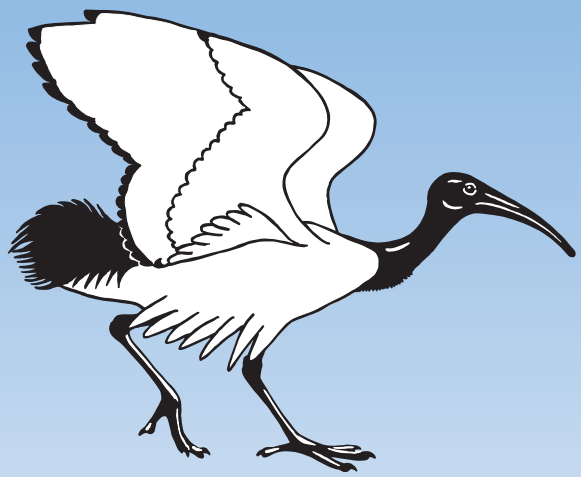
Bulletin of the British Ornithologists' Club



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CLUB ANNOUNCEMENTS

The 1015th meeting of the Club was held in the upstairs room at the Barley Mow, 104 Horseferry Road, London, SW1P 2EE, on 26 May 2025. Seven people were present: Mr H. van Grouw (*Speaker*), Mr A. Jackson, Mr M. Jennings, Dr A. Richford, Mr D. G. D. Russell, Mr Gehan de Silva Wijeyeratne and Mr C. W. R. Storey (*Chairman*).

Hein van Grouw, Senior Curator of Birds at the Natural History Museum, Tring, gave a presentation entitled *The Founding Feathers of the Barbary Dove Streptopelia risoria*, based on his long and deep knowledge of both pigeons and hybridisation. Linnaeus wrote about this bird, '*nobis communis Turtur*' (our common Turtle Dove), because it was commonly kept in Europe. However, despite being common, the Barbary Dove has confused ornithologists, its origin and history having been a long-standing mystery. Although recent DNA work has now proved otherwise, some still consider the Barbary Dove and Eurasian Collared Dove *Streptopelia decaocto* to be the same species. As a domesticated bird, Barbary Dove has a worldwide distribution, and feral populations can flourish in appropriate habitat. Eurasian Collared Dove now also occurs in many parts of the world due to its natural expansive drift, partly with some human help. Where the two species meet, they can hybridise, further confusing the picture. During his insightful talk, Hein discussed the Barbary Dove's true ancestry and considered its impact on current Eurasian Collared Dove populations. Hein's talk is now freely available online via the British Ornithologists' Club YouTube channel available at https://www.youtube.com/watch?v=Irk4ULJhfbM.

The 1,016th meeting of the Club was held in conjunction with the Linnean Society of London at their premises on Thursday 23 October 2025.

Dr Richard Broughton, Centre for Ecology and Hydrology, Wallingford, spoke on *A Quietening of the Woods: the Decline of Woodland Birds*. Richard has been studying woodland birds, in particular the closely related Marsh Tit *Poecile palustris* and Willow Tit *P. montanus*, for more than 25 years, and recently produced an acclaimed monograph on these two tit species. He explained how an array of woodland birds has been declining in Britain over recent decades, with Marsh and Willow Tits especially heavily affected, declining by 80% and 96%, respectively, since the late 1960s. The causes of these declines are complex and seem to vary at least in part between different species. Both *Poecile* tits are subordinate species but also hoard food, a trait that formerly gave them a competitive advantage over the more dominant, ecologically similar Great Tit *Parus major* and Blue Tit *Cyanistes caeruleus* during periods of food shortage. However, these dominant species have benefitted over recent decades from the surge in human provision of bird feeders, and their populations have increased greatly. A detailed long-term study of Marsh Tits by Richard at his Monks Wood, Oxford, study site shows that problems with juvenile survival and recruitment seem to be driving this species' local decline there. Willow Tit, unusually among tits, excavates its own nest hole, from which they are increasingly then excluded by the dominant species, and this seems likely to be at least one factor underlying the species' decline. Overall, the talk was highly stimulating and thought-provoking, as evidenced by the large number of audience comments and queries that Richard received subsequently.

The 1017th meeting of the Club was held in the upstairs room at the Barley Mow, 104 Horseferry Road, London SW1P 2EE, on 10 November 2025. Seventeen people were present: Mr M. Andrews, Mr J. Beaufoy, Mr P. Belman, Mr N. Bucknell, Mr S. Chapman, Ms A. Datta, Mr R. Heaton, Mr A. Jackson, Mr R. Langley, Dr R. Prŷs-Jones, Mr D. G. D. Russell, Mr L. Schrager, Ms C. Slater, Mr C. A. Slater (*Speaker*), Mr G. de Silva Wijeyeratne, Mr C. W. R. Storey (*Chairman*) and Mr S. Thompson.

Clive Slater spoke on *John Henry Gurney: a Passion for Birds*. Clive is lead author on the biography of the same title that has just been published by John Beaufoy Publishing in association with the BOC. J. H. Gurney Snr. (1819–90) grew up in a wealthy Quaker Norfolk banking family and from an early age developed a

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passion for bird collecting and study. Made a partner in Gurneys' Bank at the early age of 21, he was elected an MP in 1854, but during this time was expanding his bird work from local studies to, in 1853, a quest to collect specimens of every bird of prey species worldwide and to display them in the Norwich Museum. He gradually assembled a huge network of individuals who supplied him with specimens, including a wide range of southern African birds, which he studied closely and on which he published profusely. This bird collection and research continued despite him suffering catastrophic events in both his personal life, when his wife eloped with her groom in 1859, and in his professional life, when the bankruptcy of a bank of which he was a director precipitated a national banking crisis in 1866. By the end of his life, he had produced an extraordinary 500 publications, many illustrated by high-calibre artists who he patronised, such as Joseph Wolf, and which gained him an international reputation as an authority on birds of prey and southern African ornithology. Despite a strong emphasis on Gurney's ornithology, Clive nevertheless managed to touch on all these aspects of an extraordinary life, focusing in particular on an array of individuals with whom Gurney interacted closely, not least his ornithologically inclined son, John Henry Gurney Jnr.

Prior to Clive's talk, the Chairman introduced Sam Thompson, the Club's first CASE student (https://www.case.org). The Club is a project partner and financial supporter for a new Ph.D. studentship at the University of Oxford. Sam Thompson will be supervised by Dr Steve Portugal (a BOC trustee) and his research will be carried out at the Edward Grey Institute of Field Ornithology, at the University of Oxford. See https://boc-online.org for details of this research.

The Annual Report and Accounts for 2024 as approved by the trustees of the BOC CIO and submitted to the Charity Commission were noted without further comment.

Corrigenda: at the 1,014th meeting of the Club on 24 March 2024, Ms Ş. Mustafa and Ms R. Peisley attended and were erroneously registered as Mr.

Erratum: Flood *et al*. 2022. The dark-morph Herald Petrel *Pterodroma heraldica*. *Bull. Brit. Orn. Cl.* 142: 354–365

In 1997, two specimens labelled *Pterodroma arminjoniana heraldica* at the American Museum of Natural History, New York (AMNH) were measured and identified as dark-morph Herald Petrel *Pterodroma heraldica* by V. Bretagnolle: AMNH 191656, collected on Vanavana (Tuamotu) on 23 June 1922, and AMNH 191658, collected on Tenarunga (Gambier, Acteon group) on 13 June 1922. Photographs showing the underside of the two individuals with closed wings were shown in Flood *et al*. (2022) as Figs. 7A–B. Nowadays, the split of Herald Petrel into two species is widely accepted—Herald Petrel *P. heraldica* and Henderson Petrel *P. atrata*—despite their strong resemblance to each other. However, dark-morph Herald Petrel has diagnostic white 'tongues' basally in the inner webs of the underside of the primaries (Flood *et al*. 2022). Following a more recent reassessment of AMNH 191656 and AMNH 191658, we found that both lack the diagnostic white underwing patches. As a result, we now consider the two specimens to be Henderson Petrels and will advise the curators at AMNH accordingly.

Friends of the BOC

The BOC has since 2017 become an online organisation without a paying membership, but instead one that aspires to a supportive network of Friends who share its vision of ornithology—see: http://boc-online.org/. Anyone wishing to become a Friend of the BOC and support its development should pay UK£25.00 by standing order or online payment to the BOC bank account:

Barclays Bank, 16 High Street, Holt, NR25 6BQ, Norfolk
Sort Code: 20-45-45
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Account name: The British Ornithologists' Club

Friends receive regular updates about Club events and are also eligible for discounts on the Club's Occasional Publications. It would assist our Treasurer, Richard Malin (e-mail: rmalin21@gmail.com), if you would kindly inform him if you intend becoming a Friend of the BOC.

The *Bulletin* and other BOC publications

Since volume 137 (2017), the *Bulletin* of the BOC has been an online journal, published quarterly, that is available to all readers without charge. Furthermore, it does not levy any publication charges (including for colour plates) on authors of papers and has a median publication time from receipt to publication of

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five to six months. Prospective authors are invited to contact the *Bulletin* editor, Guy Kirwan (GMKirwan@aol.com), to discuss future submissions or look at http://boc-online.org/bulletin/bulletin-contributions. Back numbers up to volume 136 (2016) are available via the Biodiversity Heritage Library website: www.biodiversitylibrary.org/bibliography/46639#/summary; vols. 132–136 are also available on the BOC website: http://boc-online.org/

BOC Occasional Publications are available from the BOC Office or online at info@boc-online.org. Future BOC-published checklists will be available from NHBS and as advised on the BOC website. As its online repository, the BOC uses the British Library Online Archive (in accordance with IZCN 1999, Art. 8.5.3.1).

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Additional records of the extinct Carolina Parakeet *Conuropsis carolinensis*

by Benjamin E. Leese, Alexander L. Bond, Flavia A. Montaño-Centellas, Melissa D. Starking & Kevin R. Burgio

Received 3 February 2025; revised 15 July 2025; published 3 December 2025

http://zoobank.org/urn:lsid:zoobank.org:pub:2E952828-86F3-4DE2-B68C-C4751DE91CAB

Summary.—The Carolina Parakeet *Conuropsis carolinensis* was the only psittacid endemic to the south-eastern and central USA and probably went extinct in the 1940s. Much of the research on this species would be impossible without the painstaking work of Daniel McKinley, who scoured historical texts to identify hundreds of credible Carolina Parakeet observations, which were subsequently georeferenced into a publicly accessible database. We combed the historical record to expand the database of observations of the species. Here, we present 131 newly compiled records and an additional 81 newly georeferenced records of the historical occurrence of Carolina Parakeet, bringing the known total to 555 records and 508 specimens that can be located to at least the county level between 1564 and 1944. We also discuss biases in the data, particularly the temporal and spatial biases of observers that might influence attempts to reconstruct its range and hypothesised migration.

Carolina Parakeet *Conuropsis carolinensis* was once found throughout the south-eastern and central USA. Differences in colour and distribution suggest that there were two subspecies: *C. c. carolinensis* east of the Appalachian Mountains in the south-east USA, and *C. c. ludovicianus* west of the Appalachian Mountains and in the Mississippi River valley (Burgio *et al*. 2017). However, after J. J. Audubon noted a decrease that started around the turn of the 19th century (Audubon 1842), this once wide-ranging species declined rapidly and by the 1890s comprised only small, isolated populations (Bendire 1895). While the main driver of their extinction is unclear, *C. c. ludovicianus* probably went extinct in the 1910s, whilst *C. c. carolinensis* likely became extinct in the 1940s (Burgio *et al*. 2022).

Much of what we know about Carolina Parakeet can be attributed to Daniel McKinley, who, over a *c*.30-year period, wrote 14 exhaustive state-by-state summaries of the species' records (e.g., McKinley 1960, 1988). Burgio *et al*. (2018) summarised all of McKinley's work and combined it with specimen data from 39 museums, resulting in a dataset of 460 specimens and 401 observations for the years 1564–1944. Geographical data were based on reference to historical maps and publications. Burgio *et al*. (2018) also provided estimates of the reliability of each georeferenced record, and Burgio *et al*. (2017) used the same data to create the most accurate map of the species' distribution and possible migrations. Finally, Burgio *et al*. (2022) used that dataset to estimate extinction dates for the two subspecies. Along with the additional data we present here, these observations may help shed new light on the roles that habitat loss, persecution and disease could have played in the species' extinction.

Methods

Literature search.—We used Google Books (https://books.google.com/; last accessed July 2025), the Internet Archive (https://archive.org/; July 2025) and JStor (https://www.jstor.org/; July 2025) to search for historical literature. We also accessed the databases of

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state historical societies in the parakeet's former range (see Table 1). To do so, we used various alternate spellings of 'parakeets' to locate records (including paroquets, paraquets, paroqueets, etc.). We also used other phrases to narrow the search, such as the names of states within the parakeet's range, the names of major rivers, and other relevant terms (Table 2). We further attempted to identify more precise localities for observations noted by McKinley (e.g., McKinley 1977b,c, 1985, Leese 2020, 2023) but which were not georeferenced by Burgio *et al*. (2018).

Additionally, we compared McKinley's full body of work with Burgio *et al*.'s (2018) dataset. We found some omissions, including the information from McKinley's (1988) paper on the species in Louisiana. We also identified a few minor errors, which we corrected and report here with the newly identified observations from our literature search.

TABLE 1
Historical databases consulted.

Location	**Databases**
Alabama	Alabama Historical Association https://www.alabamahistory.net/ Alabama Department of Archives and History https://archives.alabama.gov/
Arkansas	Arkansas Historical Association https://arkansashistoricalassociation.org/
Florida	Florida Historical Society https://myfloridahistory.pastperfectonline.com/ State Library and Archives of Florida https://www.floridamemory.com University of South Florida Digital Collections https://digitalcommons.usf.edu/
Georgia	Georgia Historical Society https://www.georgiahistory.com/research/search-our-collection/ Georgia Archives https://vault.georgiaarchives.org/
Indiana	Indiana Historical Society https://images.indianahistory.org/
Illinois	Illinois Digital Archives https://www.idaillinois.org/
Iowa	State Historical Society of Iowa https://history.iowa.gov/history
Kansas	Kansas Historical Society https://www.kshs.org/
Kentucky	Kentucky Historical Society https://history.ky.gov/
Louisiana	Louisiana Historical Association https://www.lahistory.org/
Mississippi	Mississippi Department of Archives and History https://da.mdah.ms.gov/ Mississippi Digital Library https://msdiglib.org/ Mississippi Historical Society https://www.mshistorynow.mdah.ms.gov/ and https://www.mississippihistory.org/
Missouri	The State Historical Society of Missouri https://digital.shsmo.org/
North Carolina	North Carolina Literary & Historical Association https://www.dncr.nc.gov/programs-services/digital-collections
Nebraska	Nebraska State Historical Society https://history.nebraska.gov/collections/
Ohio	Ohio History Connection https://www.ohiohistory.org/
Oklahoma	Oklahoma Historical Society https://www.okhistory.org/
South Carolina	South Carolina Historical Society https://schistory.org/
Tennessee	Tennessee Historical Society https://tennesseehistory.org/
Texas	Texas State Historical Society https://www.tshaonline.org/
Virginia	Virginia Museum of History and Culture https://virginiahistory.org/
West Virginia	Wester Virginia Department of Arts, Culture, and History https://wvculture.org/
Other	Merrill J. Mattes Collection, Oregon-California Trail Association https://www.octa-journals.org/ Biographical Database, Church of Jesus Christ of Latter-Day Saints https://history.churchofjesuschrist.org/ Church History Catalog, Church of Jesus Christ of Latter-Day Saints https://catalog.churchofjesuschrist.org Indian-Pioneer Papers, University of Oklahoma Libraries https://repository.ou.edu/ Digital Collections, Newberry Library, Chicago, IL https://collections.newberry.org/

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TABLE 2
Keywords used when searching for new records.

Parakeet spellings (also as plural)	Geographic search terms		Cultural search terms	Biological search terms
paroquet	Nebraska	Muskingum	California (as in Trail)	flock
parroquet	Minnesota	Trinity	Oregon (as in Trail)	nest
paroquett	Wyoming	Sara	Santa Fe (as in trail)	cypress
paroquette	Wisconsin	Sarah	Mormons	sycamore
parroquette	Colorado	White	Saints	pecan
perroquet	Texas	Tombigbee	oxen	cockle
perrokeet	Louisiana	Plaquemine	horse	burr
paroquit	Dakota	Alexandria	wagon	branch
parroquit	Michigan	Yazoo	cart	tree
paraquat	Pennsylvania	Platte	trail	hollow
paroquat	Virginia	Tiptonville	Indian	mocking
paraquote	Delaware	Vidalia	boat	mockingbird
paroqueet	Maryland	Natchez	flatboat	oak
parakite	Carolina	Memphis	canoe	pine
parokite	Georgia	Nashville	steamboat	cotton
parrakeet	Florida	Orleans	boat	cottonwood
parakeet	Alabama	Iberville	diary	
parokeet	Mississippi	Green	journal	
parrokeet	Arkansas	Cumberland	journey	
parrokeat	Kansas	Atlanta	cart	
parrotquet	Missouri	Jacksonville	expedition	
parrotqueet	Iowa	Savannah	narrative	
parotquet	Indiana	Mobile	tour	
parotqueet	Ohio	Birmingham	travel	
parokeet	West Virginia	Jackson	excursion	
parokeat	Tennessee	Charleston	Cherokee	
parokweet	Kentucky	Atlanta		
paroquite	Red River	Orleans		
paroquitte	Teche	Nashville		
parroquitte	Atchafalaya	Memphis		
parokwit	Chattahoochee	Baltimore		
perruche	Cumberland	St. Louis		
papageien	Susquehanna	Boonville		
papageyen	Chesapeake	Booneville		
sittich	Scioto	Columbus		
perico	slough	Tuscaloosa		
lora	bottom	Independence		
	plains	St Joseph		
	prairie	Baton Rouge		
	morass	Alexandria		
	morrass	Frederica		
	bluff	Liberty bayou		
	saline	river		
	salt	creek		
	swamp	crick		

Specimen search.—We attempted to locate specimens listed in McKinley's work and in the index prepared by Hahn (1963) but not included in Burgio *et al*. (2018). We verified the accuracy of these records using online museum data repositories or by contacting staff directly. We searched for other specimens by consulting the Global Biodiversity Information Facility online repository (GBIF.org 2025). Finally, we also searched images on Google (https://images.google.com; July 2025) and Flickr (https://flickr.com; July 2025) and contacted museums if photos indicated that specimens were present.

