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New records and a review of the distribution of the Arctic Tern *Sterna paradisaea* Pontoppidan, 1763 (Aves: Sternidae) in Brazil

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Abstract: We report new records of the Arctic Tern *Sterna paradisaea* Pontoppidan, 1763 for the coast of Rio Grande do Sul, southernmost Brazil. Birds were in first alternate plumage, apparently overwintering in the region. A literature and museum review revealed the existence of 21 localities with records of this species in Brazil. Ten specimens were obtained in the country, attributable to eight localities. Records from five other localities were documented with band recoveries or photographs. We were able to clarify information from one of the undocumented records, while the remaining requires further investigation and/or documentation. Our review and new information on migration routes confirm that the Arctic Tern in Brazil is a regular, seasonal visitor from the northern hemisphere. We also suggest that waters off south Brazil may be used by overwintering individuals, especially during the austral winter.

The Arctic Tern *Sterna paradisaea* Pontoppidan, 1763 is a champion migrant, breeding mostly in Arctic and Subarctic regions of North America and Eurasia and spending the boreal winter in the pack ice zone of Antarctica (Burger and Gochfeld 1996; Hatch 2002). This tern is pelagic on the non-breeding grounds, ranging from open sea to pack ice (Burger and Gochfeld 1996; Hatch 2002). Transients are widespread, as well as inland records (Hatch 2002).

In Brazil, the Arctic Tern is known from a few records from the states of Ceará, Bahia, Rio de Janeiro, São Paulo, Santa Catarina and Rio Grande do Sul (Saunders and Salvin 1896; Pinto 1964; Sick 1997; Lima *et al*. 2004; Girão *et al*. 2008). Sightings and band recoveries long suggested that waters off Brazil were used by part of the population breeding in the North Atlantic during the southbound migration (Hatch 2002), a pattern recently confirmed with the use of geolocators (Egevang *et al*. 2010).

In this contribution we present new records of the Arctic Tern for south Brazil and review records of the species for the country. We also review the status of occurrence of the species for Brazil and Rio Grande do Sul in the light of our new information and recently published data on migration routes.

Our new records were obtained fortuitously during birding expeditions carried out in the littoral of Rio Grande do Sul in 2010. Records in the literature were reviewed by searching all databases in ISI Web of Knowledge, SCOPUS and Google Scholar up to December 2011 using '*Sterna paradisaea*', 'Arctic Tern', 'Brazil' and 'Rio Grande do Sul' as keywords. We also reviewed books on seabirds and bird migration in Brazil. Specimen records were obtained by using online search engines of museum collections and/or consulting curators or staff. The following collections were reviewed: Museu de Ciências Naturais (MCN) da Fundação Zoobotânica do Rio Grande do Sul, Porto Alegre, Brazil; Museu de Ciências e Tecnologia da Pontifícia Universidade Católica do Rio Grande do Sul (MCP), Porto Alegre, Brazil; Coleção de Aves da Universidade Federal do Rio Grande (CAFURG), Rio Grande, Brazil; Museu Oceanográfico Univali (MOVI), Universidade do Vale do Itajaí, Balneário Piçarras, Brazil; Museu de Zoologia, Universidade de São Paulo (MZUSP), São Paulo, Brazil; Rolf Grantsau private collection (CRG), São Paulo, Brazil; Museu Nacional (MN), Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil; American Museum of Natural History (AMNH), New York, USA; National Museum of Natural History (USNM), Washington, DC, USA; Field Museum of Natural History (FMNH), Chicago, USA; Academy of Natural Sciences (ANSP), Philadelphia, USA; Museum of Comparative Zoology (MCZ), Harvard University, Boston, USA; Louisiana State University Museum of Natural Science (LSUMZ); Baton Rouge, USA; Natural History Museum (BMNH), Tring, UK; Forschungsinstitut Senckenbergischen Naturforschenden Gesellschaft (FNG), Frankfurt am Main, Frankfurt, Germany; Museum National d'Histoire Naturelle (MNHN), Paris, France.

We followed the terminology in Humphrey and Parkes (1959) to describe plumage sequences. Due to the lack of adequate descriptions and proper identification criteria

enabling safe diagnosis of Arctic Terns in basic and first alternate plumages in the southern hemisphere, we relied on a series of field guides and general reference works as well as expert opinion to substantiate our new records. Geographical coordinates were obtained from original sources or Paynter-Jr and Traylor-Jr (1991).

