

**DETERMINING THE WINTERING RANGE OF BROAD-WINGED HAWK (*BUTEO PLATYPTERUS*) IN SOUTH AMERICA USING CITIZEN-SCIENCE DATABASE**Jonas Claudiomar Kilpp^{1,2} · Paula Cruz^{3,4} · María Eugenia Iezzi^{3,4} · Diego Varela^{3,4} · Ulises Balza⁵

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Abstract · Several species of raptors that breed in North America migrate to the southern hemisphere during the non-breeding period. The Broad-winged Hawk (*Buteo platypterus*) is one of them, and its wintering distribution reaches the north and central part of South America, although there are published records for the species in Argentina and southern Brazil. We did an exhaustive search of records of the Broad-winged Hawk for South America, using bibliography, citizen-science initiatives, personal communications, and own records. We obtained 4025 georeferenced records for the 1879–2017 period. Both the numbers of records per year and the geographical range of the species have apparently increased in recent years. We also obtained the first record for Misiones province in Argentina and for Espírito Santo state, in Brazil. The wintering range of this species is estimated to cover 12.5 million km² of the north central part of South America, including southern Brazil and northern Argentina. While it is possible that the range has expanded 700 km southwards recently, with the data available it is not possible to disentangle this possibility from changes in the distribution of bird observers.

Resumen · Determinando el rango invernal del Aguilucho Alas Anchas (*Buteo platypterus*) en Sudamérica involucrando datos de ciencia ciudadana

Varias especies de aves rapaces se reproducen en América del Norte y migran durante los meses de invierno al hemisferio sur. Uno de ellos, el Aguilucho Alas Anchas (*Buteo platypterus*), alcanza normalmente el norte y centro de Sudamérica, aunque se han publicado registros en Argentina y en el sur de Brasil. Realizamos una búsqueda exhaustiva de registros del Aguilucho Alas Anchas para Sudamérica, en la literatura científica, en proyectos de ciencia ciudadana, comunicaciones personales y registros propios, obteniendo un total de 4025 registros georreferenciados para el período 1879–2017. Tanto el número de registros por año como el rango geográfico de la especie han aumentado en los últimos años. También reportamos el primer registro para la provincia de Misiones en Argentina y para el estado de Espírito Santo en Brasil. La zona de invernada actual de esta especie cubriría aproximadamente 12,5 millones de km² de la porción central-norte de Sudamérica, incluyendo el sur de Brasil y el norte de Argentina. Si bien es posible que la especie se haya expandido unos 700 km hacia el sur en tiempos recientes, no es posible diferenciar esta posibilidad de cambios en la distribución de observadores de aves.

Key words: eBird · Global Biodiversity Information Facility · Migration · Raptor · Wintering areas

INTRODUCTION

Bird migration is a key process with the potential to affect population dynamics, partly because it constitutes a critical period with high mortality rates (Klaassen et al. 2014). For this reason, understanding the location of wintering areas as well as their spatial and temporal changes is important for the conservation of migratory birds. There are four complete migratory species of diurnal birds of prey in the Neotropics, defined as having > 90 % of their population migrate to the southern hemisphere during the Boreal winter (Bildstein 2004). One of these species is the Broad-winged Hawk (*Buteo platypterus*), a long-distance migrant raptor that breeds in North America and migrates to Central America and the northern and central part of South America during the Austral summer, with some vagrant individuals overwintering in the Florida Keys and Caribbean (Haines et al. 2003, Bildstein 2004, Juhant 2012). It enters South America from the northwest through the Mesoamerican corridor (Bildstein & Saborio 2000), and it remains in the wintering grounds between October and March, with the southern limit suggested to be located in northern Bolivia and the eastern limit to correspond with the city of Manaus, Brazil (Ferguson-Lees &

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Figure 1. First record of the Broad-winged Hawk (*Buteo platypterus*) for Misiones province, Argentina, in Iguazú National Park on 27 January 2014. Image from camera-trap.