Georeferencing.—We georeferenced observations and specimens using GEOLocate Standard Web Client (https://www.geo-locate.org/web/WebGeoref.aspx; Rios & Bart 2010)

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and GBIF Best Practices Guidelines (Chapman & Wieczorek 2006). We only included new records in the updated dataset if we could georeference them at least to county or two-county level. Following the procedure outlined by Burgio *et al*. (2018), the literary context of the observation and contemporary maps were used to select the best coordinates and measure uncertainty. Where available, links to such resources are supplied with each record.

Results

Our specimen search yielded six previously unreported geolocatable specimens held in five museums. We geolocated 37 specimens and 34 historical records that McKinley noted, but which were not included in Burgio *et al*. (2018). We also added three other written records and seven specimens noted in other recent publications (Leese 2020, 2023, Casto 2024). Our literature search uncovered 125 written records of the species that we were able to geolocate. We also made 48 corrections to Burgio *et al*. (2018). Eighteen 'new' records could not be geolocated, but are still of historical interest (Table 3).

The Supplementary Material contains the full data for geolocated records compiled here for the first time. These data have also been combined with those of Burgio *et al*. (2018), including amendments to the latter. The combined dataset of all georeferenced Carolina Parakeet observations and specimens is freely available at Figshare (Burgio *et al*. 2025). This dataset will be updated as more specimens and observations are identified.

Fig. 1 presents these records in the context of the observations in Burgio *et al*. (2018). Although they do not significantly alter the species' historical extent of occurrence, they add

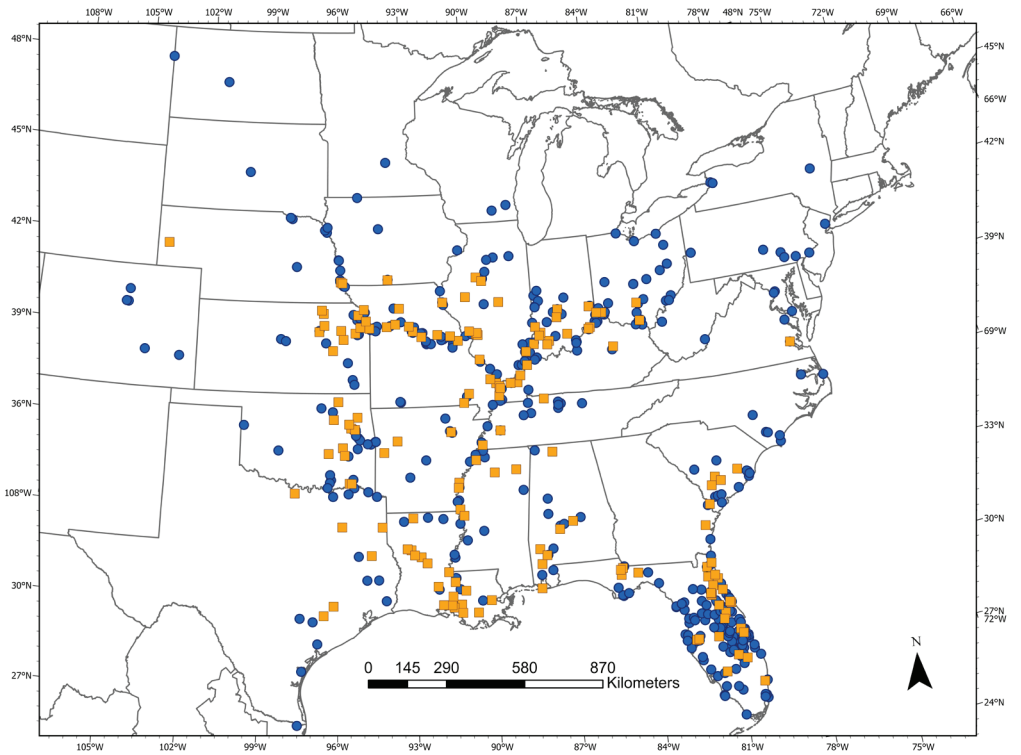

Figure 1. Historic sightings and specimens of Carolina Parakeet *Conuropsis carolinensis* (1564–1944). Orange squares = new records reported in this paper. Blue dots = records from Burgio *et al*. (2018).

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TABLE 3
Observations of Carolina Parakeets *Conuropsis carolinensis* that were not locatable to within one or two county areas or may not be historically reliable.

State	Location	Date	Observer	Citation	Validity
Arkansas	Mississippi River, perhaps Desha or Chicot County	Autumn 1829	Théodore Pavie	Klier (2000)	Valid but not locatable
Arkansas	Arkansas River, perhaps Crawford County	1840–41	William H. Allen	Eno (n.d.)	Valid but not locatable
Arkansas	Oil Trough	?	Friedrich Gerstäcker	Miller (1991), Smith & Lehman (2014)	Probably based on personal observation
Florida	St. Johns River, likely St. Johns County	February 1857	James Stirling	Stirling (1857)	Valid but not locatable
Florida	St. Johns River	Early 1836	William Marvin	Kearney (1958)	Valid but not locatable
Illinois	Between Canton and Ottawa	Late 1838	I. T. Smith	Brown (1908)	Valid but not locatable
Illinois	Southern Illinois	11–13 December 1826	John Bromfield	Tracy (1852)	Valid but not locatable
Illinois	Lower Illinois River	4 October 1835	Chandler Robbins Gilman	Gilman (1836)	Valid but not locatable
Illinois	Lower Illinois River	16 August 1840	William Fairholme	Tykal (1996)	Valid but not locatable
Kentucky	'soon after we got below the falls of Ohio'	1–2 January 1807	D. Constable	Dann (1986)	Valid but not locatable
Louisiana	'Baker's Station'	?	Charles Sealsfield (Carl Anton Postl)	Sealsfield (1844); see Schroeder (1947)	Perhaps based on personal observation
Louisiana	New Orleans or further north on Mississippi River	9 November 1829	Théodore Pavie	Klier (2000)	Valid but not locatable
Missouri	One day before passing Boonville by steamboat on the Missouri River (heading upstream)	8 May 1849	D. Jagger	Jagger (1849)	Valid but not locatable
Missouri	Either above the Kansas River in Platte County or above Independence Creek in Buchanan County	21 or 23 April 1833	Maximilian zu Wied	Leese & Gouraud (2025)	Valid but location is putative and cannot be refined further
Texas	Sabine River	?	Charles Sealsfield (Carl Anton Postl)	Sealsfield (1846); see Schroeder (1947)	Perhaps based on personal observation
Texas	Big Thicket	?	Philip Paxton (Samuel Hammett)	Paxton (1853)	Perhaps based on personal observation
Texas	On the road from Nacogdoches, TX, back to Natchitoches, LA	February 1830	Théodore Pavie	Klier (2000)	Valid but not locatable
Texas	Near the Canadian River in northern Texas (the panhandle)	1836	George Catlin	Catlin (1859, 1871); Fig. 5	Valid but not locatable

a considerable number of records, as well as a range-limit record from western Nebraska. These data help expand our knowledge of the species' range in the south outside Florida, more than double known records for Louisiana, and nearly double the number of records for Mississippi. The records demonstrate that the southern boundary of the species' range should include southern Louisiana, particularly along the Mississippi and Red Rivers.

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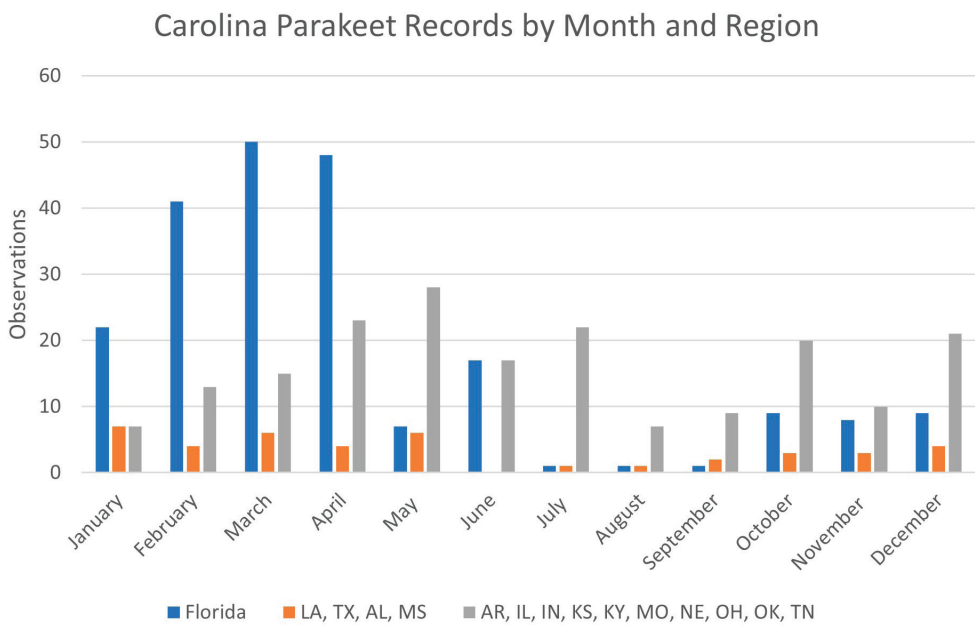

Figure 2. Carolina Parakeet *Conuropsis carolinensis* observations from various parts of its range by month. Regions are Florida (FL) (n = 214 observations; mean ± SD per month: 17.58 ± 17.46), Texas (TX), Louisiana (LA), Mississippi (MS), Alabama (AL) (n = 41 observations; 3.42 ± 2.18) and Arkansas (AR), Illinois (IL), Indiana (IN), Kansas (KS), Kentucky (KY), Missouri (MO), Nebraska (NE), Ohio (OH), Oklahoma (OK) and Tennessee (TN) (n = 192 observations; 15.5 ± 6.49). Note the relative stability of the latter group compared to Florida observations, which may be due to a bias related to climate.

Two broad patterns emerge in these new data. First, only 35% are from resident observers (near a home in which the observer resided and from where the person was not en route to another destination). Specimen data were not included in this statistic because many specimens were collected as part of excursions seeking specimens, thereby biasing the effort and increasing the likelihood that people would travel to accomplish that goal.

Second, there is a seasonal pattern to these data, with observations in Florida and other southern states declining to almost zero in the summer months. Fig. 2 illustrates these seasonal variations in observations in parts of the parakeet's former range. Burgio *et al*. (2017) mitigated the effects of this pattern by using March–August data as the comparison point for winter data.

Additional records of the species

Alabama.—In a letter dated 14 January 1818, Anne Royall (1830: 63) reported that 'thousands of paroquets flew over us in flocks' during a walk through cotton fields in Melton Bluff on the banks of the Tennessee River in the north of the state. To the west, James Robert Maxwell remembered the species as present near Tuscaloosa as late as 1861 (Maxwell 1926).

Carolina Parakeet frequented the Alabama/Tombigbee/Mobile Rivers' watershed, as it produced six more records. John Bill (1850) saw the species on the Alabama River below Montgomery on 9 March 1828. In the same area, Philip Phillips (Marcus 1955) observed parakeets around 15 September 1836. In a later visit to Alabama, Royall (1831) encountered the species in Dallas County on the Alabama River. John Landreth (Newton 1985), searching for lumber for naval purposes, noted the species on 16 April 1819, on the Alabama River.

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While ascending the Mobile River, Landreth also found 'great flocks of paraquits' at the junction of Cedar Creek and the Mobile River on 1 April 1819 (Newton 1985: 166). On the Tombigbee River, Charles Lanman reported parakeets during a visit to St Stephens in early 1854 (Lanman 1856).

In the far south of the state, Sir John Henry Cooke (1835) noted the species on L'Isle Dauphin (Dolphin Island) at the entrance to Mobile Bay.

Arkansas.—In the west of the state, Revd. William Graham (Parman 1998: 51) recorded parakeets in Sebastian and Scott Counties from 1844 to 1845 in '[f]locks on bluffs and mountains'.

William Wood (1895) saw parakeets while ascending the Arkansas River by steamboat near Morrison's Bluff on 2 April 1845. Dr Charles Brackett (Wheaton 1998) wrote to his hometown Rochester [Indiana] *Chronicle* from Jacksonport, Arkansas on 8 May 1862. Mixed with military and economic discussion, he also noted parakeets, which he considered unique to the south.

S. W. Woodhouse saw the species at Napoleon (now abandoned), at the junction of the Arkansas and Mississippi Rivers on 1 June 1849 (Tomer & Brodhead 1996). Just to the north, the missionary Cassandra Sawyer Lockwood recorded 'beautiful parroquets' during a stay at Montgomery's Point, at the confluence of the White and Mississippi Rivers, from late December 1837 to January 1838 (Thoburn 1955: 208).

Florida.—Florida boasts the most sight records and specimens of the species, by far, of any state. Records are especially numerous along the St John's River. Starting with the northernmost, Richard Longeville Vowell ate parakeets for supper at Cedar Point Plantation, north of the mouth of the St Johns River, in late October 1817 (Doyle 2011). Edward Kimber (1744) found parakeets *c*.10 miles north of St Augustine on 16 March 1743. Sarah W. Davis (1868) wrote to her husband that she saw parakeets at Green Cove Spring on 11 March 1868. David Brown (1853, writing as 'A Northern Man') noted parakeets on Drayton Island at the north end of Lake George.

Between Volusia and the mouth of Lake Monroe, on 25 August 1865, Dr Esther Hill Hawks (Schwartz 1984: 182) saw a 'large flock of beautiful little green and gold parroquetts'.

The Manchester Museum (Univ. of Manchester, UK) holds a specimen taken at Enterprise, on the north shore of Lake Monroe, in February 1875 by J. Morley (MM 7113). Near Melonville, now Sanford, on the south side of Lake Monroe, Henry Sanford Gansevoort saw the species sometime in the first two weeks of January 1869 (Hoadley 1875). Still further up the St Johns River, Bishop H. B. Whipple (1900) remembered parakeets at Lake Jesup between 1880 and 1900.

Another record from the St Johns River was made by Frank H. Sweet (1901: 568), who claimed that: 'the only nesting place known to remain is in a swamp south of Lake Washington, where still a flock keeps its old quarter in a cypress. Here they breed year after year, but seldom leave the limits of the cypress timber.'

The central part of his article is plagiarised from Frank Chapman's widely reproduced article entitled The wearing of herons' plumes of 'aigrettes' (1897). But the beginning and end of Sweet's text offer apparently first-hand accounts by the author, who lived part of his life in Palm Beach, Florida. A later editor (Anon. 1913: 3) added a sentence claiming that the birds attached their nests to the 'mouldering sides' of the cypress *Taxodium distichum* hollow. But the claim is almost certainly editorial licence and not a legitimate observation.

East of the St John's River, along the King's Road, Ellis Hughes encountered parakeets on 16 December 1838 (Hughes 1838). Hughes also drew a Carolina Parakeet (Fig. 3). The sketch below it in his diary is of Fort Lauderdale, dated 23 March 1839. The pencil tone between the images is similar, but there is no way to be sure that the parakeet sketch is

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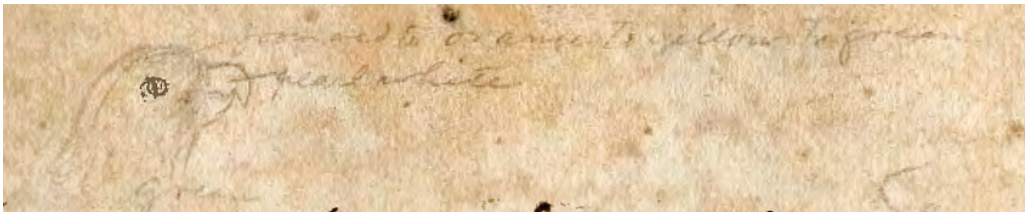

Figure 3. Ellis Hughes sketched the Carolina Parakeet *Conuropsis carolinensis* in his journal, possibly at Fort Lauderdale, Florida, on 23 March 1839. His text describes the head as 'from red to orange to yellow to green', the bill as 'pearl white', and the body as 'green' (Ellis Hughes Diary: Book 1, Univ. of South Florida Archives)

from the same time and place, as Hughes' journals often have notes from different years on the same page. A male specimen from Brevard County, collected on 6 November 1888, now resides in the EcoTarium (Worcester Society of Natural History; ECOT 2015.INV.0506).

In an account of the Seminole War, William Wragg Smith (writing as 'Lieutenant of the Left Wing') saw parakeets sometime between 23 and 27 February 1836 north of Bulow's Plantation in Flagler County (1836: 160–161):

> 'In these pines we alarmed a flock of Parakeets, which were clustered on the tops; they flew around us, setting up a most outrageous screaming and chattering and after making two or three rapid, graceful circuits, enlivening the woods with a beautiful maze of varied colors, green, gold and orange, settled again upon the bare branches of a scrub close by. […] In Florida their food consists principally of the seeds of the cyprus [*sic*] balls, which tree they are fond of frequenting; of the luscious fruit of the pawpaw, palmetto-royal and in fact, of every kind of fruit.'

Just to the south, in Volusia County he saw parakeets again on 28 February at Camp M'Crae (now Addison Blockhouse), where M. M. Cohen would record a Dr Strobel preparing specimens of the species just two weeks later (Cohen 1836, McKinley 1985).

Elsewhere in the state, Maurice Thompson (1884) reported the species on the north-eastern shore of Lake Okeechobee in 1867. Kirk Munroe included 'Paroquetts' on his list of birds of the Kissimmee River, referring to that stretch of the river between Bassinger and Lake Okeechobee in February 1882 (Leonard 1968: 86). An anonymous correspondent for the Abbeville, South Carolina, *Independent Press* recorded a pair of parakeets and a pair of Ivory-billed Woodpeckers *Campephilus principalis* taken near Silver Spring in January 1858 (Anon. 1858). Orlando B. Willcox (Scott 1999: 216) saw 'flocks of paraquettes occasionally fly over' the Caloosahatchee River at Fort Denaud on 28 November 1856. George Ballentine reported the species at the garrison near Tampa, later Fort Brooke, in 1846 (Ballentine 1854). Julia Daniels Mosely (Mosely & Crislip 1998) saw nine parakeets on 6 May 1882, at Six Mile Creek Hammock, just east of Tampa. The Rochester Museum and Science Center has two specimens, one from Fort Drum (RMSC 54.504.53) and another from London Island (RMSC 54.504.55). The Senckenberg Naturmuseum, Frankfurt am Main, has a specimen (SMF 17352) from Manatee County, taken on 5 June 1897.

