In September–May the species has been detected in the south, south-east, centre-west and north-east of the country, as well as in Amazonia (Paynter 1995, Sick 1997, Bencke 2001, Model *et al.* 2014, Cavarzere *et al.* 2019). However, occurrences in Brazil outside Amazonia are poorly known, with incomplete and confusing information, as partially demonstrated by compilations for the state of São Paulo (Willis & Oniki 2003) and the country as a whole (Somenzari *et al.* 2018). We assembled and evaluated available data on the occurrence of Blackpoll Warbler in Brazil away from Amazonia to test the hypothesis of a southern wintering area. We also report observations of an individual that spent three months in metropolitan São Paulo, the largest conurbation in South America.

Methods

Study area.—The bibliographical review covered the centre-west, north-east, south-east and south of the country, outside Amazonia, including 19 states, plus north-east Argentina and south-east Paraguay, as mentioned by Partridge (1961) and DeLuca *et al.* (2020) as part of a possible second wintering area. Records from Argentina and Paraguay were also compiled because of their proximity to Brazil. Other South American countries were considered outwith this study. Field data were obtained by FS in the state of São Paulo (SP), south-east Brazil, at Praça da Rua Nantes (23°41'35.55"S, 46°42'28.41"W; 760 m) in the residential district of Interlagos in the south of the São Paulo Metropolitan Region, the largest urban area in South America with c.21.5 million inhabitants (IBGE 2020) (Fig. 1).

Secondary data.—These were obtained via searches in scientific articles, books, grey literature and ornithological collections of the Museu de Zoologia da Universidade de São Paulo (MZUSP) and Instituto Adolfo Lutz (IAL) (both of which were visited in person by FS), as well as other museums accessed via the Global Biodiversity Information Facility (GBIF) database (<https://www.gbif.org/>). The online platforms WikiAves (WA; <https://www.wikiaves.com.br>), eBird (ML/S; <https://ebird.org>), Xeno-canto (XC; <https://www.xeno-canto.org>) and iNaturalist (<https://www.inaturalist.org/>) were also consulted (up to 31 December 2021). Records without specific locality were assigned to the central point of their respective municipality. All records were categorised as 'historical' or 'contemporary', the former covering 1969–78 (data from museums and field observations) and the latter since 1980, including records from the literature (field observations) and online platforms. Two locations (in Brazil and Paraguay) mentioned by Paynter (1995) were not located, but are presented based on the map provided in the last-named work.

Field data.—These were collected between 30 November 2020 and 31 January 2021, over a total of 63 days. Observations were made daily from dawn to dusk, as the location is in front of FS's house, during social isolation due to the Sars-CoV-2/covid-19 pandemic. Binoculars, a Canon 7D camera plus 300 mm lens and Marantz PMD66 recorder with a Sennheiser ME66 microphone were used to make and document observations. Resulting files were made available on the online platforms WikiAves, eBird and xeno-canto; see Table 1.

Results

A total of 44 non-Amazonian records of Blackpoll Warbler were obtained in Brazil ($n = 39$), Argentina ($n = 4$) and Paraguay ($n = 1$), with 13 in papers in periodicals, six in books, six in grey literature, 13 on online ornithological platforms and one from field observations by FS. Of the 44 records, 19 possess some type of documentation such as a specimen, photo or sound-recording (Fig. 1; Table 1), as described below.

Literature and ornithological online platforms.—Forty-one records dated between 1969 and 2021 were identified. Of this total, nine were historical (museums and field sightings) and 22 were contemporary (field observations), with 13 on online platforms (WikiAves 11, and eBird four, including records published on both). Five records were available for north-east Argentina ($n = 4$) and south-east Paraguay ($n = 1$) and two records (Brazil and Paraguay) cited by Paynter (1995) lack date information (Fig. 1; Table 1).