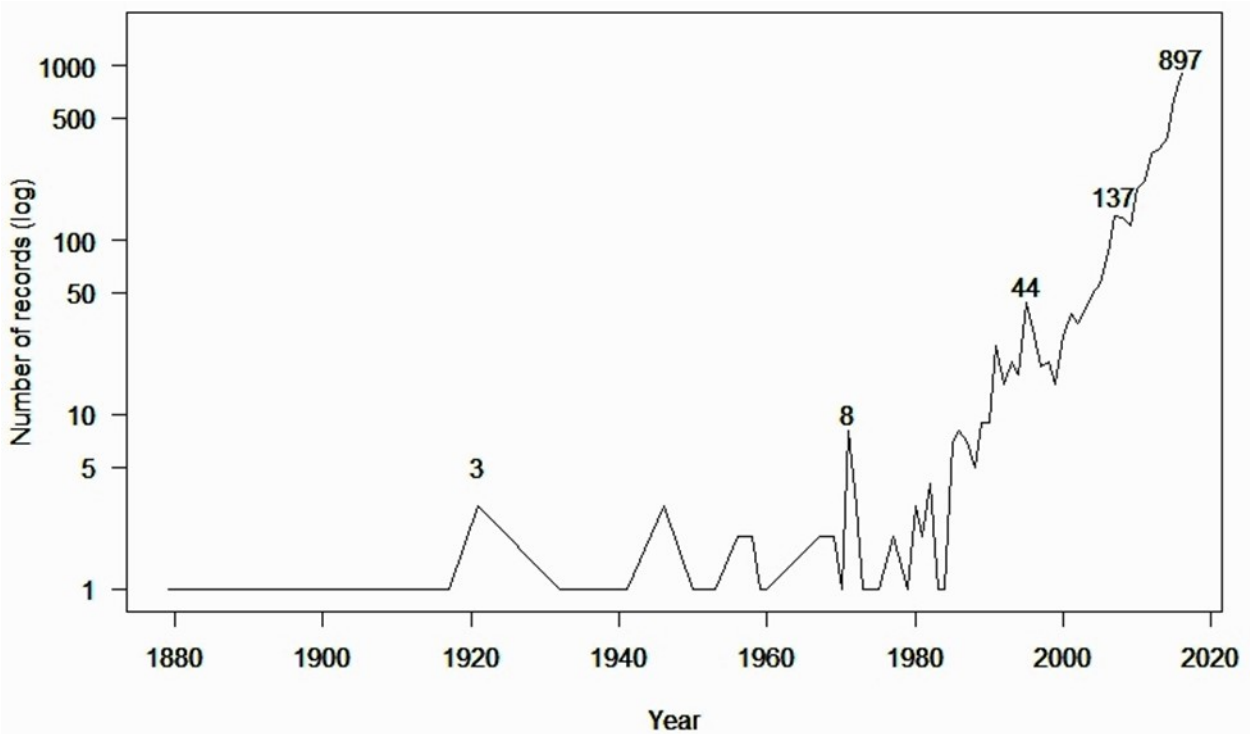


Figure 2. Changes over time in the number of records of Broad-winged Hawks (*Buteo platypterus*) in South America.

Christie 2001). However, more recent records indicate that it reaches as far south as northwestern Argentina (Roesler & Mazar Barnett 2004) and southern Brazil (Meller & Bencke 2012).

The global population of the Broad-winged Hawk is apparently increasing (Hoffman & Smith 2003, Birdlife International 2016), although some studies show declines, particularly in eastern populations (Bednarz et al. 1990, Farmer et

Table 1. Summary of unpublished records (not available online) of the Broad-winged Hawk (*Buteo platypterus*) in Argentina, Brazil, and French Guiana. New province or state records are in bold.