On the Florida Panhandle, Count Francis de Castelnau sketched parakeets on the Apalachicola River around 25 February 1838 (Fig. 4). The image's legend states that it was made when the river was in flood, so based on his travelogue it was probably sketched near Chattahoochee in Gadsden County (Castelnau 1842, Seymour 1947). Just to the south, on the opposite side of the Apalachicola River, Dr Charles Hentz 'got 3 paroquets at a shot [and] preserved one for a skeleton' on 2 June 1852 (Stowe 2000: 286). The Everhart Museum in Scranton, Pennsylvania, contains the skin of a male killed at Bristol on 6 April 1883 (EMS 2383).

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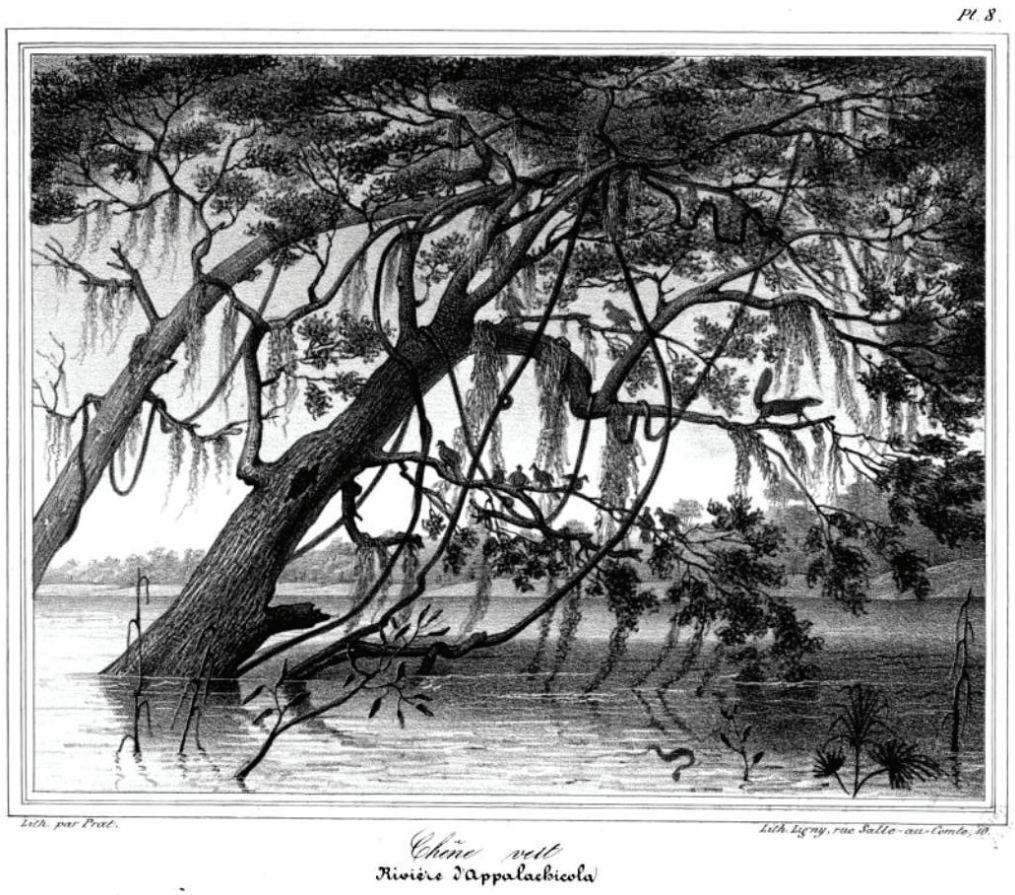

Figure 4. The French naturalist, Count Francis de Castelnau, made natural history observations throughout North America from 1837 to 1841. In his *Vues et souvenirs de l'Amérique du Nord* (Pl. 8) he included a sketch of Carolina Parakeets *Conuropsis carolinensis* on the Apalachicola River around 25 February 1838. His record is one of the relatively few from the state's north-western panhandle.

Georgia.—The Salzburger Lutherans recorded one of the few Georgia records in 1734 at their settlement in Old Ebeneezer (McKinley 1977b). In 1736, the settlement moved to a site on the Savannah River, and their 'Detailed Reports' include a note about parakeets feeding in their fields on 27 March 1748 (Jones 2021).

Illinois.—Martin Prewitt shared memories of seeing parakeets on Indian Creek, near Wanda, just south of his home (Hair 1866: 281–282):

> 'Paroquets (Carolina Parrot) used to live in hollow trees on Indian Creek. I have seen a dozen come out of one tree in a winter morning. They fed on cockleburs and used to crack small hickory nuts with their bills; sometimes they ate the apples.'

N. M. Baker also saw the species during his boyhood at Decatur, Illinois (Baker 1912: 260). Eliza Farnham recalled parakeets spending the summer months 'in the heavily wooded bottoms of large rivers' near her home in Pekin, Illinois, in the late 1830s (Farnham 1846: 77).

Revd. James Leander Scott (1843) recorded Carolina Parakeets between Trivoli (which he called Trivola) and Peoria on 21 May 1842. Just south-west of Trivoli, near the confluence

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of the Sangamon and Illinois Rivers, Eliza Steele (1841) encountered the species on 9 July 1840. Just to the west, C. L. Kraber recalled parakeets as late as 1849 near Quincy (Kraber 1905).

While stopped at the mouth of the Kaskaskia River, Henry Brackenridge (1868: 29) observed 'flocks of screaming paroquets'. Edward Doubleday (1838: 270), an English entomologist, saw 'sundry flocks of parrots' on the Mississippi, north of Alton, Illinois. Gershom Flagg, writing to his brother from his new home in Edwardsville, shared a list of wildlife in the area, including parakeets (Buck 1912). Robert Aldrich also remembered the species from Edwardsville prior to 1830 (Barler 1875). Just north of Edwardsville, near Fort Russell, Gaius Paddock recalled the species as plentiful until 1833 (Norton 1912).

Théodore Pavie, descending the Ohio and Mississippi Rivers in autumn 1829, recorded parakeets for the first time at 'the Trinity, a sizable hotel on the Missouri side' (Klier 2000: 128). 'Trinity' here refers to a town, since lost, in the area now known as Cairo, Illinois. Maximilian zu Wied mentioned the town of 'Trinity' near the junction of the Ohio and Mississippi Rivers (Witte & Gallagher 2008: 349), and it appears on the Ohio River on the map that accompanied his book (Wied 1839–41).

Indiana.—Noah J. Major, writing of his childhood in Martinsville, Indiana, recalled parakeets near his small cabin in 1833 (Esarey 1915). William Redmon described 'Paroquets as mischievous as beautiful' near his new home at Busro (Medlicott 2013: 144). Major John Norton saw 'several paroquets of a beautiful plumage' in Switzerland County, likely on Indian Creek, while taking refuge from a storm on the Ohio River on 28 May 1809 (Klinck & Talman 2011: 22). Miner K. Kellogg recalled parakeets at New Harmony in 1826 (Sylvester & Hackensmith 1968). On 26 June 1832, Virtulon Rich saw 'talkative' parakeets near Salem, Indiana (Smith 1965). William Clinkenbeard provided an interview about early pioneer life (Draper Manuscripts: 1760-1911, Series CC, Wisconsin Historical Society, Madison) where he noted that he 'Saw a good many [parakeets] at the French Lick'.

George R. Wilson (1910), in his history of Dubois County, shared records from Patoka Township and Buffalo Pond near Jasper . Tucked away in a paper titled 'Notes on the birds of 1894', A. W. Butler (1894) supplied a few more records beyond his earlier report (1892) cited by McKinley (1976). They include: Grassy and Swan Ponds in Daviess County in 1859 by Butler's grandmother; Knox and Daviess Counties in 1857 and 1858 by an unknown observer; and Franklin County by Mrs LaForge via F. R. Quick. Butler, after the record for Knox and Daviess Counties, also adds, 'They say they flew in flocks arranged along two sides of a triangle after the manner of wild geese' (1894: 76). It is not clear if Butler's friend or grandmother or both is the antecedent in the sentence, but it is a unique observation of flocking behaviour for the species, *contra* Bendire (1895) who recorded them as flying in compact flocks.

Iowa.—McKinley (1965) cited Trippe (1872) for a record of the species from Decatur County. Independent verification of the species there appears in *The Western Literary Messenger*, which mentions that parakeets visited the county regularly and were 'sometimes seen in flocks of twenty, and even more' (Anon. 1856). A putative nesting record from south-west Iowa is clearly an error, based on the plumage description of the adults, and likely refers to Burrowing Owl *Athene cunicularia* (Anon. 1888).

Kansas.—Father Bernard Donnelly observed parakeets upon his parish's establishment in 1839 (Morgan 1911). George Suckley recorded parakeets at Fort Leavenworth on 1 June 1859 as he was setting out on the Oregon Trail (Beidleman 1956). Fred Mather remembered parakeets near Coal Creek, south of Emporia, during his antebellum residence there (Mather 1897, 1898).

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On 19 September 1840 along the Santa Fe Trail, William Fairholme found 'numbers of parroquets were constantly flying over our heads in little flocks, making a great screaming as if indignant at our intrusion' (Tykal 1996: 82). The place of the encounter is unclear from the text, as Fairholme seems to have misidentified the creek at which he was staying as the Little Neosho. From other textual clues, it appears to have been One Hundred and Ten Mile Creek in Scranton, Osage County.

A late record of the species is from L. L. Jewell, who reported the species as still occurring in the Blue River valley around Irving (now abandoned) in Marshall County in 1883 (Cragin 1886).

Kentucky.—Eliza Steele (1841), who had seen parakeets on the Illinois River on 9 July 1840, also encountered them on her return east on 18 July 1840 while sailing up the Ohio River. Henry Rowe Schoolcraft (1845) encountered both parakeets and cypresses for the first time on his journey around 20 June 1818 near what is now Smithland, Kentucky. Major George Bedinger befriended a wounded parakeet in December 1775 at a camp in the canebrakes of the Ohio River, between the Cumberland and Tradewater Rivers (Heath 2002).

William Clinkenbeard remembered parakeets when he first settled near Strode's Station close to modern Winchester, Kentucky, in 1779 (Draper Manuscripts, Series CC, Wisconsin Historical Society, Madison). William Clark, of the Corps of Discovery, reported parakeets at Big Bone Lick in a November 1807 letter to Thomas Jefferson (Rice 1951). An otherwise unknown Mr Sellars mentioned the species from Union County in the earliest days of settlement (Courier Company 1886).

Louisiana.—Louis Judice, in a 1786 report to the Spanish colonial authorities, presented very detailed observations on the flora and fauna of the Bayou Lafourche, from a 1772 survey. He remembered parakeets as present throughout the area (Brasseaux *et al*. 2004).

John Landreth reported parakeets three times in Louisiana. On 8 January 1819, he 'saw a number of Paraquites about a quarter of a mile below Records's [where] the Plaqumine makes into the Atchafilio' (Newton 1985: 16). Waterways have shifted a great deal since Landreth's journey, but he seems to have been referring to just south of the present junction of Bayou Sorrel and the Atchafalaya. On 11 January 1819, he saw parakeets along with hawks, owls, and alligators on 'Bayou Fourshett' (Newton 1985: 19), a name now lost but somewhere in the vicinity of the modern-day Belle River based on Landreth's description. On 23 January 1819, Landreth found the species again, at the junction of Bayou Buff (now Avoca Island Cutoff) and Bayou Shaffer in St Mary and St Martin parishes (Newton 1985). James Leander Cathcart was with Landreth on the 1819 survey. On 16 February 1819 he observed the species at Bayou Teche between the town of Franklin and Moore's Plantation, near modern Adeline (Prichard *et al*. 1945), but the rest of his narrative does not mention Carolina Parakeet.

Many records from the state are from the journals and writings of Théodore Pavie, who travelled in Louisiana and Texas in 1829–30. Upon his arrival in New Orleans, Pavie wrote to his brother on 9 November 1829 of seeing 'little green parrots, with their squawk so unique in these woods, flit[ting] through the moss' (Klier 2000: 70). The next sentence refers to New Orleans proper, but the letter could be documenting events north of the city on the Mississippi. Pavie travelled up the Red River as far as Alexandria, and then by horseback to Natchitoches, to spend the winter with his family. Just after beginning the horseback portion of the journey, and therefore still within Rapides parish, he offers his most extensive portrait of the parakeet (Klier 2000: 158):

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> 'They fly with extraordinary swiftness, abrupt in all their movements. Passing like lighting within range of pistol shot, they all perch together on a tree whose branches dip down to the earth under the weight of these birds; then suddenly at a single screech repeated a thousand times by the rest of the flock, they all flap with wings and take off, hissing strangely.'

He also recorded the species on 20 November 1829 once he arrived in Natchitoches and then in December 1829 on a hunting trip to Spanish Lake (now drained) north-west of Natchitoches (Klier 2000). In early May 1830, he again saw the species while descending the Red River from Natchitoches en route home to France (Klier 2000).

Frances Milton Trollope, an English novelist and travel writer, visited New Orleans briefly from 27 December 1827 to 1 January 1828, and the highlight of her stay was her time outside, especially the palmettos and pawpaws *Asimina triloba* (Trollope 1832). She must have been so struck by the forest that she forgot to mention the parakeets that she saw there until trying to describe young women moving about the city of Vienna; their flitting about, she wrote, 'often reminds me of the manoeuvring of a covey of bright paroquets, such as I have seen in the forests of New Orleans' (Trollope 1838: 312–313).

While descending the Mississippi in summer 1836, Sir Richard George Augustus Levinge (1847: 33) recorded 'Thousands of parroquets were screaming through the woods' from an island below the mouth of the Red River in Concordia parish. Elizabeth Washington Foote Cheeves (1849: 119) recorded 'varied and noisy tribes of paroquets […] in immense flocks' at Opelousas, Louisiana, in the winter and spring of 1843.

Mississippi.—A *New York Times* reporter, writing as 'Galway', reported from Union forces conducting the Steele's Bayou Expedition in 1863. On 20 March 1863, he recorded parakeets at Steele's Bayou, in the vicinity of modern-day Rolling Fork ('Galway' 1863).

Colonel William F. Gray observed parakeets on 27 October 1835, while visiting Princeton, now lost to the Mississippi River, just west of Lake Washington in Washington County (Gray 1909). W. L. Clayton recalled parakeets from the early 1840s when his family first moved to the area that would become Tupelo (Gwin 1982).

Mississippi also has two uncommon summer records for the species from the deep south. While trying to return north across Confederate lines, Caroline Seabury (Bunkers 1991: 104) heard the 'incessant chattering of paroquettes' in Tunica County, seven miles from Buck Island, on 5 August 1863. Dr Elijah Millington Walker shot two parakeets near Spring Dale, Lafayette County, on 2 July 1850 (Wrenn 2004).

Missouri.—Bishop Thomas Asbury Morris encountered parakeets for the first time on 28 October 1841, at 'Camp Cypress' in Butler County in south-east Missouri, near the Black River (Morris 1854: 287). Just to the west, George Engelmann noted the species on the Little Black River on 11 March 1837, on the border of Ripley and Butler Counties (Jansma & Jansma 1992).

In Mississippi County, Thomas Beckwith shot parakeets to protect the apple crop during his boyhood on Wolf Island in the 1840s (Houck 1915). Louis Houck, his biographer, clearly had access to Beckwith or his journal when composing his sketch of Beckwith's life, but the original has not been located.

North of the junction of the Ohio and the Mississippi Rivers, Johnston Taylor saw a flock of parakeets on 12 October 1818, near Cape Girardeau (Smith 1955). Stephen Hempstead recalled a visit to Daniel Boone at Defiance, St Charles County, in early autumn 1808. Hempstead shared that Boone had been out hunting the day before his visit and had wounded a parakeet. He brought the bird home and made it a gift to Hempstead (Draper Manuscripts, Series S, Wisconsin Historical Society, Madison).

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Samuel D. Tyler recorded 'Green Parrots' at Parson's Creek in Linn County on 28 September 1838 (Tyler 1838). Also, in central Missouri, in spring 1845, William Armistead Goulder reported parakeets in the cottonwood forests of the 'Saline Bottoms' along the Missouri River near Glasgow (Goulder 1909: 76).

John Kirk Townsend noted parakeets along his route on 5 April 1834 (Mearns & Mearns 2007: 41):

> 'We observed to day [*sic*] several flocks of Carolina Parrots, (*Psittacus Carolinensis*) & I killed seven of them in a few minutes. They are in beautiful plumage. Inhabit the low grounds in the neighbourhood of streams, I believe almost exclusively, & here feed upon the seeds of the Buttonwood, (*Platanus occidentalis*). They go in flocks of from 10 to 25 & while flying keep a regular loud screaming, somewhat resembling the chattering note of the Red-headed Woodpecker [*Melanerpes erythrocephalus*]. Immediately on alighting they become quiet, & sit very still upon the trees, seeming to wish to be as close together as possible. I found these birds, (the first I have ever seen,) quite tame'.

For an unknown reason, this observation did not appear in his published journal (Townsend 1839).

Heading west during the Gold Rush, Samuel C. Jennings (1871) found the species at Independence, and William Montgomery (1850) saw parakeets at Lexington. In the west of the state, W. M. Paxton reported Carolina Parakeets until 1839 at Platte Falls on the Platte River, Missouri (Paxton 1897). On 29 May 1849, the day before crossing the Missouri to seek a fortune in California, Elisha Douglas Perkins (Clark 1967) was surprised to find parakeets as far north as St Joseph. Benjamin Franklin Bush is credited with one of the last records of the species, at Courtney, Missouri, in 1912 (McKinley 1960). However, his friend and biographer also noted that Bush observed the species as a child, in *c*.1865 at Independence (Palmer 1937: i): '…and he recalled…the Carolina paroquets that sat on stumps in the recent clearing, and were so tame or so stupid that it was possible to approach and catch them under a coat or hat.'

Nebraska.—Engineer Cantonment is the northernmost point for which observations suggest overwintering by the species, with observations by Thomas Say in December 1819 and February 1820 (McKinley 1965). Titian Ramsay Peale provided an additional observation from the same location and winter. On 20 March 1820, he bragged about killing a deer when 'the rest of the party killed 1 goose 2 Ducks and some parokeets and a Rabit [*sic*]' (Haltman 2008: 229).