Field data.—A Blackpoll Warbler was recorded in Interlagos by FS on 30 November 2020 (late in the austral spring), at 15:45 h on a cloudy day with light rain. The distinctive, constant and relatively loud calls attracted his attention, and he found it c.6 m above ground in a *Jacaranda mimosifolia* tree (Fig. 1; area a). It was a male in non-breeding plumage and after playback (of a similar call), the bird approached to within c.6 m (Fig. 2a; field data



Figure 1. Records of Blackpoll Warbler *Setophaga striata* in Brazil outside the Amazon. Inset of the Americas (upper left): dark beige = the species' breeding range (northern North America); pale beige = passage (eastern North America, the Caribbean and parts of Middle America) and dark beige + hatch is the main non-breeding area, in northern South America including Amazonia (from BirdLife International 2021). South-east and south Brazil are outlined in black and represented by white borders on the main map, with coloured points on this and the inset of metropolitan São Paulo as follows: red = historical records (specimens and field records between 1969 and 1978); blue = contemporary records in the literature (undocumented sight records from the 1980s, 1990s and 2000s); green = contemporary records on online platforms (documented records starting in 2007); and white = author's field record. Asterisks indicate the two localities mentioned by Paynter (1995), but not otherwise traced. Localities A–E are in Argentina and Paraguay. Brazil state acronyms: GO = Goiás (centre-west region); BA = Bahia (north-east); MG = Minas Gerais, ES = Espírito Santo, SP = São Paulo and RJ = Rio de Janeiro (south-east); PR = Paraná, SC = Santa Catarina and RS = Rio Grande do Sul (south). Inset of Interlagos: (a) forested square; (b) *Tipuana* tree and (c) *Caesalpinia* tree. Asterisk indicates the first author's home. Black lines indicate Brazil's borders, grey lines those of other South American countries. Source: Google Earth (© Image Landsat/Copernicus 2020).

available on request from FS). The bird was observed for an hour, when it moved away and continued calling in the distance.

Presumably the same individual (based on plumage and behaviour) stayed at Interlagos for 63 days, between 30 November 2020 and 21 January 2021. It was not detected (even using playback) on just 12 days (ignoring the first day of its final absence), five being alternate (during 5–13 January 2021) and seven of them consecutive (15–21 January 2021). During this period, it preferred to use an area about 1,800 m², circulating between three

TABLE 1

Records of Blackpoll Warbler *Setophaga striata* in Brazil outside Amazonia. Lists of species from eBird are identified by the letter S. References in parentheses indicate that the record was also cited in a second source; seasons refer to those in the Southern Hemisphere. Letters A–E represent records for Argentina and Paraguay on the border with Brazil.

No.	Locality	Coordinates	State	Municipality	Region	Season	Date	Documentation	Observer/collector	Reference/source
1	Santa Teresa	22°54'58.79"S 43°11'30.00"W	RJ	Rio de Janeiro	south-east	summer/ autumn	28/01– 16/05/1969	sight record	H. Sick	Sick (1971)
2	Quinta da Boa Vista	22°54'24.40"S 43°13'27.88"W	RJ	Rio de Janeiro	south-east	autumn	31/03, 18 & 24/04/1969	sight record	H. Sick	Sick (1971)
3	Ilha Comprida	24°44'16.13"S 47°32'28.93"W	SP	Ilha Comprida	south-east	summer	16/03/1969	specimen (MZUSP103277)	H. Misch (later attributed to R. Grantsau)	Sick (1971)
4	Bertioga	23°50'7.98"S 46°07'17.40"W	SP	Bertioga	south-east	summer	28/01/1973	specimen (MZUSP65481)	E. Dente	Willis & Oniki (2003)
5	Campo Escoteiro Geraldo Hugo Nunes	22°34'45"S 43°01'39"W	RJ	Magé	south-east	unstated	during 1975–84	not determined	L. P. Gonzaga	Gonzaga (1986)
6	Cananéia	25°00'48.42"S 47°56'4.25"W	SP	Cananéia	south-east	autumn	22/04/1976	specimen (IAL42957)	E. Dente	Willis & Oniki (1985)
7	Instituto Oceanográfico—base norte	23°29'59.94"S 45°07'7.82"W	SP	Ubatuba	south-east	autumn	until 14/06/1976	sight record	E. O. Willis	Willis & Oniki (2003), Simpson <i>et al.</i> (2012)
8	Mata de Santa Genebra	22°49'22.14"S 47°06'34.14"W	SP	Campinas	south-east	summer	some time between February 1975 and March 1978	sight record	E. O. Willis	Willis (1979)
9	(possibly Estação Ecológica de Jataí)	21°33'14.57"S 47°42'1.90"W	SP	Luís Antônio	south-east	(summer)	unstated	sight record	E. O. Willis	Willis & Oniki (2003)