Date	Site/city	Province/State	Country	Coordinates	Age
1 Feb 2013	Calilegua National Park	Jujuy	Argentina	23°70'S, 64°87'W	Adult
4 Feb 2013	Calilegua National Park	Jujuy	Argentina	23°70'S, 64°87'W	Adult
27 Jan 2014	Iguazú National Park	Misiones	Argentina	25°52'S, 54°13'W	Adult
9 Nov 2015	Eco-Portal de Piedra Reserve	Jujuy	Argentina	24°09'S, 64°40'W	Adult
12 Jan 2016	Los Molinos Dam	Jujuy	Argentina	24°15'S, 65°37'W	Juvenile
12 Nov 2016	Calilegua National Park	Jujuy	Argentina	23°70'S, 64°87'W	Juvenile
21 Jan 2007	INPA, Manaus	Amazonas	Brazil	03°09'S, 59°58'W	Juvenile
18 Nov 2007	Manaus	Amazonas	Brazil	03°09'S, 59°97'W	Adult
27 Dec 2008	Presidente Figueiredo	Amazonas	Brazil	02°00'S, 59°54'W	Juvenile
11 Jan 2011	Pacaraima	Roraima	Brazil	04°45'N, 61°13'W	Juvenile
24 Oct 2011	Humaitá	Amazonas	Brazil	07°82'S, 63°18'W	Adult
9 Nov 2011	Manaus	Amazonas	Brazil	02°91'S, 60°03'W	Juvenile
18 Dec 2011	Iranduba	Amazonas	Brazil	03°16'S, 60°25'W	Juvenile
28 Jan 2012	Manaus	Amazonas	Brazil	03°09'S, 59°58'W	Adult
11 Mar 2012	Presidente Figueiredo	Amazonas	Brazil	01°92'S, 59°46'W	Juvenile
4 Nov 2012	Manaus	Amazonas	Brazil	03°05'S, 59°97'W	Adult
14 Nov 2012	Caracaraí	Roraima	Brazil	01°09'N, 60°41'W	Adult
2 Dec 2012	Manaus	Amazonas	Brazil	03°10'S, 60°00'W	Juvenile
18 Dec 2012	Macaé	Rio de Janeiro	Brazil	22°28'S, 41°73'W	Juvenile
25 Oct 2013	Careiro	Amazonas	Brazil	03°89'S, 60°44'W	Juvenile
6 Nov 2013	Ferreira Gomes	Amapá	Brazil	00°85'N, 51°87'W	Adult
30 Nov 2013	Foz do Iguaçu	Paraná	Brazil	25°62'S, 54°47'W	Juvenile
3 Mar 2014	Manaus	Amazonas	Brazil	03°00'S, 59°98'W	Juvenile
25 Nov 2014	Paranaíta	Mato Grosso	Brazil	09°40'S, 56°74'W	Indeterminate
29 Nov 2014	Manaus	Amazonas	Brazil	02°81'S, 60°48'W	Adult
23 Dec 2014	Presidente Figueiredo	Amazonas	Brazil	01°92'S, 59°46'W	Adult
18 Jan 2015	Itamonte	Minas Gerais	Brazil	22°35'S, 44°79'W	Indeterminate
22 Oct 2015	Porto Velho	Rondônia	Brazil	08°80'S, 63°98'W	Adult
21 Mar 2015	Manaus	Amazonas	Brazil	03°00'S, 59°93'W	Juvenile
27 Feb 2016	Vargem Alta	Espírito Santo	Brazil	20°67'S, 41°01'W	Adult
9 Jan 2017	Porto Velho	Rondônia	Brazil	08°76'S, 63°95'W	Adult
21 Feb 2012	Saint Georges de l'Oiapock	Camopi	French Guiana	03°89'N, 51°82'W	Adult

al. 2008, Smith et al. 2008). A consequence of an increase in the population could be the expansion of the wintering areas quarters simply because the more individuals, the more variability is expected in migratory strategies and especially if competition for resources in the wintering areas is important.

Given that nearly 20 years have elapsed since the first records of the species in Argentina and southern Brazil, our aim is to investigate whether these southern records refer to vagrants or instead represent a regular occurrence.

METHODS

To analyze changes in number and distribution of records of the Broad-winged Hawk in South America, we searched for all records of the species in South America and separated them into two periods: 1879–1999 (defined as 'historical

records') and 2000–2017 (thereafter 'current records'). We performed the data separation in two periods, using as cut-off the year of the first record of the species in Argentina (2000). The records were obtained from the Global Biodiversity Information Facility database (GBIF 2017), which for most birds species consists mostly of eBird records (Wood et al. 2011), WikiAves (WikiAves 2018), and by carrying out a bibliographical search, using "*Buteo platypterus*" and "Broad-winged Hawk" as key words in Google Scholar. We do not consider the number of individuals recorded in each case since in some databases this information was not available. We also report new unpublished records for Argentina, Brazil, and French Guiana, which were all obtained through direct observation, except for one (from Iguazú National Park, Argentina) made by a camera trap (Figure 1, Table 1). All records were obtained opportunistically, as searching for this species was never the objective of the fieldwork. We