William W. Ingraham wrote to his brother to describe his station at the first Fort Kearney (the more famous Fort Kearney was the second to bear the name), located on the Missouri River to protect the Oregon Trail. In a letter dated 22 January 1848, Ingraham noted (Jensen 2001: 12): 'I never go in the woods but I am nearly deafened with the screeching of paroquets and croaking of ravens.'

In the far west of the state, Thomas Bullock encountered the species just 25 miles from the Wyoming border, when he saw two parakeets near modern-day Scottsbluff, Nebraska, on 27 May 1847 (Bullock 1847).

Ohio.—Edward Deering Mansfield recalled seeing parakeets at Ludlow Station, Cincinnati (Mansfield 1879) in 1805 or thereafter. Bishop Francis Asbury saw parakeets while crossing the Great Miami River on 4 September 1808. Asbury relates that he crossed at 'Judge Simm's new improvement,' but that geographical reference is now lost (Asbury 1821: 249). His itinerary description places the sighting near Hooven, Ohio.

While passing the Little Sciota River en route to Ohio on 17 May 1811, John Watson, Jr. (Smith & Smith 1968: 33) 'Saw a flock of Parrotquots [*sic*] (a beautiful bird of the Parrot

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kind, of a green colour).' En route back to Pennsylvania, Watson also found parakeets at Chillicothe, Ohio, on 4 July 1811. His journal includes a distributional observation of the species on 5 July 1811 (Smith & Smith 1968: 199): '[I] may mention as a curious circumstance that the noisy little Parrotquets [*sic*] are seen in Flocks all along the Sciota river and no where [*sic*] else in this State.'

Oklahoma.—James Hildreth, part of the Dodge-Leavenworth Expedition, observed parakeets in spring 1834 at Camp Jackson, just west of Fort Gibson in Wagoner County, Muscogee Nation (Hildreth 1836). In the same county, Alice Robertson, saw 'a gorgeous flock of brilliant green flame-crested paroquets' (Hodges & Strickland 1981: 12) on Christmas Day 1866 in Tullahassee. Edward Crabb (1930) shared a Mr Ledbetter's memory of having seen parakeets in Pittsburg County, Choctaw Nation, presumably prior to 1900.

While marching south along the Neosho River on 7 July 1863, Jacob Haas encountered 'many parrots babbling and flying about' (Christ 2014: 33) in Mayes County, Cherokee Nation, near modern-day Locust Grove. William Nicholson (1934) conducted a tour of Indian Agencies in 1870 and saw parakeets at the Caney River (he called it the Cana), just south of Bartlesville. The location can be confidently established based on the account of a day trip to the north a few days later from their cabin at 'Shoteau's Agency' (Nicholson 1934: 321) and his description of distances to creeks along that route.

The Indian-Pioneer Papers were a Depression-era project to interview Indigenous Americans, following their forced removal from ancestral land. Those papers include three recollections of parakeets. Josephine Usray Latimer recalled parakeets in a cemetery three miles east of Hugo, Choctaw County, Choctaw Nation, when they 'would come in droves in the fall and peck and eat the fine apples' (Harris 1930). Also in Hugo, Frances Hampton recalled 'wild pigeons and parrots' (Dougherty 1938) from her childhood in the 1870s and 1880s. John M. Adair and Henry C. Meigs reported the past occurrence of Carolina Parakeets at the river bottoms near Fort Gibson, Cherokee and Muskogee Counties, Cherokee Nation, during the early colonisation of the state (Ross 1937).

South Carolina.—When recording his sighting of Carolina Parakeets in Ohio, Bishop Francis Asbury (1821: 249) also noted that he saw the species 'upon Santee-River [*sic*]' in South Carolina. Unfortunately, his journals do not explicitly mention his South Carolina sighting. Asbury never stopped moving, and his journals reveal multiple visits to South Carolina. He crossed the Santee River on 27 December 1804, almost three years before his Ohio record, at Nelson's Ferry, near modern Eutaw Springs (Asbury 1821). However, he could have also been remembering parakeets from his 20 January 1803 crossing of the Santee River at 'Lower Santee Ferry', just north of modern-day McClellanville.

During the American Revolution, William Feltman marched south to participate in the siege of Yorktown. A flock of parakeets flew through his encampment on consecutive days (Feltman 1853). Recreating his path as best as possible, he encountered the first flock on 1 January 1782, near modern Branchville, South Carolina, then met the species again on 2 January 1782, near modern Grover, South Carolina.

Revd. John Bachman wrote that the species had 'become so rare in Carolina that I only once noticed a small flock of five or six among the cypress trees of the Salt Katcher swamps' (Bachman 1839: 201). The Salt Katcher is now known as the Salkehatchie, but it appears on maps of the era as Bachman knew it or as Salt Ketcher. However, Bachman's written record means that McKinley (1979b) was incorrect in assigning Audubon's 1834 report of feeding parakeets to vultures to Bachman's home in Charleston. Audubon's original experiments, in which vultures were fed parakeets, were published in 1827 (Audubon 1827, see also Audubon 1834: 35) and as such were conducted when Audubon was living in Louisiana. Audubon and Bachman experimented with the olfactory sense of vultures together in 1833,

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but their descriptions do not mention parakeets (Audubon 1834: 44–47). Bachman's (1834) independent account supports Audubon's, which might otherwise be in doubt given the latter's reputation for fraud (e.g., Halley 2020).

Tennessee.—James Ross recorded parakeets at one of his childhood homes in Clarksville in 1808 (Ross 1882). Jane Henry Thomas, born in 1800, wrote years later that she remembered Carolina Parakeets near Nashville (Thomas 1897). Frances Milton Trollope spent a few days in Memphis in January 1828 and saw 'the small green parrot' there (Trollope 1832: 42).

Texas.—Théodore Pavie, during his stay with family in Louisiana, made a side trip to Texas in February 1830. In Nacogdoches, he describes parrots 'more numerous than leaves' on the magnolias *Magnolia* sp., noting that the Mexican residents of the area often kept them as pets (Klier 2000: 205–206). In a letter to his father, he also recounts them on the road from Nacogdoches back to Natchitoches, but the precise location cannot be determined (Klier 2000).

J. Ross Browne (1868: 162) recorded 'innumerable flocks of paroquets' in spring along the Brazos River, somewhere between Austin and Houston. The year of the observation is unclear, but it was probably in the early 1850s. H. G. Askew also remembered parakeets in eastern Harrison County in winter 1850–51 (Webb 1939).

McKinley (1978) noted an image by George Catlin of shooting parakeets in Texas. A pencil version (Fig. 5) provides details that were not available to McKinley. The latter is from 1870–72 and is a recreation of cartoons 256 and 356 from his original collection of

Figure 5. George Catlin travelled and painted throughout the American West during the 1830s, making some of the most important records of the life of Indigenous Americans on the Great Plains. He recorded the Carolina Parakeet *Conuropsis carolinensis* as far north as Fort Union, North Dakota and as far south as Texas. The sketch shows Catlin and his men hunting parakeets in Texas, probably along the Canadian River (no. 212, author and his men shooting Paroquets in Texas (1836). mssHM 35183, Papers and illustrations of George Catlin, 1868–92, The Huntington Library, San Marino, California)

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sketches (Catlin 1871). It is entitled 'No. 212. The author and his men, shooting Paroquets, in Texas 1836'. Based on his travelogue (Catlin 1859), he was in Texas in 1836 at a Pawnee village and then along the Canadian River, both in the Texas Panhandle. The date eliminates McKinley's (1978) supposition that the image was from along the Brazos River in 1834.

Discussion

Natural history and range.—The records presented here do not provide any new data that help resolve the validity of the named subspecies. Burgio *et al*. (2017) used the Appalachians and the Alabama/Mississippi state line as their division of the subspecies when conducting their analysis but still placed the range of *C. c. carolinensis* partially within Louisiana. Museum specimens of the species from Louisiana are identified as *C. c. ludovicianus* (Museum of Comparative Zoology, Cambridge, MA; Natural History Museum, Tring, UK; see McKinley 1988). The lack of specimens from Alabama, Mississippi, Georgia, North Carolina or South Carolina makes it impossible to determine the boundary between the subspecies in the south-east (see Ridgway 1916: 148). Genetic analyses may help elucidate their taxonomic validity, but the species clearly had two populations, one centred on the Missouri, Ohio and Mississippi Rivers, and another in the south-eastern states, especially Florida.

These records confirm that the Carolina Parakeet was a riparian species, with Graham (Parman 1998) offering the only record of the species in upland habitat. Cypress was the most common tree associated with parakeets in these records (Bachman 1839, Schoolcraft 1845, Morris 1854, Sweet 1901). The species was also recorded in pines *Pinus* sp. (Smith 1836), cottonwood *Populus* spp. (Goulder 1909) and sycamore *Platanus occidentalis* (Mearns & Mearns 2007).

George Bedinger's 1775 record from the canebrakes of Giant Cane *Arundinaria gigantea* along the Ohio River (Heath 2002) offers rare documentation of parakeets occurring in such habitat (e.g., Featherstonhaugh 1835: 72), although botanists have posited such a relationship (Janzen 1976, but see Platt *et al*. 2001, 2013).

The most frequently recorded food sources of the species (Snyder & Russell 2020 Appendix 2) are reflected in these newly compiled records: cocklebur *Xanthium* spp. (Hair 1866), cypress (Smith 1836) and apples *Pyrus malus* (Hair 1866, Houck 1915, Harris 1930). Less common food items also appeared: sycamore (Mearns & Mearns 2007), pawpaw (Smith 1836), Royal Palm *Roystonea regia* (Smith 1836), hickory *Carya* spp. (Hair 1866) and sumac *Rhus* spp. (Rowland 1925, McKinley 1988). To our knowledge, these are the first records of the latter three items in the parakeet's diet.

The additional records do not directly supply insights into any possible migrations by the species (McKinley 1977d, Snyder 2004, Burgio *et al*. 2017, Snyder & Russell 2020). However, the expanded dataset offers opportunities to refine previous efforts. These should, as much as possible, consider the various biases that form part of the historical record for the species.

Possible biases.—All records of Carolina Parakeet are unstructured and opportunistic. As such, the data are subject to the same biases as many citizen science observations (Sullivan *et al*. 2009, Zhang 2020), including:

1. Detection bias refers to the risk that a species may not be recorded even when it is present. Many observations include notes about the parakeet's noisy and obvious flocks, so this bias seems unlikely in these data. However, if the species underwent a quiet period while moulting (Metcalf 2004), there might be a slight reduction in records during this period.

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2. Identification bias refers to the risk of incorrectly identifying a species. However, there are no other similar species in the Carolina Parakeet's former range, so this bias is very low, if present, in these data (Burgio *et al*. 2018). Often, the birds' calls were used (or assumed to be used) in identifying them. These vocalisations were relatively distinctive and are unlikely to have been confused with other taxa (Mearns & Mearns 2007, Snyder & Russell 2020).

3. Spatial bias occurs when observers are not evenly distributed throughout the range of the species being monitored. In the case of Carolina Parakeet, the eastern part of its distribution was occupied by a large immigrant population by the early 19th century, with the notable exceptions of mountainous and swampy regions. Colonisation west of the Appalachians and the trans-Mississippi continued throughout the 19th century, offering a more extensive spatial coverage as time progressed. The travel that carried Americans west was not evenly dispersed, with rivers being central to human movement in the 19th century. For example, most records in Missouri are from along either the Mississippi or Missouri Rivers, with few records elsewhere in the state (Fig. 1).

This bias may affect the data due to an over-representation of travel observations. McKinley (1964, 1977a,d, 1979a) noted in multiple sources that he was reviewing the travel literature for parakeet records. Thus, areas that formed part of commonly travelled routes are over-represented in the data. Some places may lack records because the locations were not on a main route. Resident observers accounted for only 35% of the records presented here, so these data lack the insight that residents might provide concerning annual patterns of presence and absence. The travel bias may also overlap with the temporal bias noted below, as people often chose to make trips to Florida and the south in winter.

4. Effort bias recognises that not all observers bring the same skill set and attention to their observations. For example, one would expect the average traveller on the Missouri River and overland trails to spend less effort looking at and identifying birds than Audubon. However, we are not aware of any reason to believe that skilled naturalists were particularly concentrated in any single geographical area, so this bias is unlikely to affect the data.

This bias also appears because the economic motive of taking the species for the pet trade or as skins obviously modified the effort of collectors. One would expect that observations from many specimens would be biased to areas of dense parakeet population, where collectors could make most profit for their effort. Similar biases towards beautiful, rare species are present throughout biological collections (Cooper *et al*. 2019, Nekola *et al*. 2019).

5. Temporal bias accounts for uneven effort across time in making observations. For instance, most American colonists set out on overland trails in April or May, thereby influencing when those travellers might encounter parakeets.

Leese (2020) noted a pattern in which the southern states had few if any records of Carolina Parakeet during June–September. This pattern in the south probably results from the climate, with fewer observers braving the heat and humidity of the summer months. One might also argue that people would avoid the wetland habitats used by Carolina Parakeets because of the risk of malaria, a threat that the wisdom of the day associated especially with wetlands (Hardy 1887, Nelson 2002, Hong 2011). In the case of Florida, the bias may be because people sought out Florida in the winter (e.g., Barbour 1884: 13).

The historical nature of the observations discussed in this paper adds at least two other biases:

6. Transmission bias considers that not all historical observations have the same chance of being collected and published in such a way that makes the records usable. For example, the lower literacy rate of African Americans and Indigenous Americans during

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the 1800s makes it much less likely that their observations would be recorded (Thornton & Young-DeMarco 2024). The biases of past and current publishers, the interests and holdings of historical societies, and the searchability of those records all create biases in the data. For instance, there are more travel narratives published than local diaries. Reuben Gold Thwaites published 32 volumes of *Early western travels*, and the *American exploration and travel series* from the Univ. of Oklahoma Press now counts 84 volumes, but there are no such series' of local diaries. This bias even affects what authors chose to include in their published manuscripts, e.g., John Kirk Townsend noted parakeets on 5 April 1834 in his journal (see Missouri, above), but that note did not appear in the final published version of the journal.

7. Novelty bias may appear in these data as an over-representation of northern records, because of the assumed tendency of travellers moving south to note a species upon first seeing it but then not mention it thereafter. For example, a traveller on the Ohio and Mississippi Rivers might note a parakeet in Ohio or Indiana but become accustomed to them and not mention the species in Mississippi (see McKinley 1976). Several travelogues containing Carolina Parakeet records make it clear that they are noting the first time that parakeets were seen (e.g., Collot 1826: 134, Morris 1854: 287, Mearns & Mearns 2007: 41).

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Supplementary Material

Full geolocation data for Carolina Parakeet *Conuropsis carolinensis* records presented in this paper (in the style of Burgio *et al.* 2018). The spreadsheet contains the following tabs: new data from this study, amendments to Burgio *et al.* (2018), additional specimens noted by McKinley but not in Burgio *et al.* (2018), additional records noted by McKinley but not in Burgio *et al.* (2018), records from McKinley's (1988) paper on the species in Louisiana, records from other recent publications, museum abbreviations, and references that do not appear in the main text of the manuscript. The combined dataset of all georeferenced Carolina Parakeet observations and specimens is freely available at Figshare (Burgio *et al.* 2025).

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Description of the nest, eggs and nestlings of Ochre-backed Woodpecker *Celeus ochraceus*

by Hilda Raianne Silva de Melo, Bruna Stefane da Silva Santos, Aryna Dias Pereira & Januário da Conceição Júnior

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Summary.—Ochre-backed Woodpecker *Celeus ochraceus* is endemic to northern and north-eastern Brazil south of the Amazon, as far west as eastern Pará and south to Espírito Santo. Despite its ample distribution, few data are available on the species' breeding. Here we provide the first descriptions of the nest, eggs and young of the species based on field work in the state of Maranhão. Nests were cavities excavated in trees of five species—*Terminalia argentea* (Combretaceae), *Copernicia prunifera* (Arecaceae), *Attalea speciosa* (Arecaceae), *Lafoensia glyptocarpa* (Lythraceae) and *Pterodon emarginatus* (Fabaceae)—with mean cavity entrance dimensions of 5.8 ± 0.5 cm (width) and 6.9 ± 1.2 cm (height). Eggs were white, with a mean size of 29.0 × 20.2 mm and mass of 6.01 g. Chicks hatched with their eyes closed and fledged after 24–26 days, when their plumage is similar to that of the adult including the malar marking of males and females. Growth curves of the nestlings were best adjusted to the length of the wing ($R^2 = 0.98$).

Recent studies have highlighted the diversity of life history strategies and breeding ecology of Neotropical birds that nest in cavities. In their review, Bonaparte *et al*. (2024) identified important advances since 2008 in the description of the nests and nesting behaviour of, for example, Ochre-collared Piculet *Picumnus temminckii* (Bodrati *et al*. 2015), Lesser Crescent-chested Puffbird *Malacoptila minor* (Ubaid & Melo 2018) and Moustached Woodcreeper *Xiphocolaptes falcirostris* (Melo *et al*. 2022).

The Neotropical region harbours 35% of the world's cavity-nesting birds, or some 678 species, among them many species of Picidae (van der Hoek *et al*. 2017). Despite this diversity, there is a paucity of data on the natural history of these species, particularly those that excavate their own cavities, which hampers our understanding of their ecology (Aitken & Martin 2008, Cockle *et al*. 2011, Crozariol 2016, van der Hoek *et al*. 2017). Woodpeckers, as primary excavators, use trees as well as substrates such as cacti and termite mounds, thereby creating niches for secondary cavity-nesting species (Winkler *et al*. 2020).

Although Ochre-backed Woodpecker *Celeus ochraceus* has a comparatively large range, in northern and north-eastern Brazil south of the Amazon, as far west as eastern Pará and south to Espírito Santo, knowledge of its reproductive biology remains scarce (del Hoyo *et al*. 2020). Nest sites are not well known, with available records indicating that it uses cavities excavated in trees and possibly arboreal ant or termite nests (del Hoyo *et al*. 2020). However, the duration of nestling development is undocumented, with just a single observation by Leite & Marcelino (2010), who reported a nest containing three nestlings in the state of Tocantins. Their account is the only known description of the species' breeding, highlighting the need for further studies to elucidate key aspects of its ecology, such as incubation and nestling periods, and parental behaviour.