No.	Locality	Coordinates	State	Municipality	Region	Season	Date	Documentation	Observer/collector	Reference/source
10	Serra dos Órgãos National Park (430 m)	22°29'37.71"S 43°03'55.83"W	RJ	Teresópolis and others	south-east	spring or summer (unstated)	during 1980–81	sight record	unstated	Scott & Brooke (1985)
11	Clube Círculo Militar	22°52'44.54"S 47°05'5.04"W	SP	Campinas	south-east	summer	18/03/1990	sight record	F. C. T. de Lima & A. Aleixo	Lima & Aleixo (2000)
12	Fazenda Bela Vista	20°53'S 48°10'W	SP	Pontal	south-east	spring	20/11/1991	sight record	J. F. Pacheco	Willis & Oniki (2003)
13	Novo Hamburgo	29°43'20.22"S 51°08'1.07"W	RS	Novo Hamburgo	south	summer	during 1991–92	sight record	T. A. Parker	Bencke (2001)
14	Fazenda Marco Chama (PE Cerrado)	24°10'30"S 49°33'44"W	PR	Sengés	south	unstated	during 1994–99	unstated	E. Carrano & C. F. Ribas	Carrano & Ribas (2000)
15	Parque Estadual Ilha do Cardoso	25°8'18.10"S 47°57'51.59"W	SP	Cananéia	south-east	unstated	unstated	unstated	unstated (possibly P. Martuscelli)	São Paulo (1995–2001)
16	unstated	19°01'26.63"S 40°01'23.09"W	ES	unstated	south-east	unstated	unstated	unstated	unstated	Paynter (1995)
17	Parque Estadual de Jacupiranga (now Mosaico de Unidades de Conservação de Jacupiranga)	24°52'19.97"S 48°21'6.00"W	SP	Barra do Turvo	south-east	unstated	unstated	unstated	unstated (possibly P. Martuscelli)	IF (1996)
18	Parque Estadual Jurupará	23°57'4.83"S 47°17'51.31"W	SP	Ibitúna	south-east	unstated	unstated	unstated	unstated (possibly P. Martuscelli)	IF (1996)
19	Região Serrana (Fazenda Pindobas IV)	20°19'S 41°17'W	ES	Conceição do Castelo	south-east	summer	24/02/1998	sight record	C. Bauer <i>et al.</i>	Bauer (1999), Bauer <i>et al.</i> (2000)



No.	Locality	Coordinates	State	Municipality	Region	Season	Date	Documentation	Observer/collector	Reference/source
20	Parque Nacional do Iguaçu	25°26.7'83"S 53°48'19.19"W	PR	unstated	south	unstated	unstated	unstated	unstated	Straube & Urben-Filho (2004)
21	Jardim Europa	25°01'53.30"S 47°54'44.37"W	SP	Ilha Comprida	south-east	summer	08/02/2006	sight record	G. M. Kirwan	<i>Cotinga</i> 26: 92
22	Reserva Ecológica de Guapiaçu (REGUA)	22°27'03.4"S 42°46'15.4"W	RJ	Cachoeiras de Macacu	south-east	summer	20/02/2008	photo (WA310100)	L. Pimentel	WikiAves
23	Quinta da Boa Vista	22°54'24.40"S 43°13'27.88"W	RJ	Rio de Janeiro	south-east	summer	19/03/2008	photo (WA11238)	G. Serpa	WikiAves
24	Parque Tarquínio Joslin dos Santos	24°58'19.58"S 53°27'44.51"W	PR	Cascavél	south	autumn	April and May 2008	sight record	K. J. Model <i>et al.</i>	Model <i>et al.</i> (2008)
25	Reserva Ecológica de Guapiaçu (REGUA)	22°27'03.4"S 42°46'15.4"W	RJ	Cachoeiras de Macacu	south-east	spring	03/12/2011	photo (ML107570151)	E. Defonso	eBird (S47214128)
26	Distrito Federal	15°47'S 47°55'W	DF	Brasília Distrito Federal	centre-west	unstated	unstated	sight record	R. B. Cavalcanti & J. C. da Silva	Cavalcanti & Silva (2011)
27	SQS 114 or 115	15°47'42.83"S 47°52'57.26"W	DF	Brasília Distrito Federal	centre-west	autumn	21/04/2012	photo (WA892942)	M. Monteiro	WikiAves
28	Rural area	23°32'39.93"S 46°13'01.13"W	SP	Mogi das Cruzes	south-east	autumn	31/03/2013	photo (WA924114)	R. Cardoso	WikiAves
29	Lago da UNIFEI	22°24'41.73"S 45°27'5.18"W	MG	Itajubá	south-east	autumn	16/05/2013	photo (WA963030)	C. Soares	WikiAves
30	Mata do Soldadinho	22°26'21.0"S 47°37'31.0"W	SP	Rio Claro	south-east	autumn	15/06/2014	recording (WA1358214)	C. Gussoni <i>et al.</i>	WikiAves eBird (S24580952)
31	Porto Seguro	16°27'19.30"S 39°03'48.68"W	BA	Porto Seguro	north-east	summer	11/01/2015	photo (WA1592491)	R. Vieira	WikiAves