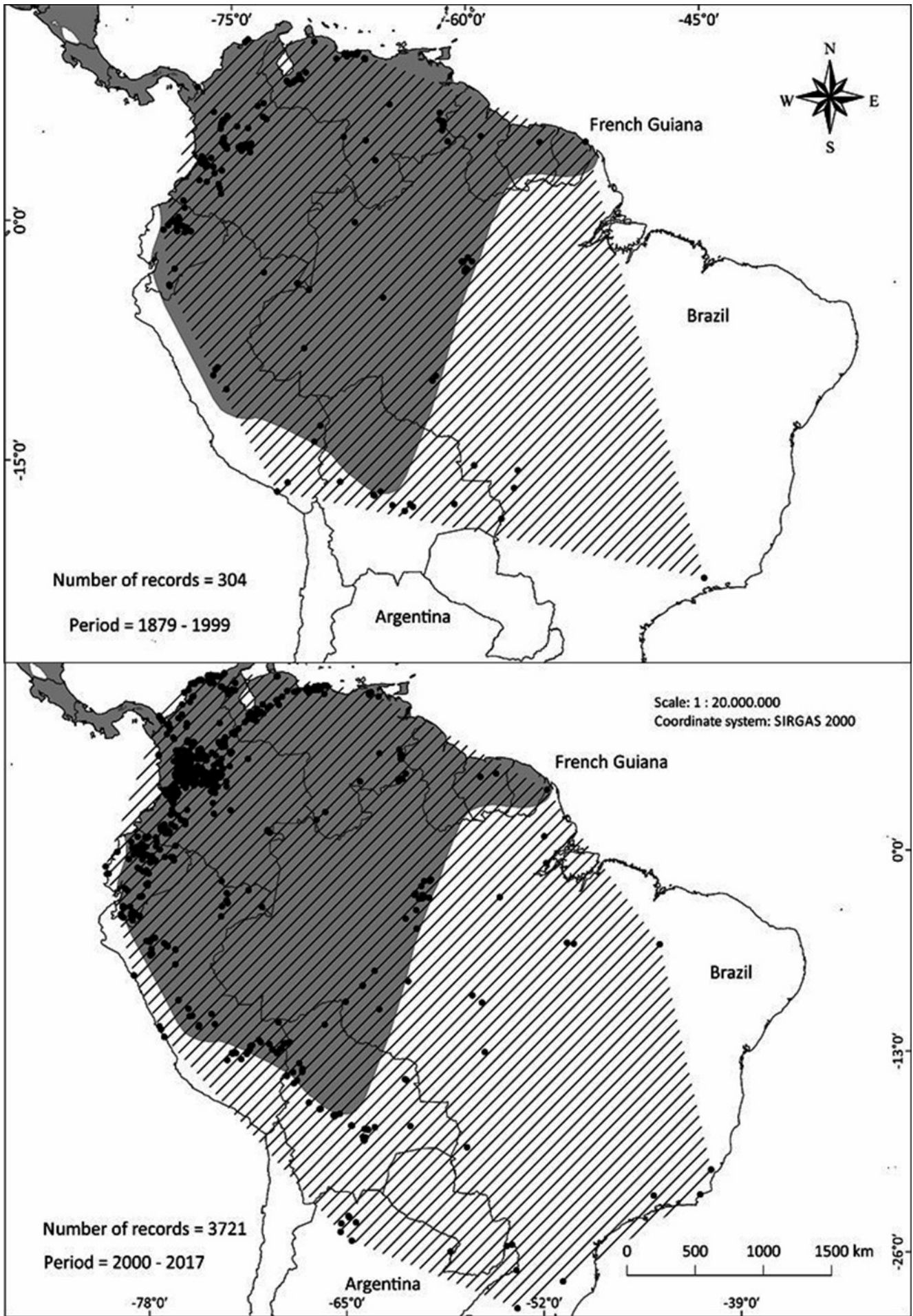


Figure 3. Records of the Broad-winged Hawk (*Buteo platypterus*) for South America during the two periods studied. Black dots represents individual records from all sources; striped area represents minimum convex polygons (MCP) for each time, and light-gray area corresponds with all the wintering range of the species following Birdlife International (2016). MCP values are 9.65 and 12.55 million km², respectively.