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The present study provides a detailed description of the nest, eggs and nestlings of *C. ochraceus*. It also documents the species' breeding season, further contributing to understanding of its reproductive biology.

Methods

Observations were made in Povoado Piquizeiro II, a rural settlement in the municipality of São João do Sóter (04°49'20.45"S, 43°48'53.94"W), Maranhão, Brazil. This region is dominated by *cerradão* (savanna woodland) with tracts of *cerrado* savanna characterised by extensive stands of carnaúba palms *Copernicia prunifera* (Arecaceae). The region's climate is tropical with dry winters, corresponding to the *Aw* category in the Köppen-Geiger classification (Peel *et al*. 2007). There are two, well-defined seasons, a dry season between July and November, and a rainy season during December to June, with mean annual precipitation of 1,600 mm and a mean temperature of 27.8°C. The study area lies in the central Itapecuru basin, where natural vegetation is being converted rapidly to farmland for the production of commercial crops and is impacted by illegal fires during the dry season.

Nests were encountered opportunistically during general surveys of the avifauna of Povoado Piquizeiro II, between 2020 and 2024. Once identified, each nest was monitored for as long as possible. An endoscopic camera with a 5-m cable and LED lighting was used to inspect the interior of each cavity. Whenever possible, eggs were extracted by hand for measurement. Nests, eggs and nestlings were measured using digital callipers (accurate to 0.05 mm) and a metal ruler (1 mm). Eggs and chicks were weighed using a digital scale (0.01 g). The nest and nestlings were monitored at intervals of 1–4 days, the variation being due to the logistical difficulties of reaching some nests.

Growth curves for the chicks were compiled and adjusted using a second-degree polynomial regression, based on measurements of the wing, tail, culmen and body length, and mass. The polynomial equation and its respective coefficient of determination (R^2) were developed for each parameter. For comparative purposes, morphometric data were taken from two adult *C. ochraceus* trapped in Maranhão and Piauí. Analyses were run in the R program (R Core Team 2022) using the 'ggplot2' (Wickham 2016), 'ggpmisc' (Aphalo 2021) and 'dplyr' packages (Wickham *et al*. 2020).

Results

Ten active nests were encountered during the study, in different years, but always between September and January, which appears to be the species' principal breeding season in the study region, when the woodpeckers are actively preparing their nests and caring for their young.

Like other woodpeckers, the species nests in cavities excavated in the trunks of live or dead trees: *Terminalia argentea* (Combretaceae) (n = 4), *Copernicia prunifera* (n = 3; Fig. 1a), *Attalea speciosa* (Arecaceae) (n = 1), *Lafoensia glyptocarpa* (Lythraceae) (n = 1) and *Pterodon emarginatus* (Fabaceae) (n = 1). In the cavity, a thin layer of small wood chips from the tree lines the base of the incubation chamber. Nest trees had a mean circumference at breast height of 77.9 ± 36.0 cm (range 59.0–126.5 cm) and holes were sited 247.6 ± 145.0 cm (range 125–450 cm) above ground. The parameters of nest measurements are presented in Fig. 1b.

Eggs were white and unmarked (Fig. 1c), measured 20.17 ± 0.34 × 29.0 ± 1.0 mm and weighed 6.01 ± 0.15 g (n = 4). Clutches varied from one (n = 1) to two (n = 4) or three (n = 2) eggs or nestlings. Eggs were laid asynchronously, one per day.

After the chicks hatched, adults removed the eggshells from the nest and then regularly extracted the faecal sacs. Young hatched with closed eyes, featherless, and pink-skinned,

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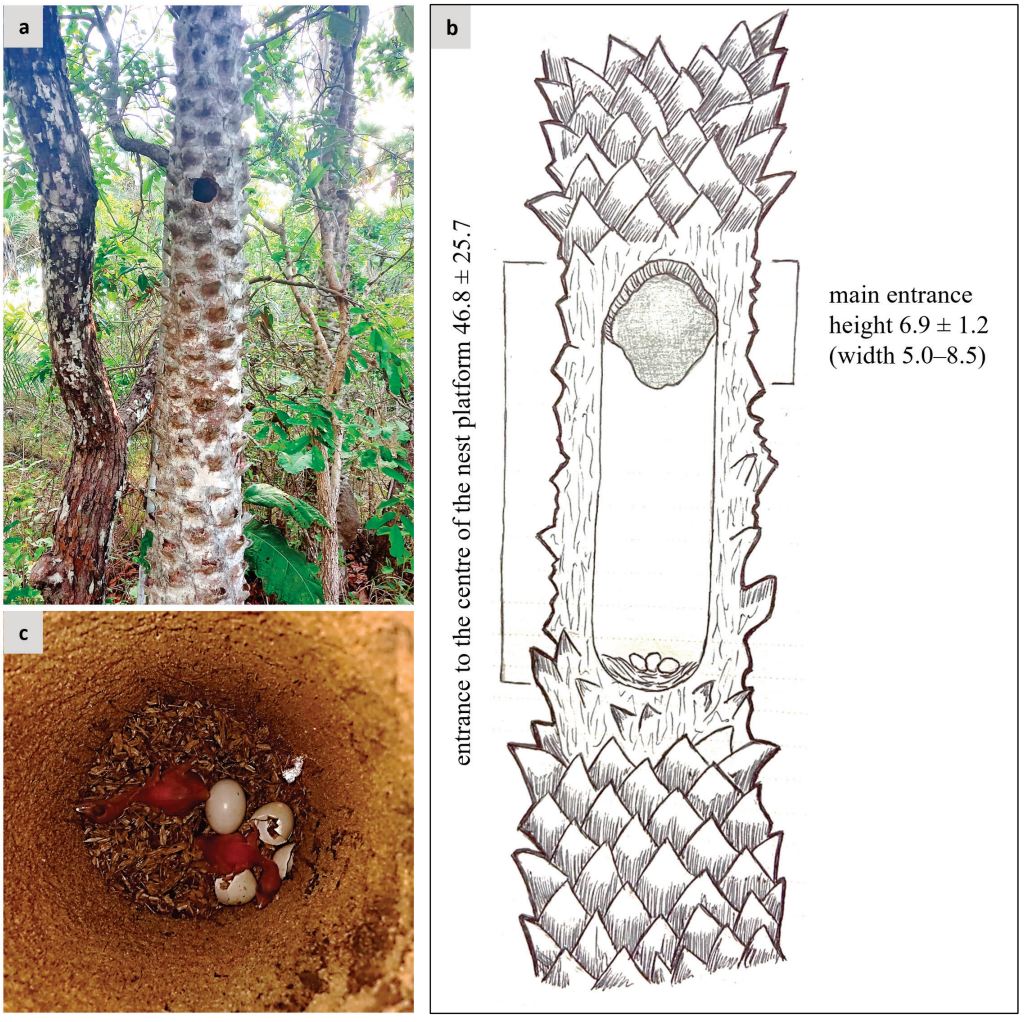

Figure 1. (a) Nest of an Ochre-backed Woodpecker *Celeus ochraceus* in a carnaúba palm *Copernicia prunifera*, Povoado Piquizeiro II, São João do Sóter, Maranhão, Brazil, (b) diagram of the nest, based on measurements (cm) of the ten nests analysed during the present study given as mean ± standard deviation, (c) eggs and nestlings in the nest (a and c: Hilda Raianne Silva de Melo; b: José Arthur Felipe Pequeno)

with a well-developed labial commissure, visible egg tooth and proportionately large head (Fig. 2a). Mean mass was 6.0 ± 1.41 g and total length 63.0 ± 5.65 mm (n = 3). By day ten, the chicks have quills and well-developed feathers on the head, back, wings, vent and tail (Fig. 2b). Around day 20, the plumage coloration was similar to that of the adults, with the barred pattern on the wings and well-defined ochre tones. At this age, the nestlings already emitted soft vocalisations (Fig. 2c). Fledging occurred after 24–26 days, when males and females could be distinguished based on their malar markings (Fig. 2d).

The growth curves showed that most morphological parameters did not reach adult values by the time of fledging (Fig. 3). Body mass increased steadily from day 16 to day 23, but declined slightly just prior to fledging. The best adjustment (R^2 = 0.98) was obtained for wing length (Fig. 3).

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Figure 2. Nestling of Ochre-backed Woodpecker *Celeus ochraceus* (a) one day after hatching, (b) ten days old, (c) 20 days old and (d) 26 days old, Povoado Piquizeiro II, São João do Sóter, Maranhão, Brazil (Hilda Raianne Silva de Melo)

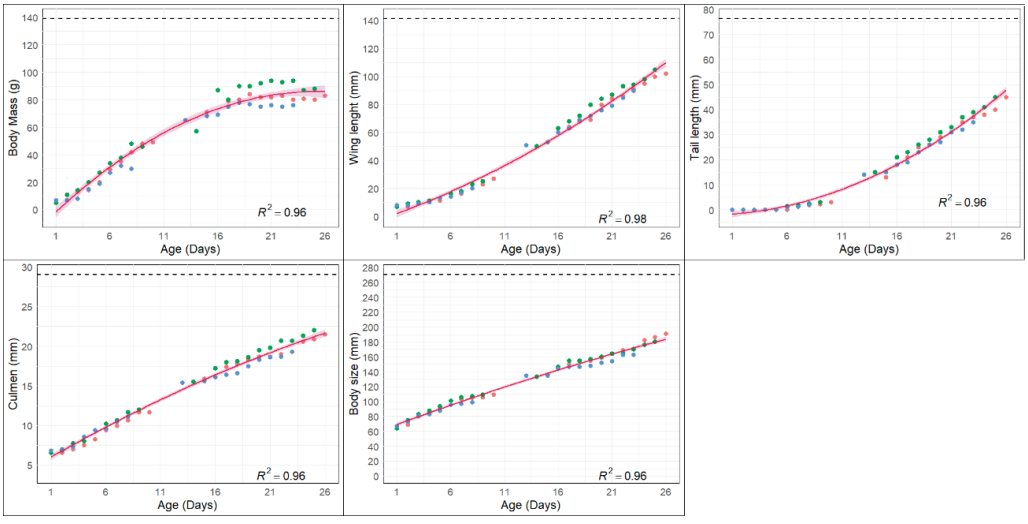

Figure 3. Growth curves of Ochre-backed Woodpecker *Celeus ochraceus* nestlings adjusted according to second-degree polynomial regression. The dashed red lines indicate mean values recorded for two adult *C. ochraceus*. Each coloured dot along the curves represents an individual measurement.

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Discussion

The study of a species' biology is fundamentally important for understanding certain aspects of its natural history and life history parameters. The principal parameters assessed here include clutch size, growth rate and duration of parental care, as well as the breeding season, which is determined by ecological and climatic factors (Bennett & Owens 2002).

Our results indicated that *C. ochraceus* breeds during September–January at our study site in Maranhão, which is covered by *cerradão* woodland and tracts of *cerrado* savanna. This period coincides with the onset and peak of the local wet season, when insect prey is probably most abundant, reflecting the influence of climatic conditions on the species' breeding phenology. Marini *et al*. (2012) noted that the breeding seasons of most Cerrado birds start between September and November, at the onset of the wet season, with relatively short nesting periods of 3–4 months.

The selection of nest site is an important stage in birds breeding (Hoover & Brittingham 1998), given that it determines the environment in which the adults, eggs and nestlings will be exposed during a critical phase of their lifecycle (Rodrigues *et al*. 2017). In our study, *C. ochraceus* nested in live trees of *Terminalia argentea*, *Copernicia prunifera*, *Attalea speciosa*, *Lafoensia glyptocarpa* and *Pterodon emarginatus*, behaviour different from that reported by Leite & Marcelino (2010), who described a *C. ochraceus* nest in a wooden fence post, presumably due to the availability of suitable nest sites in the different areas. The selection of live or dead trees as nest sites appears to vary among species in the genus *Celeus*. In Peru, Rufous-headed Woodpecker *C. spectabilis* has been observed nesting in a live *Cavanillesia* (Malvaceae) tree (Lloyd 2000), whilst in north-east Argentina Helmeted Woodpecker *C. galeatus* nests predominantly in live (partially decayed) trees of *Nectandra lanceolata* and *N. angustifolia* (Lauraceae) (Lammertink *et al*. 2020). In contrast, Chestnut-coloured Woodpecker *C. castaneus* has been reported nesting in dead trees (Russell 1964).

The nest dimensions recorded here for *C. ochraceus* were different from those recorded previously for this species and its congeners: Leite & Marcelino (2010) reported that the diameter of the cavity entrance used by *C. ochraceus* in Tocantins was only 5.8 cm. Winkler *et al*. (1995) also reported a nest entrance with a diameter of just 5 cm for Chestnut Woodpecker *C. elegans*, although Kratter (1998) described a *C. spectabilis* nest with an entrance diameter of 11 cm.

In Tocantins, Leite & Marcelino (2010) encountered a nest of *C. ochraceus* only 90 cm above ground. In our study, the recorded height was 125 cm, a relatively similar value. Compared to congenerics, Winkler *et al*. (1995) observed that nests of *C. castaneus* may also be found 90 cm above ground, whereas those of Waved Woodpecker *C. undatus* may be sited up to 30 m up. Nests of *C. spectabilis* were located 2.8 m above ground (Kratter 1998). These differences may reflect adaptations to the environment or species-specific nesting strategies within the genus *Celeus*.

The eggs of *C. ochraceus* were white and unmarked, a characteristic common among cavity-nesting birds (Oniki 1985), since visual camouflage is unnecessary. Clutch size ranged from one to three eggs, consistent with other tropical woodpecker species, which display considerable variation both among and within species (Martin *et al*. 2000). For example, *C. elegans* lays up to three eggs (Winkler & Christie 2020), *C. castaneus* up to four (Russell 1964) and *C. galeatus* was reported with one to three nestlings per nest in the Atlantic Forest of Argentina (Lammertink *et al*. 2019). This suggests that *C. ochraceus* is similar in these aspects to its congeners.

The characteristics of the *C. ochraceus* nestlings during the first days of life, such as their skin coloration, that they hatch with eyes completely closed and the lack of feathers,

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are typical of most picids, including for example Red-crowned Woodpecker *Melanerpes rubricapillus* (Cruz-Bernate *et al*. 2019) and Green-barred Woodpecker *Colaptes melanochloros* (Jauregui 2020). Ruschi *et al*. (2014) observed that nestlings of White-browed Woodpecker *Piculus aurulentus* hatch naked, but accumulate feathers progressively, until they achieve an appearance similar to the adult female by the end of the nestling stage. At 20 days, *C. ochraceus* was completely feathered, with a coloration similar to that of adults. Jauregui (2020) observed that *Colaptes melanochloros* nestlings are completely covered with feathers 18–20 days post-hatching, which is similar to the pattern recorded by us.

The nestling period of *C. ochraceus* was compared with that of other woodpecker species with sympatric distributions and/or similar morphological traits, as well as with representatives of different genera in the Picidae, to contextualise its reproductive strategy. In our study, nestlings of *C. ochraceus* fledged between days 24 and 26, similar to the value reported for *Melanerpes rubricapillus*, in which fledging occurs between 28 days (Garcés Restrepo *et al*. 2012) and 30–33 days (Skutch 1969). The nestling period of *C. ochraceus* was longer than in Black-cheeked Woodpecker *Melanerpes pucherani* (21 days), but considerably shorter than in Guadeloupe Woodpecker *M. herminieri* (37 days; Winkler *et al*. 2020). Although no published data are available on the nestling period of other *Celeus* species, our results indicate that the nesting of *C. ochraceus* is comparable to that of some species, yet distinct from others, in the family. Such variation is probably associated with differences in parental behaviour, body size or particular aspects of the family's reproductive strategy.

Our detailed descriptions of the nest, eggs and nestlings of *C. ochraceus* represent an important advance in our understanding of the species' natural history. The data also reveal important ecological adaptations, such as flexibility in its selection of nesting substrates, which may reflect the species' capacity to occupy different habitats across a region with different vegetation formations, from *cerradão* woodland to *cerrado* savanna. These findings provide valuable insights for future research and the development of conservation measures, especially for threatened ecosystems such as those of the Cerrado biome. Further studies are recommended to evaluate the species' population dynamics and the impacts of environmental change on the breeding biology of *C. ochraceus*.

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Morphometric and plumage colour variability in subspecies of African Blue Flycatcher *Elminia longicauda* (Stenostiridae) and congenerics

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Summary.—Using museum specimens, we employed canonical variate analysis to test for differences in morphometrics and plumage colour among subspecies of African Blue Flycatcher (*Elminia longicauda longicauda*, *E. l. teresita* and, using mensural data alone, *E. l. loandae*) as well as two other *Elminia* species—White-tailed Blue Flycatcher *E. albicauda* and Dusky Crested Flycatcher *E. nigromitrata*—to elucidate whether variation between *E. longicauda* subspecies is comparable to that in congenerics. We found statistically significant differences in morphometrics and plumage coloration among *Elminia* species, as well as between *E. longicauda* subspecies in ventral plumage coloration, tail and tarsus lengths, and bill depth. Thus, the validity of two *E. longicauda* subspecies is supported. Future studies, such as genetic or behavioural analyses, could further test for differences among these taxa and elucidate the vicariant mechanisms that led to their evolution.

Molecular and morphometric systematic studies below the species level are important in exposing the history of species with larger geographic distributions. These studies can also be sensitive to temporally local evolutionary changes. A species that is distributed into reproductively isolated populations is a good candidate for a vicariant evolutionary event (Ridley 2004). However, if there is sufficient genetic interchange between distinct populations of a species, then subspecies distinction may be inappropriate (Ball & Avise 1992, Zink 2004, Winkler 2010). Whether populations of a species can be statistically separated from one another is likely to be case-dependent and, consequently, the practice of testing subspecies hypotheses is scientifically valid for identifying potential vicariance events (Winkler 2010).

In Afrotropical birds, the gradual reduction and fragmentation of forests over recent geologic history is a major factor driving speciation via isolation of forest birds (Fjeldså & Bowie 2008). Several African regions are particular 'hotspots' for this, including the area around Mt. Cameroon, in which subspecies or species differences may be found in association with elevational changes, rivers, and forest/savanna transitional zones (Prigogine 1987, Louette 1992, Smith *et al*. 2004).