No.	Locality	Coordinates	State	Municipality	Region	Season	Date	Documentation	Observer/collector	Reference/source
32	Reserva Ecológica dos Petroleiros	22°35'39.26"S 43°25'49.96"W	RJ	Nova Iguaçu	south-east	summer	09/02/2016	photo (WA2695699)	O. Vieira	WikiAves
33	Balneário Piçarras	26°46'3.54"S 48°40'17.13"W	SC	Balneário Piçarras	south	winter	23/06–14/08/2016	photo (WA2166503)	D. Garcia <i>et al.</i> (WikiAves) F. Farias (eBird)	WikiAves eBird (S30951348)
34	Environs of RPPN Toca da Onça	20°23'S 41°28'W	ES	Iúna/Muniz Freire	south-east	unstated	unstated	sight record	unstated	IEMA (2018)
35	Parque São Rafael	23°38'00.2"S 46°27'42.8"W	SP	São Paulo	south-east	spring	09/12/2019	dead bird photo (ML192285661)	'Depave-3'	eBird (S62468657)
36	Serra Bonita	15°23'30"S 39°34'06"W	BA	Camacan and Pau Brasil	north-east	unstated	unstated	sight record	unstated	Cavarzere <i>et al.</i> (2019)
37	Porciúncula	20°58'7.29"S 42°02'27.48"W	RJ	Porciúncula	south-east	autumn	26/03/2020	photo (WA3740021)	T. Lyra	WikiAves
38	Interlagos, Praça da Rua Nantes	23°41'35.4"S 46°42'28.6"W	SP	São Paulo	south-east	spring/ summer	30/11/2020– 30/01/2021	photo (WA4099729) recording (XC621148)	F. Schunck	Wikiaves eBird (S76912132)
39	Estrada Mogi das Cruzes	23°48'37.5"S 46°27'27.3"W	SP	São Bernardo do Campo	south-east	autumn	21–25/03/2021	photo (WA4247584)	A. Ramos <i>et al.</i>	Wikiaves eBird (S83819318)
A	Arroyo Uruguayí	25°53'26.51"S 54°35'9.79"W		Misiones, Argentina		summer	11/01/1958	specimen	W. H. Partridge	Partridge (1961)
B	Tobunas	26°28'42.02"S 53°53'28.95"W		Misiones, Argentina		autumn	31/05/1959	specimen	W. H. Partridge	Partridge (1961)
C	unstated	26°25'51.20"S 56°09'40.89"W		Paraguay		unstated	unstated	unstated	unstated	Paynter (1995)
D	853 Ruta Nacional 14	27°36'08.7"S 55°16'34.7"W		Misiones, Argentina		autumn	25/05/2019	photo (ML258502571)	M. Ruz	eBird (S72913106)
E	PN Iberá-Portal Cambyretá	27°49'24.9"S 56°50'52.6"W		Ituzaingó, Argentina		spring	16/10/2019	sight record	C. Ferrari & S. Vitale	eBird (S61371270)





Figure 2. Plumage development of the Blackpoll Warbler *Setophaga striata* at Interlagos, São Paulo, Brazil: (a) 30 November 2020; (b) 27 December 2020; (c) 23 January 2021 and (d) 30 January 2021 (Fabio Schunck)