On the morning of 12 July 2010 at the border of Tramandaí and Cidreira municipalities (approximately 30°05'51" S, 50°10'16" W), Rio Grande do Sul, C.E.A. and A.B.S. observed and photographed (Figures 1-3) two Arctic Terns on a sandy oceanic beach. Another individual was observed by these authors two days earlier at 30°04'27" S, 50°09'45" W, Tramandaí municipality, Rio Grande do Sul. On both occasions birds were resting on the upper swash zone with some South American Terns *Sterna hirundinacea* Lesson, 1831 and Cabot's Terns *Thalasseus acuflavidus* (Cabot, 1847). Arctic Terns showed no signs of exhaustion, although one individual (Figure 1) displayed what appeared to be a healed injury on the left leg.

Figure 1. Arctic Tern *Sterna paradisaea* Pontoppidan, 1763 in first alternate plumage recorded on the border of Cidreira and Tramandaí municipalities, Rio Grande do Sul, Brazil, on 12 July 2010. Note the small size (compared to the South American Terns *Sterna hirundinacea* Lesson, 1831 in the foreground), diagnostic short tarsi, short bill, rounded head, dark eye-ring, dark brownish red legs, dark lesser-covert bar, and characteristic dark outer web of the outermost tail streamer, which extends beyond the closed primaries. Photograph by C.E. Agne.

On the basis of plumage pattern and time of the year, all individuals were in first alternate plumage, attributable to the '*portlandica*' phase (Olsen and Larsson 1995; Hatch 2002). Primaries showed no trace of worn and rectrices extended to wing-tip. Birds were identified by their small size (compared with the South American Tern), diagnostic short tarsi, slim and narrow dark bill, dark brownish red legs, dark eye-ring, dark lesser-covert bar, narrow dark line along the rear edge of the primaries, and dark outer webs of the outermost tail streamers, which extend beyond the closed primaries (Watson 1975; Olsen and Larsson 1995; Burger and Gochfeld 1996; Hatch 2002; A. Jaramillo, J. Kvarnback and P. Thomas, *in litt.* 2011). According to these authors, the above-mentioned features distinguish the species from three similar terns: the South American Tern, abundant in south Brazil during the austral winter (Vooren and Chiaradia 1990; Bugoni and Vooren 2005; Costa and Sander 2008; Petersen and Petry 2011); the Common Tern *Sterna hirundo* Linnaeus, 1758, abundant in south Brazil during the austral summer (Vooren and Chiaradia 1990; Bugoni and Vooren 2005; Costa and Sander 2008; Petersen and Petry 2011); and the Antarctic Tern *Sterna vittata* Gmelin, 1789, recorded only twice in Brazil (Sick 1997).

Including our new information, there are 21 localities with records of the Arctic Tern in Brazil (Table 1). A total of ten specimens were obtained in the country, attributable to eight localities in the states of Bahia, São Paulo, Santa Catarina and Rio Grande do Sul. Three records from Bahia, Rio de Janeiro and Santa Catarina refer to band recoveries. Two sightings in two localities were documented with photographs.

Figure 2. Another individual of the Arctic Tern *Sterna paradisaea* Pontoppidan, 1763 in first alternate plumage recorded on the border of Cidreira and Tramandaí municipalities, Rio Grande do Sul, Brazil, on 12 July 2010. Note the small size (compared to the South American Terns *Sterna hirundinacea* Lesson, 1831 in the background), diagnostic short tarsi, short bill, dark brownish red legs, and dark lesser-covert bar. Photograph by C.E. Agne.

There is no documentation to substantiate records from seven localities: a Bahia count (Nascimento 2001), observations off the southeastern and southern coast (Olmos and Bugoni 2006), records from Ubatuba, Bertioga and Peruíbe, in São Paulo (Willis and Oniki 2003), and two reports from Rio Grande do Sul (Sick 1984, 1997; Costa and Sander 2008). We were able to clarify the information in Olmos and Bugoni (2006) (see the 'Remarks' column in Table 1), while the remaining require further investigation and/or documentation.