Using museum specimens, we aimed to examine for quantitative differences among three subspecies of African Blue Flycatcher *Elminia longicauda* based on morphometrics and plumage coloration. *E. longicauda* inhabits riparian habitats of West Africa east to the central highlands of Africa (Hall & Moreau 1970). Its populations appear to be naturally disjunct. This fragmented distribution has possibly promoted geographical differentiation, with multiple subspecies being recognised (Sclater & Mackworth-Praed 1918, White 1963, Mayr *et al*. 1986, Erard *et al*. 1997). *E. l. longicauda* inhabits West Africa, from Gambia to Nigeria, whilst the other commonly recognised subspecies, *E. l. teresita*, occurs from eastern Nigeria and Cameroon to western Ethiopia, Tanzania and Kenya (Hall & Moreau 1970, Mayr *et al*. 1986; Fig 1; but see Discussion). Their potential ranges overlap in the vicinity of Cameroon

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Figure 1. Geographic distribution of African Blue Flycatcher *Elminia longicauda* subspecies *E. l. longicauda* and *E. l. teresita*, with the area of potential range overlap indicated by a question mark. Shapefile generated from the IUCN database.

(Fig. 1). A third subspecies, *E. l. loandae* described from Angola (Sclater & Mackworth-Praed 1918), is usually considered a synonym of *E. l. teresita* (Mayr *et al*. 1986, Erard *et al*. 1997). Colour differences in *E. longicauda* populations provide the conventional qualitative basis for subspecies classification. *E. l. teresita* has a white belly and generally paler underparts compared to the darker underparts of *E. l. longicauda* (Sclater & Mackworth-Praed 1918, White 1963; Fig. 2). Additionally, there may be genetic differences in *E. longicauda* populations, but only *E. l. teresita* has been screened to date (Nguembock *et al*. 2008).

Figure 2. Ventral plumage colour differences between the subspecies of African Blue Flycatcher *Elminia l. longicauda* (left-hand three), *E. l. teresita* (middle three) and *E. l. loandae* (right-hand two), showing the whiter belly of *E. l. teresita* in contrast to the darker underparts of *E. l. longicauda* (Guy M. Kirwan, © Trustees of the Natural History Museum, London)

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While collecting morphometric data on museum specimens for other studies (e.g., Corbin 2008), we observed that some *E. longicauda* specimens appeared to possess variable morphometric characteristics and wondered if these might possess statistical support. Furthermore, to our knowledge apparent differences in plumage coloration between *E. l. longicauda* and *E. l. teresita* had never been quantified and examined statistically. Hence, our goal was to test if there are significant differences in morphometrics and/or coloration between *E. l. longicauda* and *E. l. teresita*. Additionally, we tested for differences in morphometric traits alone among specimens labelled as *E. l. loandae*, *E. l. longicauda* and *E. l. teresita*.

We also quantified morphometrics and plumage coloration of two other *Elminia* species—White-tailed Blue Flycatcher *E. albicauda* and Dusky Crested Flycatcher *E. nigromitrata*—to elucidate whether variation between *E. longicauda* subspecies is comparable to variation among congenerics. *E. albicauda* is phylogenetically most closely related to *E. longicauda* (Nguembock *et al*. 2008) and Hall & Moreau (1970) and Erard *et al*. (1997) suggested they form a superspecies. *E. nigromitrata* was recovered as sister to both *E. longicauda* and *E. albicauda* (Nguembock *et al*. 2008).

Methods

We measured ten morphometric characters in specimens (*Elminia l. longicauda* [*n* = 42]; *E. l. loandae* [*n* = 24]; *E. l. teresita* [*n* = 107]; *E. albicauda* [*n* = 27]; and *E. nigromitrata* [*n* = 9]; Table 1) at the Natural History Museum, Tring (NHMUK), Field Museum of Natural History, Chicago (FMNH) and American Museum of Natural History, New York (AMNH). For *E. longicauda* subspecies designation, we referred to identifications made on specimen labels. We excluded juvenile specimens from our study. Morphometric characters were selected for their relevance to the species' behaviour and ecology (Miles *et al*. 1987, Corbin 2008, Töpfer 2018) as well as their potential for separating taxa within *Elminia* (i.e. tail length and the relative lengths of rectrix 1 and 2; see below). We measured wing chord and tail with a ruler to the nearest 0.5 mm. The following were measured using digital callipers: tarsus length, middle toe length, bill length (from naso-frontal suture to tip), bill width across quadrates,

TABLE 1
Geographical distribution (by country) of *Elmina* specimens sampled for morphometric analysis.

Country	***E. albicauda***	***E. l. longicauda***	***E. l. loandae***	***E. l. teresita***	***E. nigromitrata***
Angola	12	-	21	-	-
Cameroon	-	-	-	51	1
Central African Republic	-	-	-	3	-
Democratic Republic of Congo	10	-	-	-	3
Gambia	-	1	-	-	-
Ghana	-	8	-	-	-
Ivory Coast	-	3	-	-	-
Kenya	-	-	1	11	4
Liberia					1
Nigeria	-	19	-	-	-
Sierra Leone	-	11	-	-	-
Sudan	-	-	-	7	-
Tanzania	3	-	-	-	-
Uganda	-	-	2	35	-
Zimbabwe	1	-	-	-	-
Totals	27	42	24	107	9

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TABLE 2
Geographical distribution (by country) of *Elmina* specimens sampled for analysis of colour (luminance).

Country	***E. albicauda***	***E. l. longicauda***	***E. l. teresita***	***E. nigromitrata***
Angola	13	-	-	-
Cameroon	-	12	18	1
Central African Republic	-	1	-	-
Democratic Republic of Congo	9	-	13	5
Ghana	-	3	-	-
Ivory Coast	-	3	-	-
Kenya	-	-	12	4
Liberia	-	-	-	1
Nigeria	-	8	-	-
Sierra Leone	-	4	-	-
Tanzania	3	-	-	-
Uganda	4	-	6	-
Zimbabwe	1	-		-
Totals	30	31	49	11

bill width across nares, bill depth including maxilla and mandible at naso-frontal suture, longest rictal bristle length and projection of the first rectrix beyond the second.

We quantified coloration of *Elminia* specimens via digital image analysis. This method is highly repeatable, independent of the human vision system, and preferred over spectrometry for objectively quantifying the coloration of large portions of avian plumage (Endler 2012, McKay 2013). We photographed plumage of specimens (*E. l. longicauda* [*n* = 31]; *E. l. teresita* [*n* = 49]; *E. albicauda* [*n* = 30]; and *E. nigromitrata* [*n* = 11]; Table 2) at AMNH and FMNH. Unfortunately, these collections lacked specimens identified as *E. l. loandae*, so we were unable to analyse its plumage coloration (morphometric and plumage colour measurements were taken at different times as part of separate sampling efforts). Specimens were photographed using an Exilim Ex-ZR100, 12.5 Megapixel digital camera (Casio Computer Co., Tokyo). Camera settings (e.g. white balance, exposure, etc.) were set manually to prevent image under-exposure, saturation and other biases inherent to the camera (Stevens *et al*. 2007). To standardise lighting conditions, specimens were photographed in a white photography box with the camera mounted at a uniform distance of *c*.30 cm from each specimen. All specimens were photographed alongside a greyscale of known reflectance (p. 1 of *Globe soil colour book*, Visual Colour Systems, New York). Images were saved as JPEG files with minimal compression. This renders information loss from image compression negligible but permits adequate disc space to accumulate a large photographic dataset (Bergman & Beegner 2008, Langkilde & Boronow 2010).

Photographs were analysed in IMAGEJ version 1.47 (National Institutes of Health, Bethesda, MD). We used the 'Freehand Selection' tool to select areas of interest in each image and the 'Colour Histogram' plugin to record the mean R, G and B channel pixel values of each area. In each specimen, we selected the crown and nape, mantle, the entire breast and belly, and dorsal and ventral surfaces of the tail feathers. All patches of worn or damaged plumage were avoided during sampling. When using digital photography to quantify coloration, several steps must be taken to account for and correct biases due to natural variations in lighting and camera processing (Stevens *et al*. 2007). Hence, we

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tested for a linear relationship in our camera's response to changes in lighting intensity by examining RGB data over known reflectance values from our greyscale reflectance standard, and we then equalised the RGB channels to the reflectance standard (Stevens *et al*. 2007). Finally, we converted equalised RGB data into a biologically meaningful metric (Endler 2012). Because our primary interest in coloration was searching for statistical differences in the lightness of plumage among *E. longicauda* subspecies and congeners, we converted RGB data into luminosity (R + B + G), a measure described by Endler (2012). Plumage coloration of museum specimens may fade with age (Armenta *et al*. 2008) and could have affected our results. To assess this, we constructed a principal component from a covariance matrix of the original luminance variables regressed against year of collection by subspecies.

We performed statistical analyses with JMP Pro 17.2.0 (Version 17.2.0. SAS Institute Inc., Cary, NC, 1989–2023). Morphometric data were non-normally distributed, so we $\log_{10}$ transformed them prior to analysis. We performed Canonical Variates Analysis (CVA; Hotelling 1936) on the log-transformed morphometric data using species of *Elminia* and then on subspecies of *E. longicauda*. We also performed CVA on plumage colour (luminance) measurements in species of *Elminia* and then *E. l. longicauda* and *E. l. teresita*, respectively. Additionally, we tested for sexual dimorphism in *E. longicauda* subspecies using a nested analysis of variance of principal components (sex within subspecies) from the covariance matrix of the ten morphometric variables measured to evaluate if possible sexual dimorphism could influence our analyses. Finally, we performed regressions of the primary luminance principal component over estimated longitude of collection sites to evaluate if geographic clines can explain variation in colour traits in *E. l. longicauda* and *E. l. teresita*. The raw data are available on request from either of the authors.

Results

Among the three *Elminia* species sampled, the first canonical axis explained *c*.80% of the variation and described differences based on tail length, toe length and T1 projection (*E. longicauda* vs. the other two species). Along the second axis, *E. nigromitrata* had bill length, width and depth larger relative to the other two species. These differences were statistically significant (Wilkes Lambda = 0.04, F = 61.8, P <0.001) and only two of 173 *E. longicauda* specimens were misclassified as *E. albicauda* (Table 3). In *E. longicauda*, the subspecies differ morphometrically (Wilkes Lambda = 0.47, F = 8.11, P <0.001). Of 43 *E. l. longicauda* specimens, 72% were predicted to be more similar to their group multivariate centroid than to *E. l. teresita* or *E. l. loandae*. Eighty-six percent of the 107 *E. l. teresita* specimens were correctly classified and 52% of *E. l. loandae* specimens were correctly identified (Table 4). Primary morphometric characteristics separating subspecies included a longer tail and tarsus for *E. l. longicauda*, and a deeper-based bill for *E. l. teresita* (Fig. 3). Among *E. longicauda* subspecies, only *E. l. longicauda* exhibited statistically significant size dimorphism (in tail length alone; t = 3.46, df = 20.8, P = 0.002), however, male *E. l. teresita* tends to have a longer tail than females

TABLE 3
Actual and predicted *Elminia* species classifications based on canonical variate analysis of morphometric measurements.

Species	***E. albicauda* (predicted)**	***E. longicauda* (predicted)**	***E. nigromitrata* (predicted)**	***N***
E. albicauda (actual)	100%	0%	0%	27
E. longicauda (actual)	0.01%	0.99%	0%	173
E. nigromitrata (actual)	0%	0%	100%	9

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TABLE 4
Actual and predicted African Blue Flycatcher *Elminia longicauda* subspecies classifications based on canonical variate analysis of morphometric measurements.

Subspecies	***E. l. longicauda* (Predicted)**	***E. l. loandae* (Predicted)**	***E. l. teresita* (Predicted)**	***N***
E. l. longicauda (actual)	72%	0%	28%	43
E. l. loandae (actual)	0%	52%	48%	24
E. l. teresita (actual)	9%	5%	86%	107

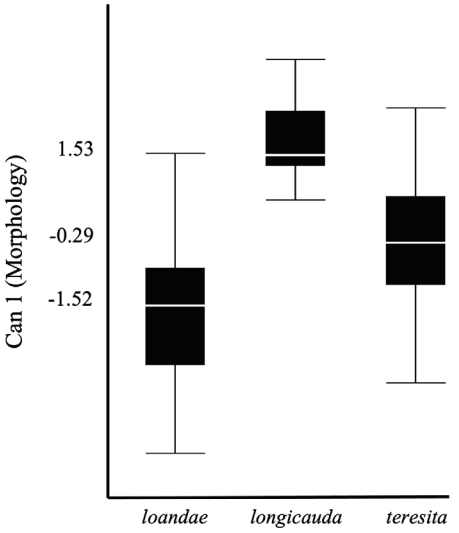

Figure 3. Canonical variate analysis axes for morphometrics of African Blue Flycatcher *Elminia longicauda* subspecies based on ten morphological characters. The first canonical variable explained almost 87% of the total variation (Wilkes Lambda = 0.44, F = 8.02, P <0.0001) and is interpreted as an overall size axis.

TABLE 5
Actual and predicted *Elminia* species classifications based on canonical variate analysis of colour (luminance) measurements.

Species	***E. albicauda* (predicted)**	***E. longicauda* (predicted)**	***E. nigromitrata* (predicted)**	***N***
E. albicauda (actual)	93%	7%	0%	29
E. longicauda (actual)	0%	100%	0%	79
E. nigromitrata (actual)	0%	0%	100%	11

(t = 1.93, df = 94.2, P = 0.06). Our sample of *E. l. loandae* was very small (n = 3) and so could not be analysed morphometrically in respect of potential sexual dimorphism. A nested analysis of variance of these components (sex within subspecies) revealed differences among taxa in both components but no sexual dimorphism within any subspecies (F = 0.35, df = 3, P = 0.79).

Among the three *Elminia* species sampled, the first canonical axis explained *c*.74% of variation and the second explained *c*.26% of plumage colour (luminance) variation. Differences in plumage luminance among species were statistically significant (Wilkes Lambda = 0.02, F = 120, P <0.001). Predicted species classifications based on canonical variate analysis of plumage luminance were 100% accurate in most comparisons, with the exception of a small percentage (7%) of predicted *E. longicauda* misclassified as actual *E. albicauda* (Table 5). In *E. longicauda*, *E. l. teresita* was brighter overall (see Fig. 4), particularly belly plumage (Wilkes Lambda = 0.56, F = 11.26, P <0.001). In general, subspecies clustered independently with respect to luminance (Table 6) yet one-third (35%) of *E. l. longicauda*

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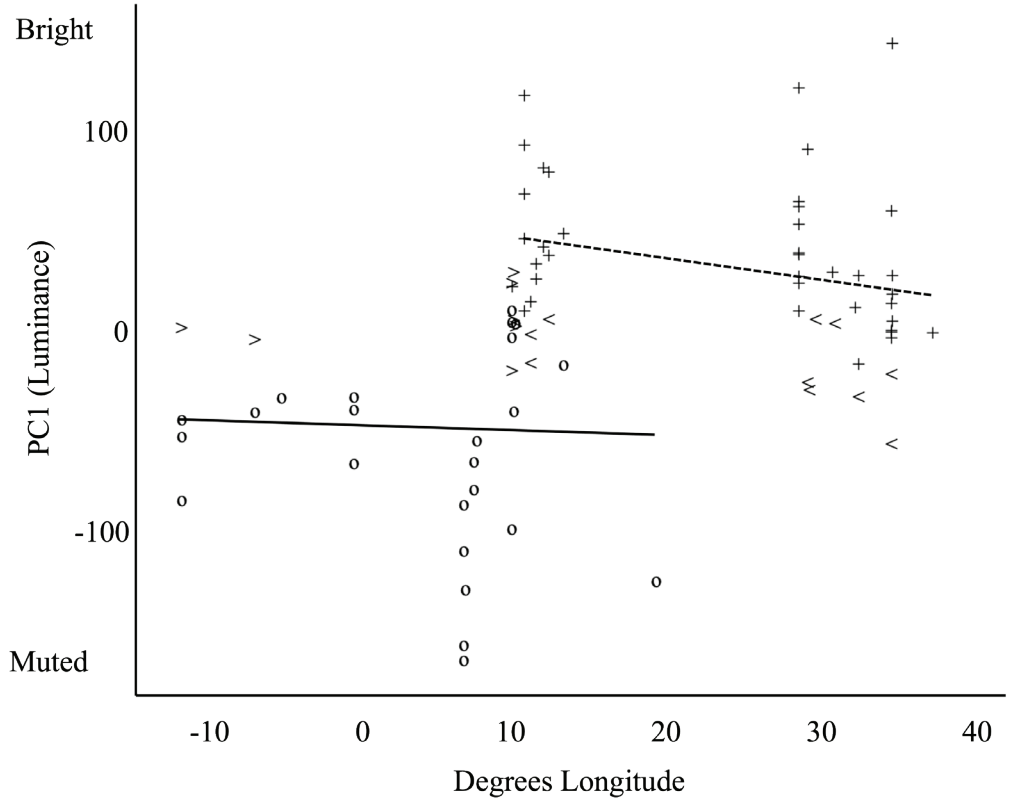

Figure 4. Clinal luminance variation and misclassification in African Blue Flycatcher *Elminia longicauda* subspecies with longitude. *E. l. teresita* specimens (+ and < symbols) are brighter on average than nominate specimens (o and > symbols) (t = 6.8, df = 53.9, P <0.0001). > = *E. l. longicauda* misclassified as *E. l. teresita*; and < = *E. l. teresita* misclassified as *E. l. longicauda*. Solid line = regression for *E. l. longicauda*; stippled line = regression for *E. l. teresita*. Regression lines are not significant (*E. l. longicauda* R^2 = 0.001, F = 0.035, P = 0.85; *E. l. teresita* R^2 = 0.072, F = 3.59, P = 0.064) but are shown to illustrate subspecific differences.

TABLE 6
Actual and predicted African Blue Flycatcher *Elminia longicauda* subspecies classifications based on canonical variate analysis of colour (luminance) measurements.

Subspecies	***E. l. longicauda* (predicted)**	***E. l. teresita* (predicted)**	***N***
E. l. longicauda (actual)	65%	35%	33
E. l. teresita (actual)	10%	90%	48

specimens were misclassified as *E. l. teresita.* Much of the misclassification occurred in the geographic region of overlap around 10–13ºE (Fig. 4). Regression lines of luminance plotted over longitude were not significant for either subspecies (*E. l. longicauda* R^2 = 0.001, F = 0.035, P = 0.85; *E. l. teresita* R^2 = 0.072, F = 3.59, P = 0.064).