Figure 3. Vegetation at Interlagos, São Paulo, Brazil, in the three areas used by the individual Blackpoll Warbler *Setophaga striata*: (a) forested square, (b) *Tipuana* tree and (c) *Caesalpinia* tree (Fabio Schunck)

main sites (a–c) (Fig. 1, Interlagos inset). It spent most time in a large *Tipuana tipu* tree with a crown of $c.350 \text{ m}^2$ (area b; Fig. 3b). It usually moved between sites using intermediate trees, but occasionally made flights of $c.60 \text{ m}$ from area b to area c, or vice versa.

The bird called usually in the early morning and mid to late afternoon, when it was very vocal and always made the same type of short call (XC 621148) even on very hot days ($>30^\circ\text{C}$) or in heavy rain. The bird vocalised before dark from area a (Fig. 3a), where it probably roosted, as the city square has a group of trees where other birds also roost, but this was not confirmed. It responded to playback only on the first three days, after which it did not respond, and was not observed interacting with other species such as Great Kiskadee *Pitangus sulphuratus*, Rufous-bellied Thrush *Turdus rufiventris*, Sayaca Tanager *Tangara sayaca* and Bananaquit *Coereba flaveola*, among other local birds.

The warbler fed on small insects that it captured on tree trunks and leaves, mainly of the *Tipuana*, which has rough bark and cracks on its trunk and main branches where arthropods hide. It caught insects by climbing heavy trunks and perching upside-down from leaves (ML 346801461). Six times it was observed taking small insects (probably Diptera), both on trees (near flowers) and distant from them, as well as near a lamp post, including during fast and efficient sallies in flight. It foraged at a mean height of 6 m, but also captured insects up to 12 m above ground in the canopy, and near the ground

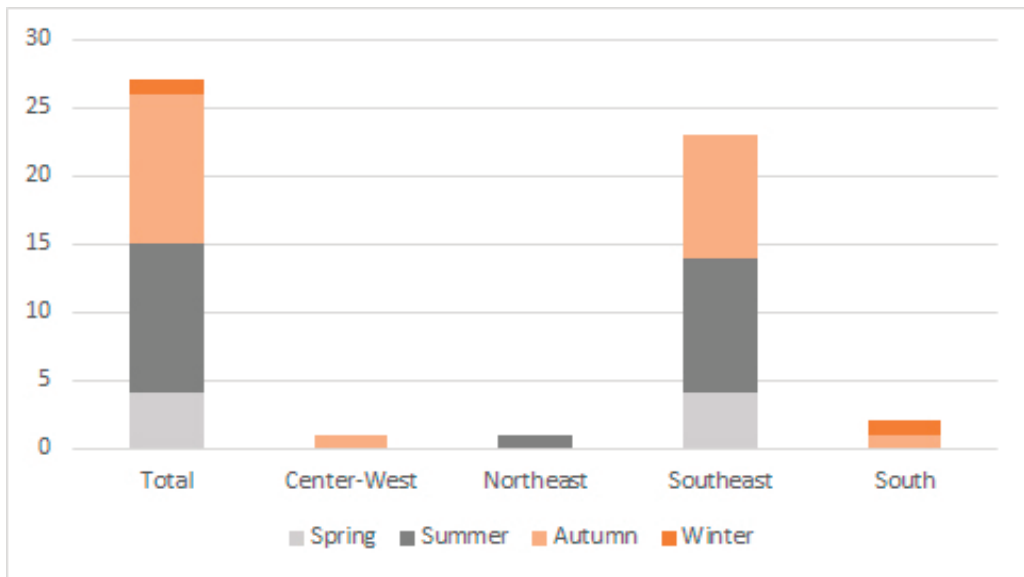


Figure 4. Graph showing the seasonality of Blackpoll Warbler *Setophaga striata* records by Brazilian region covered by this study.

(ML 346798621/931; videos ML 380884031/4041). The bird was very active, being observed preening or otherwise resting for a few minutes only five times during the 25 days with sightings (video ML 380913941), usually on rainy days.