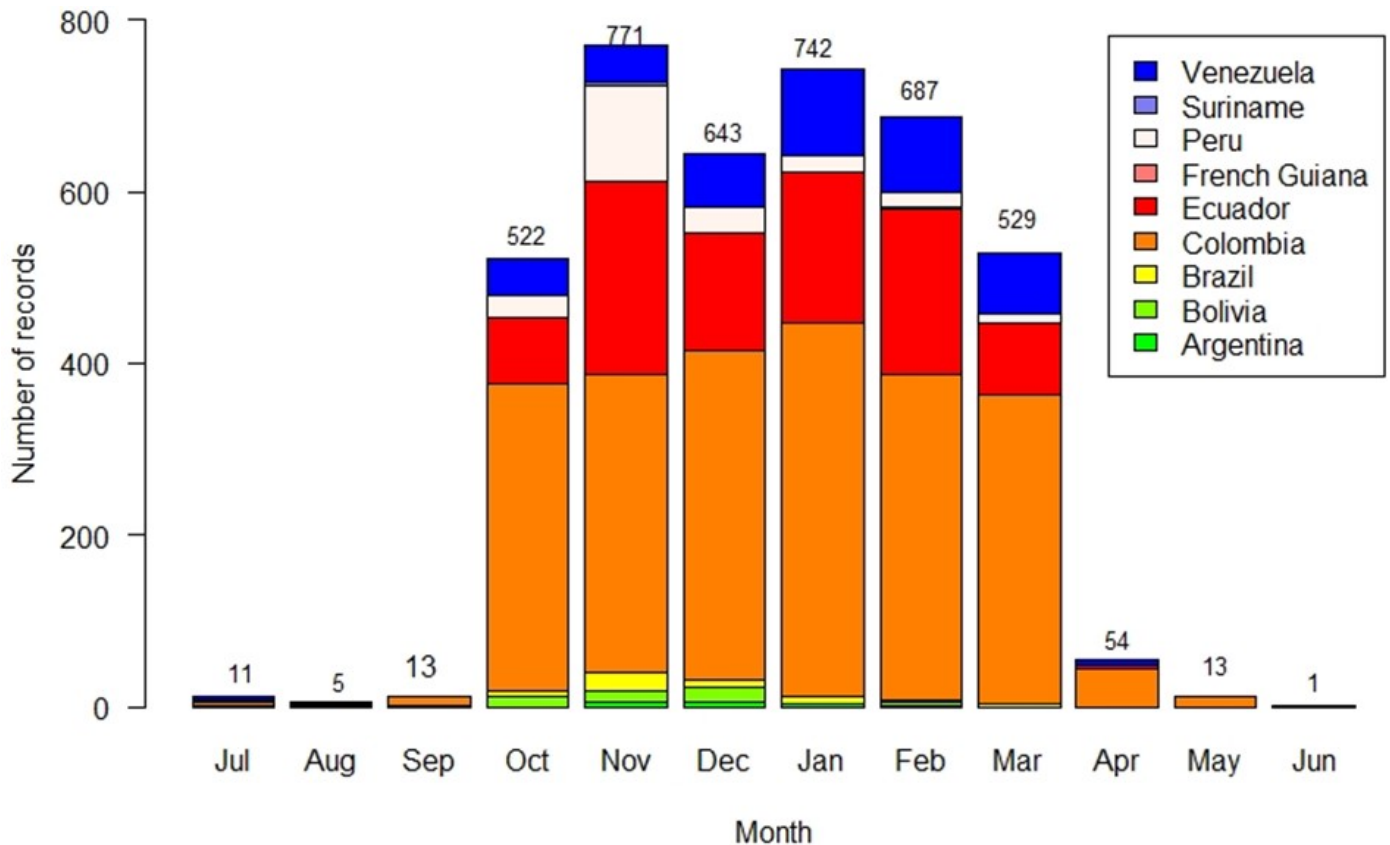


Figure 4. Monthly records by country of Broad-winged Hawks (*Buteo platypterus*) in South America. Of the total records ($n = 4025$), 34 do not appear here because only the year of the sighting was made available.

checked that no new records were duplicated in the GBIF database because different observers may have included the same record in different repositories. We used minimum convex polygons (MCP) in QGIS 2.18 software to assess the total area contained by the records for each period (wintering range) in South America.