Only in *E. l. longicauda* were more recently collected specimens brighter (R^2 0.2, F = 7.5, P = 0.01). However, the low R^2 and potential outliers prompted us to conduct a post-hoc Lack of Fit Test (JMP Pro 17.2.0). This was significant (Maximum R^2 = 0.6, F = 3.05, P = 0.02). Hence, age of specimens did not affect our results. Most likely, this would have affected our

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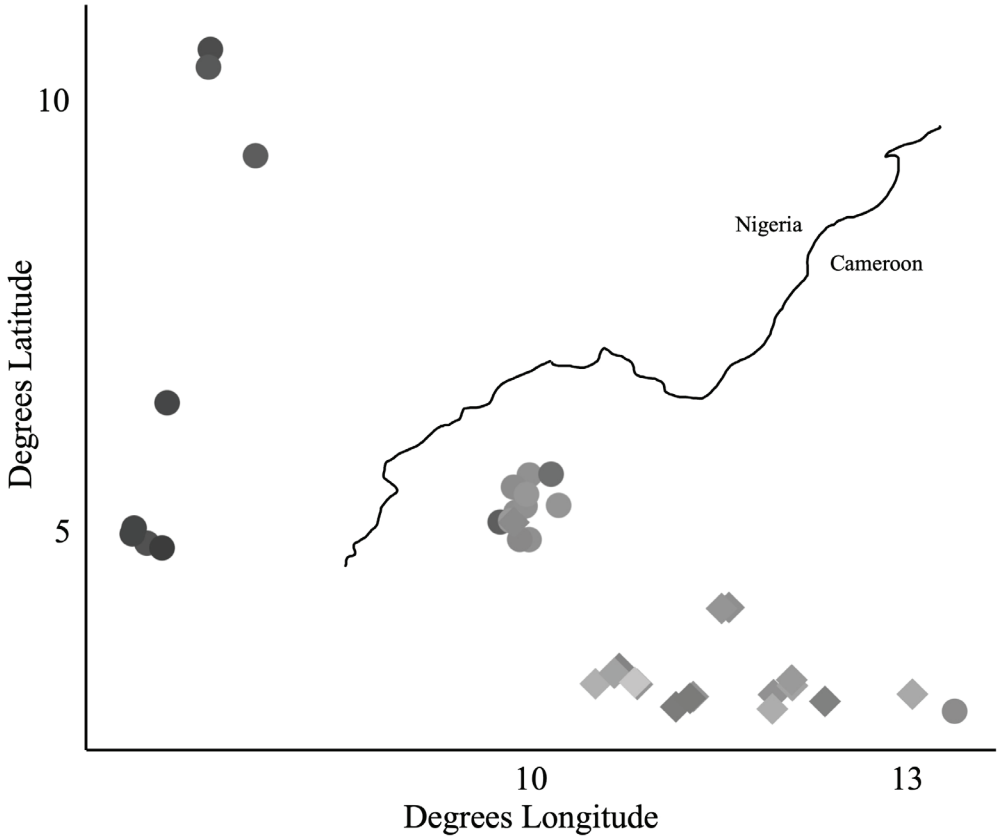

Figure 5. Map of specimens used for colour analysis from Cameroon and Nigeria. Belly luminance, which is a character generally used to diagnose *E. l. longicauda* from *E. l. teresita*, is indicated by the shade of the symbol. The paler the symbol, the brighter the belly. Filled circles = *E. l. longicauda*; filled diamonds = *E. l. teresita*, but all specimens from Nigeria were originally labelled *E. l. longicauda*. The line approximates to the Cameroon/Nigeria border. Many of our latitude/longitude entries are estimates based on museum label data and as a result their positions have been randomly displaced slightly to reduce the extent of graphical overlap.

results if all *E. l. teresita* specimens had been collected more recently than *E. l. longicauda* but they were not (t = 0.27, P = 0.80).

Discussion

Unsurprisingly, our analyses strongly supported significant differences in morphometrics and plumage coloration (luminance) among the species *E. albicauda*, *E. longicauda* and *E. nigromitrata* (Tables 3 and 5). A small number (7%) of *E. longicauda* were misclassified as *E. albicauda* based on plumage luminance (Table 5); however, this is likely an artifact of the overall similarities in plumage coloration between the two species, which are visually very similar dorsally (Hall & Moreau 1970, Erard *et al*. 1997, Clement 2020). Additionally, they share a relatively recent evolutionary history (Hall & Moreau 1970, Nguembock *et al*. 2008).

Our primary goal was to examine if statistically significant differences occur between *E. longicauda* subspecies, which traditionally are qualitatively distinguished by ventral coloration (Sclater & Mackworth-Praed 1918, White 1963, Erard *et al*. 1997; Fig 2). Our analyses demonstrate that differences between *E. l. longicauda* and *E. l. teresita* in both

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plumage coloration and morphometric characteristics are statistically supported, validating these taxa as distinct infraspecific groupings. We also identified morphometric differences among *E. l. loandae* and recognised *E. longicauda* subspecies; however, *E. l. loandae* was more frequently misclassified (Table 4) and is similar in morphometric space to *E. l. teresita* (Fig. 3). Future work with a larger sample is needed to further explore/clarify the status of *E. l. loandae* with respect to recognised *E. longicauda* subspecies. Additionally, our study lacked a quantified sample of *E. l. loandae* plumage coloration for comparison to recognised *E. longicauda* subspecies. This is an important consideration for future work as *E. l. loandae* was initially described as having brighter plumage than *E. l. teresita* (Sclater & Mackworth-Praed 1918).

Misclassifications in both colour and morphometrics occurred more frequently between *E. longicauda* subspecies (Tables 4 and 6) than among other *Elminia* species (Tables 3 and 5), suggesting variation within *E. longicauda* is not as distinct as that among *Elminia* species. While Tobias *et al*. (2010) provided criteria to delimit species, we do not feel that there is sufficient justification in our data to consider elevating *E. longicauda* subspecies to species status, but other potential lines of evidence have yet to be examined (e.g., acoustics, behaviour). The main differences we identified between *E. longicauda* subspecies were statistically brighter plumage (especially the belly) and deeper-based bill in *E. l. teresita*, vs. longer tail and tarsus in *E. l. longicauda* (Fig. 3). Although ventral coloration has long been recognised as a trait to distinguish the subspecies (Sclater & Mackworth-Praed 1918, White 1963, Erard *et al*. 1997), our study is the first to demonstrate this statistically, and morphometric differences appear to have not been previously reported for the group.

Statistical differences in plumage colour and morphometric measurements have been demonstrated in other avian subspecies and have helped support their validity (e.g., Patten & Unit 2002, Loskot 2005, Luttrell *et al*. 2015). Morphometric differences among subspecies have been attributed to local adaptations or supporting behavioural differences (Arizaga *et al*. 2006, Greenburg & Olsen 2010). Likewise, differences in plumage coloration among subspecies can be attributed to assortative mating or environmental factors (Inouye *et al*. 2001, Olsen *et al*. 2010). Therefore, it is probable that the plumage colour and morphometric differences observed between *E. longicauda* subspecies can be attributed to one or more of these factors, and field studies could further investigate relationships between these traits and environmental or evolutionary variables.

The described ranges of *E. longicauda* subspecies (Mayr *et al*. 1986) appear to overlap in Cameroon, creating the potential for genetic admixture between populations (Fig. 1). Additionally, based on our study we found the majority of misclassifications among subspecies occurred in this general geographic region around 10–13°E (Figs. 4–5). Recent authors (Elgood *et al*. 1994, del Hoyo & Collar 2016, Languy 2019) treat populations in eastern Nigeria and Cameroon as either *E. l. longicauda or E. l. teresita*, rather than recognising the possibility that both subspecies might occur. Our colour analysis suggests the nominate occurs in Nigeria and across most of Cameroon with *E. l. teresita* only at the base of the Mambilla Plateau in western Cameroon. Thus, a logical step for future work is to examine populations of *E. longicauda* subspecies in this region from a genetic standpoint with broader geographic sampling (available museum specimens from this region are modest), to elucidate if subspecies are genetically supported, and to what degree admixture might occur. It is notable that *E. longicauda* itself appears to be a relatively young species among the Stenostiridae, having been estimated to have diverged from its sister taxon, *E. albicauda*, *c*.0.01–0.08 mya (Nguembock *et al*. 2008). Additionally, Nguembock *et al*. (2008) reported that *E. longicauda* may be non-monophyletic, although only *E. l. teresita* was screened. Thus, genetic analysis may help resolve taxonomic questions regarding the status of *E. longicauda*.

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Other traits helpful to consider when evaluating taxonomy, such as potential acoustic and behavioural differences among *E. longicauda* subspecies (Tobias *et al*. 2010), could be studied by field workers.

Lastly, it is notable that other pairs of African forest bird taxa separate in the same general area of Nigeria/Cameroon where *E. longicauda* subspecies changeover (Prigogine 1987, Louette 1992, Smith *et al*. 2004). It has been speculated that changes in forest to savanna and other environmental shifts in relatively recent geological history have isolated forest bird populations and restricted gene flow among them, causing divergence (Prigogine 1987, Louette 1992). Although further study is needed, this mechanism plausibly also explains the differentiation of *E. longicauda* subspecies.

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The correct authorship and type material of *Phoenicoparrus jamesi*

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Summary.—The flamingo *Phoenicopterus jamesi*, named for Henry Berkeley James and now usually placed in the genus *Phoenicoparrus*, became known to science as a result of collections made by Carlos Rahmer in the northern Chilean Andes in early 1886. For the past century, authorship has been almost invariably attributed to P. L. Sclater, writing in the *Proceedings of the Zoological Society of London*, despite that Rahmer published his own account in Spanish, in the *Anales de la Universidad de Chile*, in a paper that remained virtually unseen outside Chile for decades. Both manuscripts were ostensibly published in 1886, with Sclater's now widely accepted as dating from October based on subsequent research, whereas Rahmer's apparently appeared in August. Despite our extensive investigations, concrete evidence to precisely date the *Anales* paper has proved elusive. As a consequence, following the ICZN *Code* Art. 21 a specified date was available, which could be further narrowed to a precise day, 31 August 1886 (*cf.* Art. 21.3.1), thereby giving priority to Rahmer. Such treatment matches that afforded to other avian nomina authored in the same periodical. With respect to the type material, we show that the three specimens (an adult male and immatures of both sexes) sent to Sclater in London and now in the Natural History Museum, Tring, are syntypes (not holotype and paratypes) of *Phoenicopterus jamesi* P. L. Sclater, 1886, but that the adult male is also the holotype of *Phoenicopterus Jamesi* Rahmer, 1886. Two specimens in the Museo Nacional de Historia Natural, Santiago, proposed as a lectotype and paralectotype are here determined to have no type status, although one from the type locality is topotypical and a probable paratype.

Authorship of the high-Andean James's Flamingo *Phoenicoparrus jamesi* has almost universally been accorded to Sclater (1886) since the first installment of Peters' (1931) benchmark world checklist and Hellmayr's (1932) monograph on the Chilean avifauna (e.g., Hellmayr & Conover 1948, Johnson & Goodall 1965, Blake 1977, Kahl 1979, del Hoyo 1992), including all of the modern global checklists (Dickinson & Remsen 2013, del Hoyo & Collar 2014, Clements *et al*. 2024, Gill *et al*. 2024). Seemingly the only exception to this occurs in a review of the avian type material held in the Museo Nacional de Historia Natural de Chile, Santiago, wherein authorship was assigned to Rahmer (1886) and the 'type series' was said to comprise two specimens (a lectotype and paralectotype) collected by Rahmer and held in the latter collection (Torres-Mura & Lemus 1989). *Phoenicopterus jamesi* P. L. Sclater, 1886, was reported to be based on a holotype also collected by Rahmer held in what is now the Natural History Museum, Tring (Warren 1966: 146).

What *is* clear from all of the available accounts is that the new species was discovered and collected by Carlos F. Rahmer (fl. 1880–1912), a Chilean-German taxidermist and

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deputy director of the Museo Nacional de Historia Natural, Santiago, during an expedition in early 1886 to the Tarapacá region of northern Chile at least partially financed by Henry (Harry) Berkeley James (1846–91), an English entrepreneur then based in the country, and led by Rodolfo Amando Philippi (1808–1904) (see also James 1892: v). Here, we revisit the available evidence to settle the issue of priority, as well as reviewing the type material associated with both names.

Which has priority? *Phoenicopterus jamesi* Rahmer, 1886 vs. *Phoenicopterus jamesi* P. L. Sclater, 1886?

The two 'competing' descriptions were both ostensibly published in the second half of 1886. In the case of Sclater's, in the *Proceedings of the Zoological Society of London*, we are fortunate to possess detailed reviews of this periodical's publication dates (see Dickinson *et al*. 2011), but for Rahmer's, which appeared in the *Anales de la Universidad de Chile*, we are unaware of any critical review of this journal's publishing history, and data on this issue (based on our enquiries, see below) seem to be very few.

Rahmer's original description can be cited thus: *Phoenicopterus Jamesi* Rahmer, 1886, *Anales de la Universidad de Chile* 69: 753.—foot of Isluga volcano, 3,500 m, Tarapacá, Chile. Sclater's thus: *Phoenicopterus jamesi* P. L. Sclater, 1886, *Proceedings of the Zoological Society of London* 1886: 399, Plate 36 (Fig. 1) and fig. 3 [in text].—Sitana [= Sitani, *c*.3,700 m, 19º16'S, 68º42'W], foot of Tsluga [= Isluga] volcano, Tarapacá, Chile (see Paynter 1988: 242). What is also clear is that Rahmer sent at least one additional notice of his discovery, including a colour illustration (Fig. 2), to the *Journal für Ornithologie*, in a communication dated 28 October 1886 that was published in April 1887.[1]

Figure 1. Plate 36 in Sclater (1886) showing the adult male syntype (NHMUK 1912.10.17.1) of James's Flamingo *Phoenicoparrus jamesi* (P. L. Sclater, 1886) and the holotype of *Phoenicoparrus jamesi* (Rahmer, 1886) (courtesy of the Biodiversity Heritage Library)

Although Philip Lutley Sclater's (1829–1913) original description was received on 25 June 1886, based on the review by Duncan (1937) the real date of its publication was 1 October 1886. It is pertinent to note that prior to this, in 1932, Carl Eduard Hellmayr (1878–1944), without the benefit of Duncan's research, seems to have used the date of the meeting where Sclater's note was read, i.e. 25 June (Hellmayr 1932), as the publication date. Rahmer's original description is said to have been published in August

[1] Multiple notices concerning new 'species' by a single author were not uncommon during the 19th century, e.g. see the examples noted by Kirwan & Kirkconnell (2022), McAllan (2016) and Rookmaaker (2016) for Cassin, E. P. Ramsay and A. Smith respectively.

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(Torres-Mura & Lemus 1989), presumably based on the page header date issued with his article in the *Anales de la Universidad de Chile* (V. Neira Barría *in litt*. March 2024, J. C. Torres-Mura *in litt*. June 2024), rather than the type of forensic investigation into the dates of publication of the *Proceedings of the Zoological Society of London* (*PZS*) undertaken by Duncan (1937). Hellmayr (1932) was basically opaque as to when Rahmer's description had been issued, except to imply that it must have been published later than Sclater's. This case contrasts with Hellmayr's usual punctiliousness over a question of this sort, where priority was clearly 'up for grabs'; it is surprising that he offered no explanatory footnote in either his Chile monograph or in the relevant volume of the Catalogue of birds of the Americas (Hellmayr & Conover 1948: 278). That, around the same time as the first of these works was being finalised, Hellmayr read the proofs of Peters' checklist (Peters 1931: vii) was perhaps significant in cementing the view that Sclater's publication had priority.

Our enquiries in Chile, with the journal's publisher, the Universidad de Chile (V. Neira Barría *in litt*. March 2024), the Biblioteca Científica Abate Juan Ignacio Molina, Museo Nacional de Historia Natural, Santiago (G. Riveros), and the country's national library (Biblioteca Nacional de Santiago de Chile), have failed to yield any concrete information as to when the relevant part of the *Anales* appeared, or even how this periodical was published during the relevant period[2]—in parts or only when all parts comprising a volume were ready? Furthermore, the pre-1900 volumes of the *Anales de la Universidad*

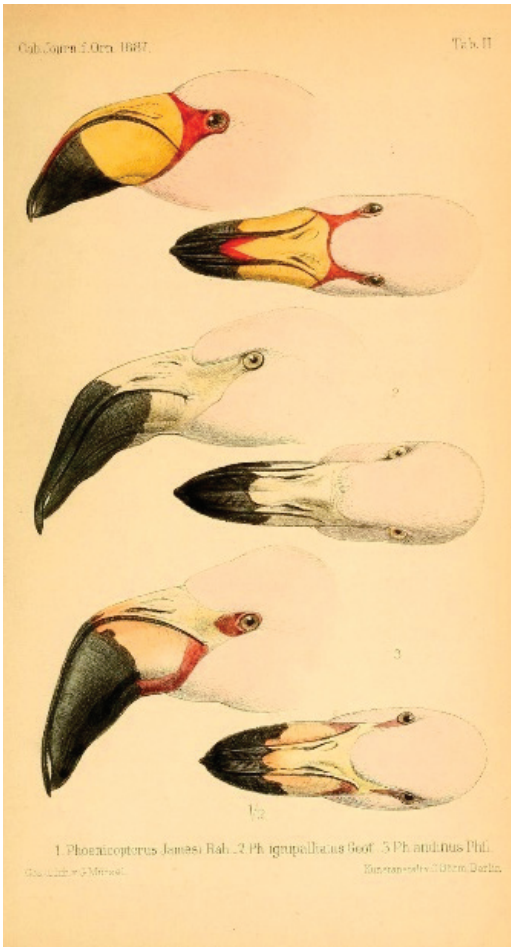

Figure 2. Plate 2 of Rahmer (1887) showing the bill shapes and patterns of (top to bottom) *Phoenicopterus jamesi* Rahmer, 1886; *P. ignipalliatus* I. Geoffroy St. Hilaire, 1829 [= Chilean Flamingo *P. chilensis* Molina, 1782]; and *P. andinus* R. A. Philippi, 1854; note the dissimilarity between the bill pattern portrayed for *P. jamesi* with either specimen in the Museo Nacional de Historia Natural de Chile, Santiago (see Figs. 7–8) but the much closer accord with that of Sclater's adult male syntype in the Natural History Museum, Tring (Fig. 4) (courtesy of the Biodiversity Heritage Library)

[2] Earlier in its history, until 1860, it was reported on the title page that each volume was 'publicase por cuadernos o entregas mensuales, doce de las cuales forman un tomo al fin de cada año' ('published in papers or monthly instalments, twelve of which form a volume at the end of each year'). Thereafter, in most other years during the 1860s (except 1866, 1867 and 1869) two volumes per year were issued, but publication was still reported as 'monthly', with each volume thus comprising six parts. However, such information is not provided for the 1880s and, in any case, probably proves nothing more than the norm or the intention, and would not serve as proof of when a given part was published. The page headers with different month dates in the 1886 volume available on the Hathi Trust Digital Library website (https://www.hathitrust.org/; see also the Santiago museum's own website, where *Anales* articles are listed but no front and back matter from the journal volumes: http://anales.uchile.cl/index.php/ANUC/issue/archive) do suggest part publication, but we have no information to confirm that the pages were released in chronological order, or whether the dates were for grouping papers by chronology of receipt, despite being published collectively?