A gradual change from the more discreet and basic winter plumage to the more colourful and contrasting pre-breeding plumage occurred during the bird's stay. Black streaks gradually appeared on the upperparts, flanks and head, whilst the vent became paler, the black malar better delimited and thicker, and the face whitish (Fig. 2).

The bird seemed indifferent to the threats posed by the urban environment, such as constant traffic (including a truck that became stuck by the *Tipuana*, requiring use of a chainsaw to remove some of its branches to get free), loud noises (including a New Year's Eve fireworks display) and the presence of predators, both natural (e.g., a pair of Tropical Screech Owls *Megascops choliba*) and non-natural (e.g., domestic cats).

Location and seasonality of records.—The 39 records cover the four non-Amazonian regions of Brazil, i.e. the south-east ($n = 29$), south ($n = 5$), centre-west ($n = 2$) and north-east ($n = 2$), and eight states (Bahia [BA], Minas Gerais [MG], Espírito Santo [ES], São Paulo [SP], Rio de Janeiro [RJ], Paraná [PR], Santa Catarina [SC] and Rio Grande do Sul [RS]), the Federal District [DF], 26 municipalities (given only one per location) and 37 localities. Among the records are 12 in the coastal plain and 27 in the interior, including the plateau and mountains. Just six municipalities and the Federal District had more than one record on different dates, three of which (Rio de Janeiro, Bertioga and Campinas) involved historical and contemporary records. The four records in Argentina are from Misiones province in the north-east of the country and that in Paraguay is in the south-east (Fig. 1; Table 1).

More or less dated records ($n = 26$) include ten for the austral autumn (20 March–21 June), ten in summer (21 December–20 March), three in spring (22 September and 21 December) and one in winter (21 June–22 September). Two others spanned the seasons: one in summer and autumn (28 January–16 May 1969; Sick 1971) in Santa Teresa, Rio de Janeiro city (south-east Brazil), and one in spring and summer (30 November 2020–30 January 2021) at Interlagos, São Paulo (also south-east Brazil). The only winter record (23 June–14 August

2016) was at Balneário Piçarras, SC (south Brazil). Records for Argentina were in spring ($n = 1$), summer ($n = 1$) and autumn ($n = 2$) (Figs. 1 and 4; Table 1).

Plumage.—Three types were detected among 17 records documented by specimen(s) and/or photo(s): non-breeding ($n = 9$, 53% in September–March, or spring and summer in southern South America), mixed (in the transition between non-breeding and breeding; $n = 1$, 6%) and breeding ($n = 7$, 41% in April–August, or autumn and winter in southern South America) with two cases of plumage transition from winter to pre-breeding, of which just one was published (Sick 1971). The three records in Argentina involved two in breeding plumage in summer and autumn (Partridge 1961; ML 258502571) and one in non-breeding plumage in spring (eBird, S61371270).

Discussion

The total number of non-Amazonian records of Blackpoll Warbler in Brazil over the last 52 years ($n = 39$) is quantitatively and qualitatively greater than indicated by Somenzari *et al.* (2018) and DeLuca *et al.* (2020). The difference is mainly due to the variety of data sources analysed (papers, books, grey literature and field data), especially information available on online platforms, which provided 33% of all data and 56% of contemporary data, demonstrating the importance of birdwatching for producing field data and its ability to fill gaps in ornithological knowledge (Gura 2013).

The data show that the occurrence of Blackpoll Warbler outside the Brazilian Amazon is not limited to summer and autumn, as suggested by Willis & Oniki (2003) and Somenzari *et al.* (2018) but is much broader. The species is present as early as 20 November, in late spring (15%, $n = 4$), with a considerable increase during summer and autumn, the main period of its presence (41%, $n = 11$ records for both seasons), with only one winter record (4%) involving an individual that did not return to North America to breed. These data confirm its categorisation as a boreal winter migrant in Brazil (Somenzari *et al.* 2018). However, the relative number of undated records (32%, $n = 14$), mainly in the grey literature, preclude more accurate assessment of the seasonality of its regional occurrence. This demonstrates the importance of publishing complete field data, whether for resident or migratory birds.