Three of these undocumented records may be errors. We could not find details or locate specimens attributable to the mentions: 'obtained in Rio Grande do Sul (… March)' in Sick (1984; 1997), and the 'Ubatuba, cidade' and 'Cidade de Praia, Peruíbe' museum records in Willis and Oniki (2003). The March record for Rio Grande do Sul is particularly intriguing because it was not included in the seminal publications of Belton (1984; 1994), who worked in close association with H. Sick. The Peruíbe record in Willis and Oniki (2003) may be attributable to the 'Itanhaém, Praia Grande' skin housed at the Museu de Zoologia, USP. We believe this may be the case because there is no specimen from Peruíbe, whereas the Itanhaém bird, known from the literature since Pinto (1964), was strangely omitted in Willis and Oniki (2003). Since Peruíbe, Itanhaém and Praia Grande are all located in the

same stretch of beach on the coast of São Paulo, the source of this confusion may be toponymical.

Another intriguing record in our compilation refers to the observation of nearly 500 birds in Jandaíra, Bahia, during a Neotropical Waterbird Census (Nascimento 2001). Although Bahia holds many records and flocks of Arctic Terns are known to come ashore in the region (Table 1; see below), a large concentration of this pelagic species on a tropical beach in February as reported in Nascimento (2001) is very unlikely and disagrees entirely with the migratory timing of the species (see Egevang *et al*. 2010). Considering that this observation was made by volunteers in a time when good field guides were seldom available in Brazil, it is probable that the record suffers from identification and extrapolation problems inherent in bird censusing programs. Such hypothesis is supported by Lima *et al*. (2004; 2005), who state that the Arctic Tern does not mix with other tern species resting overnight on sand banks in Bahia, being recorded solely during seabird mortality events. The flock of 15 birds observed

Table 1. Summary of records of the Arctic Tern *Sterna paradisaea* Pontoppidan, 1763 in Brazil. Our own comments are given in parenthesis in the 'Remarks' column. The catalogue number of specimens is given in brackets. CE – Ceará; BA – Bahia; RJ – Rio de Janeiro; SP – São Paulo; PR – Paraná; SC – Santa Catarina; RS – Rio Grande do Sul; MCNC – CETREL collection, Camaçari, Brazil; CRG – Rolf Grantsau private collection, São Paulo, Brazil; MN – Museu Nacional, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil; BMNH – Natural History Museum, Tring, UK; MZUSP – Museu de Zoologia, Universidade de São Paulo, São Paulo, Brazil; FNG – Forschungsinstitut Senckenbergischen Naturforschenden Gesellschaft, Frankfurt am Main, Germany; USNM – National Museum of Natural History, Washington, DC, USA.

LOCALITY	STATE	GEOGRAPHICAL COORDINATES	DATE	REMARKS	REFERENCES
Porto de Pecém	CE	03°32' S, 38°48' W	Oct 2006	A weakened bird photographed resting on the beach and captured by hand	Girão *et al*. (2008)
Jandaíra (Mangue Seco)	BA	11°27' S, 37°20' W	Feb 1995	482 birds counted during a Neotropical Waterbird Census (probably an error, details and documentation needed; see main text for further comments)	Nascimento (2001)
Mangue Seco	BA	11°27' S, 37°27' W	Aug 1993; Aug 1995	Two birds collected after mortality event [MCNC 14; CRG 9547]	Lima *et al*. (2004); R.K.H. Grantsau *in litt*. (2012)
Salvador	BA	12°59' S, 38°31' W	Jul 1994	One bird collected after mortality event [CRG 9513]	Lima *et al*. (2004); R.K.H. Grantsau *in litt*. (2012)
Macaúbas	BA	13°00' S, 42°41' W	May 1977	Banded in Aug 1974 as a chick in Greenland; inland record	Olmos (2002)
Foz do Rio Una, Valença	BA	?	Oct 1983	(Flock of 15 birds resting near mangroves; two collected [MN 34331; MN 34332])	G.R.R. Brito *in litt*. (2012)
Off the coast of Bahia	BA?	?	?	(One collected [BMNH 1894.10.28.6])	Saunders and Salvin (1896); R. Prys-Jones *in litt*. (2012)
Rio de Janeiro State	RJ	?	Mar 1960	Banded in Jul 1957 as a chick in USA; (map suggests that this is an inland record)	Sick (1997); Lara-Resende and Leal (1982); Olmos (2002)
Continental shelf and slope (200-1500 m depth) off RJ/SP	RJ;SP	?	May 1997	(Two individuals observed from a bottom longline vessel; no pictures taken, but translucent primary edges observed)	Olmos and Bugoni (2006); F. Olmos *in litt*. (2012)
Ubatuba	SP	23°26' S, 45°04' W	?	(No details; see main text for further comments)	Willis and Oniki (2003)
Bertioga	SP	23°51' S, 46°09' W	Sep 1984	Observed by E.O. Willis (no further details)	Willis and Oniki (2003)
Itanhaém, Praia Grande	SP	24°11' S, 46°47' W	Aug 1954	(One collected [MZUSP 36657])	Pinto (1964); L.F. Silveira *in litt*. (2012)
Cidade de Praia, Peruíbe	SP	?	?	(No details; could refer to the Itanhaém record above; see main text for further comments)	Willis and Oniki (2003)
Iguape	SP	24°43' S, 47°33' W	Jul 1969	(One collected [MZUSP 70510])	Willis and Oniki (2003); L.F. Silveira *in litt*. (2012)
São Francisco do Sul	SC	26°14' S, 48°39' W	Sep 1912	(One juvenile collected [FNG 15477]; 'vom Dampfer erl.' on the original label)	
Northern Santa Catarina	SC	?	Nov 1966	Banded in Jul 1950 as a chick in Canada	Sick (1997); Lara-Resende and Leal (1982); Olmos (2002)
Rio Grande do Sul	RS	?	Mar	(No details; apparently an error; see main text for further comments)	Sick (1984; 1997)
"Northern coast of Rio Grande do Sul"	RS	?	Spring 2002	One bird observed (details on identification not given)	Costa and Sander (2008)
N of Tramandaí	RS	29°58' S, 50°06' W	Dec 1972	One bird collected with partially healed wound in wing [USNM 525977]	Belton (1974; 1994)