RESULTS

We obtained 4025 georeferenced records for the Broad-winged Hawk in South America ($12^{\circ}27''N$ to $29^{\circ}41''S$) during the 1879–2017 period. We excluded Cauca river valley records (Colorado et al. 2006) because they were not specified by date, which prevented assessing multiple registrations. Most of the records of Broad-winged Hawks that we found correspond to forests in the Andean region (93.3%), but there were 179 observations (4.3 %) in the Pacific (Peru, Ecuador, and Colombia) and Caribbean coasts (Colombia and Venezuela), and 177 records (4.4%) in the savannas and lowlands of the Amazon basin (Klavins et al. 2012, Meller & Bencke 2012). Although 98.5% of the all records were obtained from the GBIF database, only 34% of the records from Brazil ($n = 25$) and 45% of the records from Argentina ($n = 9$) were from this source. The rest of the records were obtained either from the new records presented in this work, or from previously published literature. The bibliographical records for Brazil were compiled through the year 2010 by Meller & Bencke (2012), and we also found records in Valente et al. (2011). New records for the south of Brazil were added by Willrich & Joenck (in prep.). For Argentina, we found records from the northwest (Roesler & Mazar Barnett 2004) and the Chaco region (Klavins et al. 2012). We also found one published record from Guyana (Robbins et al.

2004), and Thiollay (2007) mentions eight non-geo-referenced records for French Guiana, not included in this study due to the lack of coordinates. During the first 110 years of data, no more than eight records per year have been found, but in the 1990s and early 2000s there has been a progressive increase, with a maximum number of 84 individuals in 2006. Since the year 2007, there have been at least 122 records per year, with a peak of 897 records found in 2016 (Figure 2).

We obtained 32 new records (i.e., neither published nor included in a digital repository) in South America, including the first one for Misiones province (Atlantic Forest ecoregion) in Argentina and for the state of Espírito Santo (Brazil). We also obtained a new georeferenced record for French Guiana (Table 1).

Since 1999, the area covered by wintering records of the Broad-winged Hawk in South America has increased 24.2% (Figure 3), now encompassing almost all north and central South America (ca. 12.55 million km^2). Records from Brazil occurred from middle October to middle March, with higher frequency during November and December, while records from Argentina ranged from November to early February (Table 1). Considering total South America, the highest number of records occurred in November ($n = 771$), followed by January ($n = 742$) and February ($n = 687$) (Figure 4).

DISCUSSION

Both the numbers of records and the area covered for the Broad-winged Hawk in South America have grown in the last two decades. However, it is difficult to determine if this is a consequence of an increase in birdwatching-tourism effort over time (Pivatto & Sabino 2007, Puhakka et al. 2011), an

actual increment of the population size, an expansion of the wintering area (e.g., independently of population size changes), or effects of all these factors combined. Nevertheless, these results help to clarify the range used by this species during the wintering season in South America. Its wintering distribution seems to cover the north-central portion of the subcontinent, from Venezuela to northern Argentina, except for Chile and northeastern Brazil. There are no published records from Paraguay as far as we know (Hayes 1995), but given the entire scenario, the presence of the species is expected in this country.

Although more studies are necessary on migratory raptors to evaluate changes in spatial and habitat use, citizen-science records have proved useful to study these patterns in the Neotropics (Lees & Martin 2014). Similar to the Broad-winged Hawk, an increase of wintering records has also been reported for the Osprey (*Pandion haliaetus*) in Argentina (Saggese et al. 2014).

More information is required to establish the status of this species in South America and its movement during the Austral summer. However, with almost 20 years since its first discovery in northern Argentina, it seems unlikely that the presence of the Broad-winged Hawk in Argentina and southern Brazil is the result of vagrancy, and instead it appears as if the species is regular in the area. However, an expansion of the range cannot be tested properly with the data presented.

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