Non-Amazonian records of Blackpoll Warbler are from all other regions of Brazil, but most are in the south-east (77%, $n = 30$), mainly in São Paulo (43%, $n = 17$) and Rio de Janeiro states (23%, $n = 9$). Records in the centre-west ($n = 2$), north-east ($n = 2$) and south ($n = 5$), plus four records in north-east Argentina and one in south-east Paraguay relatively close to south-east and south Brazil, represent a widely spaced suite of localities (Fig. 1). The preponderance of records in the south-east and south may be associated with these areas being among the best-studied ornithologically in Brazil (e.g., Scherer-Neto & Straube 1995, Rosário 1996, Sick 1997, Willis & Oniki 2003, Bencke *et al.* 2010, Simon 2019) with the largest number of active observers and photographers (as indicated by records on eBird and WikiAves). However, with increasing numbers of observers across the country, the number of records in the south-east and south may indicate a true concentration. The data show records focused on two blocks of Atlantic Forest. The first and main block (with 31 records) is in eastern Brazil between southern Bahia and Santa Catarina, centred on the states of São Paulo and Rio de Janeiro. The second (with eight records) lies on the border between Brazil, Argentina and Paraguay, and includes Misiones (Fig. 1). Just as Amazonia is the species' main wintering area, the Atlantic Forest may represent a second, southerly, non-breeding region for smaller numbers, as hypothesised by Partridge (1961) and DeLuca *et al.* (2020). This region includes the Atlantic coast of south-east and south Brazil, its plateau and mountains, north-east Argentina and south-east Paraguay (Fig. 1).

The occurrence of Blackpoll Warbler south of the Amazon has long been known (Partridge 1961), but the apparent increase in records in the last decade might suggest another hypothesis other than increased detectability by researchers and birdwatchers. It may indicate a change in the migratory behaviour of some birds, perhaps due to climate change, which has been observed for other long-distance migrants elsewhere in the world (e.g., Coppack *et al.* 2003, Huntley *et al.* 2006, Zurell *et al.* 2018). Data for this species in South America (mainly historical and little known) need expansion into a database to assist future investigations into various issues, including the possible influence of climate change.

There are many cities in the Atlantic Forest biome of south-east and south Brazil, including São Paulo and Rio de Janeiro, which are the largest in the country. It is unsurprising, therefore, that urban occurrences of Blackpoll Warbler (33%, $n = 13$) exist, as already noted by Sick (1971) in reporting the first record in Brazil outside Amazonia, near his house in Santa Teresa, RJ, where it was present for five months. He also noted the bird's preference for specific plants (*Tamarindus indica*), its insectivorous preferences (including Diptera), change in plumage from March (contrasting black-and-white pattern) and constant singing in April as its return to North America approached. Sick also mentioned the presence of three other Blackpoll Warblers at the same site, including a female, and others in the Quinta da Boa Vista, 5 km from Santa Teresa, which also fed in tamarinds. Another was at the latter locality in March 2008 (WA11238; Maciel 2009). There have been just three records involving birds observed for certain periods since. Willis & Oniki (2003) reported that a bird was seen until 14 June 1976 in Ubatuba, SP, but provided no further details. An adult male in breeding plumage was watched throughout the austral winter, between 23 June and 14 August 2016, at Balneário Piçarras, SC (WA 2166503). The adult male at Interlagos, SP, in 2020–21 showed similar behaviour to that described by Sick (1971). This record was the second for São Paulo city, the first being one in December 2019 (ML 192285661) which died (ML 192285691) due to unknown trauma—a risk associated with urban environments. These records show that urban areas in south-east and south Brazil are used by Blackpoll Warbler and other migrants from North America (hawks, shorebirds, ducks, swallows) and so their green areas need to be protected and expanded.

Data show a dominance of non-breeding plumage in November–March and pre-breeding or breeding plumage from April. However, one seen in November at Pontal, SP, had mixed plumage (J. F. Pacheco *in litt.* 2021) and some in early February already had varying amounts of breeding plumage. Permanence of birds in urban areas has permitted the gradual change in plumage to be recorded (Fig. 2), information which is scarce in South America.

Increasing reports of wintering Blackpoll Warblers *c.*2,500 km south of the Amazon are perhaps reflective largely of more birders, better technology and reporting mechanisms (e.g., WikiAves, eBird) and that part of the species' global population seems to have specialised (or is becoming specialised) at making longer trips. A second wintering area, even if small, can be advantageous for the species' conservation, given that the Atlantic Forest has many natural reserves and currently low rates of deforestation (Bencke *et al.* 2006, Fonseca *et al.* 2021, MapBiomias 2022), whereas Amazonia is presently suffering extensive deforestation and fires. The possible existence of a second wintering area for Blackpoll Warbler could enable studies on the birds' geographic origin, frequency of occurrence and faithfulness to this region.