on the littoral of Bahia in October and documented with specimens confirms that at least occasionally groups of Arctic Terns do come ashore to rest in the region. Even if it had not been documented with specimens, this record would still be more plausible than that of the Jandaíra report because it involves a smaller number of birds and is in accordance with the migratory schedule of this species.

The Arctic Tern is considered uncommon in Brazil (Sick 1997). Although our review seems to support this situation, it is likely that the population of this pelagic tern has been largely underestimated in the country. Recently unraveled migration routes (Egevang *et al*. 2010) and observations of Arctic Terns and unidentified *Sterna* spp. (which potentially include this species) off the southeastern-southern coast (Saunders and Salvin 1896; Neves *et al*. 2006; Olmos and Bugoni 2006) indicate that an important portion of the population of the northern Atlantic uses waters off Brazil during migration. Under this scenario, scant Brazilian records are better perceived as a biased sample from this larger population that regularly passes through the western portion of the central and southern Atlantic, than an indicator of genuine rarity. This hypothesis is supported by the fact that at least eight records from the Brazilian coast and mainland refer to exhausted, injured and/or young birds, which were probably disorientated during migration and cast ashore or inland.

Figure 3. The same individual depicted in Figure 2 in flight. Note the diagnostic short tarsi, dark brownish red legs, dark lesser-covert bar, diagnostic narrow dark line along the rear edge of the primaries, and characteristic dark outer web of the outermost tail streamer. The other birds are Cabot's Terns *Thalasseus acuflavidus* (Cabot, 1847). Photograph by C.E. Agne.

Our new records and a June record for Uruguay (Escalante 1995) further indicate that birds cast ashore in the southeastern Atlantic may also be overwintering individuals. Since many non-breeding Arctic Terns remain in low latitudes during their first year (Hatch 2002), it is reasonable to assume that waters off south Brazil are used by overwintering individuals, especially during the austral winter, when climatic conditions in and around Antarctica deteriorate.

Despite the paucity of published records, the status of 'visitor from the northern hemisphere' has been attributed for the Arctic Tern in Brazil (CBRO 2011) and Rio Grande do Sul (Belton 1994). Our review and data on migration routes in Egevang *et al*. (2010) confirm this status and demonstrate that this species regularly migrates off all Brazilian coastal states, especially south of Rio Grande do Norte.

As mentioned above, at least four similar-looking tern species (*i.e.*, South American, Common, Arctic and Antarctic) may be found in southern South America during the austral winter in basic or first alternate plumage. Thus, we recommend careful attention in the field and proper documentation of records in order to distinguish these species and improve the identification of field marks. We also emphasize the necessity of at-sea studies and tracking of young birds to improve our knowledge on the use of the southern Atlantic by these species, especially during the austral winter.

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