Regional reviews of historical and current avian data that include behavioural and ecology information are still much needed in South America, especially for migratory species. Such reviews permit little-known publications to be re-evaluated, their original data made more available, and can prevent erroneous repetition in the literature. In turn,

they can support broader reviews of geographic distributions and migratory routes, thereby underpinning conservation.

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Extra data

Records of the Blackpoll Warbler *Setophaga striata* at Interlagos, São Paulo, Brazil. Data by Fabio Schunck.

Date	Period	Behavior/record type	Documentation
30/11/2020	15:45	feeding/observation	Image
01/12/2020	09:00	feeding/observation	Image/vocalisation recording
02/12/2020	09:30/14:10/17:10	feeding/observation	Image
03/12/2020	07:45	feeding/observation	Image
04/12/2020	05:55	vocalisation	
05/12/2020	05:40	vocalisation	
06/12/2020	05:50-06:30/14:00-16:30	feeding/observation	
07/12/2020	05:40	vocalisation	
08/12/2020	09:30	feeding/observation	image
09/12/2020	07:35	feeding/observation	
10/12/2020	08:18/11:00	vocalisation	
11/12/2020	07:00	vocalisation	
12/12/2020	11:30	feeding/observation	filming
13/12/2020	10:10	vocalisation	
14/12/2020	15:00	vocalisation	
15/12/2020	15:32	feeding/observation	filming
16/12/2020	16:45	feeding/observation	image/filming
17/12/2020	05:52/16:40	vocalisation	
18/12/2020	09:30/17:48	vocalisation	
19/12/2020	09:00/14:10	vocalisation/observation	
20/12/2020	07:00	vocalisation	
21/12/2020	08:00/16:13	observation	
22/12/2020	6:00-10:30	feeding/observation	image
23/12/2020	17:46	vocalisation	
24/12/2020	10:00	vocalisation	
25/12/2020	09:30/17:00	vocalisation/observation	
26/12/2020	11:45	vocalisation/observation	vocalisation recording
27/12/2020	06:00/09:45/11:18/15:30	feeding/observation	image/vocalisation recording/filming
28/12/2020	06:00-10:25/14:22-15:00	vocalisation/observation	
29/12/2020	09:30/11:00/15:00	vocalisation/observation	
30/12/2020	09:00	vocalisation	
31/12/2020	09:00 e 14:00 e 16:30	vocalisation	
01/01/2021	08:00 e 9:00 e 10:00	vocalisation/observation	image/filming
02/01/2021	07:00	vocalisation	
03/01/2021	10:30 e 14:35	vocalisation	image/vocalisation recording/filming
04/01/2021	07:00 e 10:00	vocalisation	
05/01/2021	along the day	no activity	
06/01/2021	7:30 e 10:00 e 17:55	vocalisation	
07/01/2021	along the day	no activity	

08/01/2021	along the day	no activity	
09/01/2021	10:40	vocalisation	
10/01/2021	along the day	no activity	
11/01/2021	17:20	vocalisation	
12/01/2021	08:46	vocalisation	
13/01/2021	along the day	no activity	
14/01/2021	10:00	vocalisation	
15-21/01/2021	along the day	no activity	
22/01/2021	10:10 e 11:40	vocalisation/observation	vocalisation recording
23/01/2021	10:15 até 11:00	vocalisation/observation	image/filming
24/01/2021	09:40-12:22	vocalisation/observation	vocalisation recording
25/01/2021	08:10-8:40/10:30/14:43/17:52	vocalisation/observation	image/vocalisation recording
26/01/2021	07:32/9:33/11:49/17:51	vocalisation/observation	
27/01/2021	05:55/16:10	vocalisation	
28/01/2021	05:55	vocalisation	
29/01/2021	17:14	vocalisation/observation	image
30/01/2021	13:30	vocalisation/observation	image/filming
31/01/2021	along the day	no activity	
after that date	over the days	no activity	