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de Chile held at the Museo Nacional de Historia Natural de Chile were received only on the death of Philippi and so can provide nothing to assist. We also contacted relevant institutions outside Chile that possess runs of the *Anales* from the late 19th century. What is now the library at the Natural History Museum, London, lacks vol. 69 of the *Anales*, but provided scans of many other volumes from this period for use in the Biodiversity Heritage Library website; however, no information that can help is available (C. O'Carroll *in litt*. June 2024). Vol. 69 is held by the Princeton University Library, Princeton, NJ, but again an enquiry there failed to yield a date of receipt, any evidence of the original wrappers, or even whether the volume was published as a single or in multiple parts (J. Hunter *in litt*. to D. Wiles, October 2024). Finally, to eliminate the possibility that Rahmer might have published something about his discovery in a local newspaper prior to the *Anales*, LQF searched the Biblioteca Nacional de Santiago de Chile holdings of the major national title, *El Mercurio de Valparaíso* (which became simply *El Mercurio* in June 1900), published between 1 January and 31 December 1886 (a total of 309 issues; only 14 July was missing) for any evidence of this. This search also drew a blank. Rahmer was the museum's Assistant Director and, as this was the only bird he named, it could have served as a suitable item of publicity for his institution.

We must now turn therefore to contemporary and near-contemporary sources, to see what light they might shed. From the card index of Charles Wallace Richmond (1868–1932) (see Fig. 3) it is clear that Richmond had seen only Rahmer's notice in the *Journal für Ornithologie* but had no access to the volume of the *Anales de la Universidad de Chile* containing the same author's earlier description, despite both his own efforts and those of his colleague Hellmayr. However, via Philippi (1902), he was aware of it and, as can be seen on the front side of the card, he wondered whether it might antedate Sclater's nomen. Unlike Hellmayr (1932), Richmond was aware that *Phoenicopterus jamesi* P. L. Sclater, 1886, had not been published until October—perhaps via correspondence with Sherborn or based on a receipt date for the volume at the Smithsonian—and could not be dated from June 1886 (see Duncan 1937). Neither the *Zoological Record* nor the annual literature summaries in *Archiv für Naturgeschichte* for 1886 and 1887 made any mention of Rahmer's 1886 name, but they did report his *Journal für Ornithologie* description.

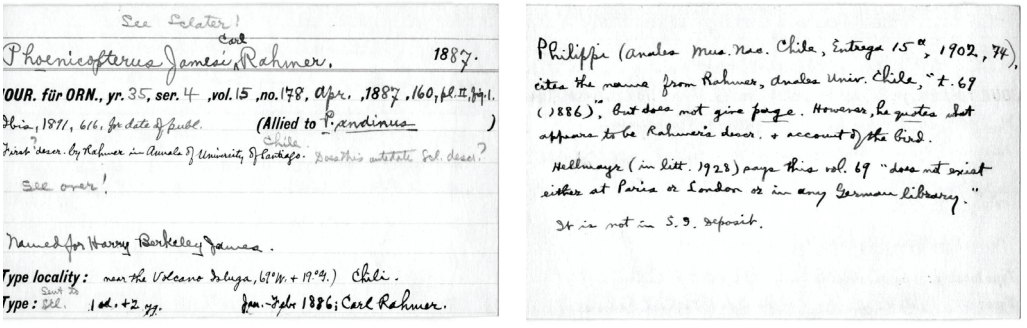

Figure 3. Front and reverse of C. W. Richmond's card entry for *Phoenicopterus jamesi* Rahmer, 1887. From this, it is clear that Richmond had seen only Rahmer's notice in the *Journal für Ornithologie*, published in April 1887, but (even as late as 1928) had no access to vol. 69 of the *Anales de la Universidad de Chile* containing Rahmer's earlier description with a page header date of August 1886 (which we herein accept as the date of publication given the lack of evidence to the contrary; see main text and Art. 21.2). However, via Philippi's (1902) paper Richmond knew of Rahmer's earlier publication and, as can be seen on the front of the card, he wondered whether it might antedate Sclater's nomen. Note that, unlike Hellmayr (1932), Richmond was aware that *Phoenicopterus jamesi* P. L. Sclater, 1886, had not been published until October of that year, and that the June date indicated by Hellmayr was therefore incorrect, if taken as a publication date (see Duncan 1937). Reproduced from the card images available online at https://zoonomen.net/.

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Salvadori (1895: 22) cited the authority rather unusually as '*Rahmer, in litt.; Sclat. P. Z. S. 1886*', without listing the *Anales* description in his synonymy, though he did include a footnote conceding that 'Herr Rahmer' had pointed out *Phoenicopterus jamesi* had been named in the *Anales* for 1886, but that he, Salvadori, had not seen this. Although Richmond reported Philippi (1902: 74) as dating Rahmer's name to 1886, the latter listed first the *PZS* description (also credited to Rahmer by Philippi) then the description in the *Anales*. Doubtless also following Salvadori, Dubois (1904: 908) awarded the credit to Rahmer in the *Anales* but as 'p. ?', presumably because Philippi (1902) had listed only the volume number. In his paper on Rahmer's collection, forwarded to him by Berkeley James, Sclater (1886) had mentioned Rahmer's letter proposing to name the bird '*jamesi*', which he adopted, and consequently Salvadori mentioned that Rahmer had coined the name[3]. Brabourne & Chubb (1912), who strictly followed decisions taken in the *Catalogue of the birds in the British Museum*, including Salvadori (1895), credited the name to Rahmer in Sclater, but James (1892) and Sharpe (1899) listed Sclater alone. Others to favour Sclater were Reed (1896) and von Berlepsch & Stolzmann (1906), whereas Ménégaux (1909) supported the Rahmer in Sclater option, and Albert (1901), Ménégaux (1910), Gigoux & Looser (1930) and Schumann (1930) all plumped for Rahmer.

There is a clear absence of contemporary and/or recoverable evidence to help date Rahmer's paper in the *Anales* describing this flamingo. Even contemporaneous authors to varying degrees aware of the issue of priority were defeated in their efforts to locate the relevant volume, at least outside Chile. For many years, Philippi (1902) was probably unique among them in having seen Rahmer's (1886) Spanish-language description. Hellmayr, perhaps to some extent urged on by Richmond (who evidently believed that Rahmer might have been first to publish), did not manage to access details until sometime between 1928 (when according to Richmond his searches had failed) and his 1932 monograph (when he had). However, there is still no evidence that Hellmayr had by the latter date actually *seen* a copy of Rahmer's original description, otherwise he would surely have noted the page header date of 'August'. Rather, it seems likely that he had only been sent details of the paper, presumably via a correspondent in Chile. Nevertheless, in 1932, Hellmayr (unlike Richmond, who died the same year) was still under the misconception that Sclater's description had been published in June, so he would have maintained the latter's priority in any case. By 1931 he had returned to Vienna, where he remained busy with the outstanding volumes of *Catalogue of birds of the Americas*. However, the relevant part containing the flamingos was published only posthumously, under the co-authorship of Henry Boardman Conover (1892–1950), with basically identical details to those presented in his Chile manuscript of 1932. Thus, if Hellmayr ever did uncover further information is a matter for speculation, e.g., notes he left behind when he had to leave Vienna in 1939 (Zimmer 1944: 620, indicated to be in 'safe storage'; see also Vuilleumier 2003: 582) if still extant might be revealing.

As a result, we refer to Arts. 21.2 and 21.3 (ICZN 1999, which also covers subsequent references to articles), accept the date specified, August 1886, 'as correct in the absence of

[3] MDB conjectures that Rahmer must have known Sclater would publish a name and description, but he probably did not view publication in Chile as affecting what was done in Europe. Earlier, Claudio Gay published a review of Chilean birds as part of a broader coverage of the country's natural history in a series of volumes intended to be published only in Chile. In the case of birds, this led Marc Des Murs to rename Gay's new species in his own illustrated work published at the same time, which caused some confusion later with new names (*cf*. Bruce 2023: 42–47). Rahmer therefore perhaps sent details to the *Anales* and, especially, to *J. Orn*., to ensure Berkeley James was suitably commemorated, at least in Chile, unsure as to whether Sclater would acquiesce to his request on this point. In opening the 1887 article, Rahmer reported that a description had already appeared in the *Anales* for 1886, thereby explaining one of Salvadori's footnotes (1895: 22), and that the bird would also be covered by Sclater.

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evidence to the contrary', and under Art. 21.3.1 '…when month and year, but not day, are specified…' adopt 31 August 1886 as the date of publication. This establishes a degree of symmetry with another but quite different decision by Hellmayr (1932), namely to accept August 1854 as the correct date of publication for *Phoenicopterus andinus* R. A. Philippi, published in the *Anales*, seemingly based solely on the page header and a lack of evidence to the contrary.[4,5] We thereby afford priority to Rahmer, demoting *Phoenicopterus jamesi* P. L. Sclater, 1886, to a junior objective synonym and homonym.

Which specimens are types and of which name?

There is universal agreement that the type material of this flamingo was collected by Rahmer, but the types listed of the two names need reappraisal. In respect of Sclater's text, the author mentioned that Rahmer had obtained an 'adult male in full dress and a male and female not in full dress', although the Latin description, measurements, the accompanying plate (see Fig. 1) and his figure (on p. 400), illustrating differences in the bill between his *jamesi* and *Phoenicopterus andinus*, are all obviously based exclusively on the first of these specimens. He referred again to the young individuals only to confirm differences in wing structure from other species (Sclater 1886: 401). Warren (1966: 146), however, referred to a holotype, the adult male collected on an unspecified date that is held at the Natural History Museum, Tring (NHMUK 1912.10.17.1; Fig. 4) and is a basically perfect match for both Sclater's description and the plate. Warren plainly took her cue from Salvadori (1895: 22), who mentioned the presence of the two non-adult specimens in the British Museum collection but did not indicate that they were 'types' and, in a footnote, stated that the adult male 'type' was still in the possession of Mrs Berkeley James. Thereafter, Sharpe (1906: 400) noted that between 1891 (the year of Berkeley James's death) and 1898 the latter's collection of almost 1,400 skin specimens of Chilean birds, among them the 'type of *Phoenicopterus jamesi*', had been presented to the museum by his widow. Sclater clearly used the adult male as his primary reference material in 1886, before it went to James's own collection, probably on the understanding that it would ultimately come to the British Museum, which point Sclater is likely to have been particular about. Nevertheless, the two juveniles must be considered syntypes of Sclater's nomen as they are unambiguously mentioned in the original description, as Richmond correctly noted on the relevant card in his index (https://zoonomen.net/cit/RI/SP/Phod/phod00046a.jpg). Both are still present in Tring, catalogued as NMHUK 1892.2.10.397 and NHMUK 1892.2.10.398, labelled male and female respectively, not in fully adult plumage, and collected by Rahmer at Sitani,

[4] Philippi also sent 'duplicate' descriptions of several of his new taxa including *Phoenicopterus andinus* (Philippi 1855) and several *Buteo* taxa (all now in synonymy) in the late 1890s to *Arch. Naturgesch.*, and it was perhaps Philippi's experience that influenced Rahmer to do likewise, in addition to the precedent set by Gay and Des Murs (see above).

[5] One of our referees, Steven Gregory, felt that the indicated date of publication of Rahmer's paper should be accepted only with more and better evidence. However, the most notable result of dating *Phoenicopterus Jamesi* Rahmer from August 1886 is that this name is thus treated in precisely the same way as all other avian names published in the same journal. For example, Philippi (sometimes in conjunction with Landbeck) introduced *c*.50 new nomina in the *Anales* (as captured in https://zoonomen.net/cit/RI/SP/RIspTotal.html). In all of these cases, it appears that the indicated date of publication has been accepted, without recourse to the level of investigation attempted here. Many of Philippi's names are now in synonymy and/or were also published in *Arch. Naturgesch*. A detailed review of the dating of avian names published in the *Anales*, and the perceived priority of those descriptions in cases where duplicates were published elsewhere, would be of value, but in the interim treating Rahmer's name in the same way as all others that have been subject to scrutiny is the only sensible course.

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Figure 4 (above and left). The adult male holotype (NHMUK 1912.10.17.1) of James's Flamingo *Phoenicoparrus jamesi* (Rahmer, 1886) and one of three syntypes of *Phoenicoparrus jamesi* (P. L. Sclater, 1886), in the Natural History Museum, Tring, collected by Carlos Rahmer and presented by the widow of Henry Berkeley James, in dorsal (A) and ventral views (B), plus labels (C) (Guy M. Kirwan, © Trustees of the Natural History Museum, London)

Figures 5–6. The young male (above; NMHUK 1892.2.10.397) and young female (NHMUK 1892.2.10.398) syntypes, respectively, of James's Flamingo *Phoenicoparrus jamesi* (P. L. Sclater, 1886), in the Natural History Museum, Tring, collected by Carlos Rahmer on 15 January and 21 January 1886, respectively (Hein van Grouw, © Trustees of the Natural History Museum, London)

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like the adult, on 15 January and 21 January 1886, respectively (GMK & HvG pers. obs., February 2024; Figs. 5–6). Arts. 72.1.1 and 72.4.1 make clear that a type series consists of 'all the specimens on which the author established a nominal species-group taxon…'.

On the other hand, Rahmer (1886) was not explicit in his original description about how many specimens he had, although he noted encountering a flock of 30 individuals and, from other sources, he evidently collected more than one (Sclater 1886, Johnson & Goodall 1965). However, he described only an 'adult male', traditionally all that was needed to establish the type of the species, if not referring to the specimen as the type, which was essentially implied. Gigoux & Looser (1930: 24) indicated that the 'type' of *both* descriptions was an adult male and that in all likelihood was the specimen that had been sent to London. The details presented by Rahmer are a very good match for the bird illustrated in Sclater's (1886) paper (and thus also to NHMUK 1912.10.17.1). In his *J. Orn*. description, Rahmer (1887) published a German translation of his *Anales* paper, presaged by a paragraph of background information, which (in translation to English) reads 'I described the bird in the Annals of the University of Santiago and also sent a short note about it to Mr Sclater in London, who also received *all* [our emphasis] the birds, including one old and two young specimens of the new species.' This information can be taken into account to determine what constitutes a type series for a nomen established before 2000 (Art. 72.4.1, 72.4.1.1).

Nevertheless, unlike Sclater's description in the *Proceedings*, Rahmer's makes no mention of the number of specimens he had available, but the only plumage described, and indeed mentioned, is the adult male. Neither of the other two specimens sent to Sclater is an adult, and two specimens (see below) that remained in Santiago (despite Rahmer's German text) were not sexed. As the sole adult male collected by Rahmer was that subsequently sent to Sclater, under Arts. 72.4.1.1 ('for a nominal species … established before 2000, any evidence, published or unpublished, may be taken into account to determine what specimens constitute the type series) and 73.1.2 ('if the nominal species-group taxon is based on a single specimen, either so stated or implied in the original publication that specimen is the holotype fixed by monotypy'), we consider that the holotype of Rahmer's *Phoenicopterus Jamesi* is NHMUK 1912.10.17.1.

Much later, in an inventory of avian type material held in the Museo Nacional de Historia Natural de Chile, Torres-Mura & Lemus (1989) listed MNHNCL 4786, an unsexed individual collected in the Andes of Tarapacá in January 1886, by Rahmer, as the lectotype of *Phoenicopterus Jamesi* Rahmer, 1886, and MNHNCL 4787, another unsexed individual taken at Chilcaya, Salar de Surire, Putre, in January 1886, by Rahmer, as the paralectotype. Neither of these specimens (see Figs. 7–8) is a good match for the bird Rahmer described.[6] Furthermore, MNHNCL 4787 is from a locality that is not mentioned

[6] The original description reads: 'Macho adulto; Plumaje rojizo mui pálido, la cabeza i el tercio superior del pescuezo rosado claro, el buche rayado rosado oscuro. Las plumas del dorso son largas de color escarlato. La cola blanca con un lijero tinte de rojizo. Cubiertas superiores de las alas color carmín pálido pasando a un rojizo vinoso. Remigias negras, cubiertas inferiores de las alas carmín oscuro. El pico dentado, más corto que el *Phoenicopterus andinus* i suavemente encorvado, aplastado en los dados, dorado claro; la punta de mandíbula superior i la base desnudo del pico purpureas, la punta de la mandíbula inferior es negra. Las piernas purpureas, patas con tres dedos, ojos pardos.'

Our translation: 'Adult male; Very pale reddish plumage, the head and upper third of the neck light pink, the striped breast dark pink. The feathers on the back are long and scarlet. The tail is white with a slight reddish tint. Upperwing-coverts pale carmine changing to wine reddish. Remiges black, underwing-coverts dark carmine. The toothed bill, shorter than in *Phoenicopterus andinus* and gently curved, flattened into "cubes", light golden. The tip of the upper mandible and the bare base of the bill are purple, the tip of the lower mandible is black. Purple legs, three-toed feet, brown eyes.'

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Figures 7–8. Specimens of James's Flamingo *Phoenicoparrus jamesi* held in the Museo Nacional de Historia Natural de Chile, Santiago, listed without rationale as the lectotype (MNHNCL 4786; left) and paralectotype (MNHNCL 4787; right) of *Phoenicopterus jamesi* Rahmer, 1886, by Torres-Mura & Lemus (1989); in reality, neither specimen is a name-bearing type (see text and Table 1) (© Bárbara Toro)

by Rahmer in his original description. Irrespective of either specimen being a poor match for Rahmer's description, the rationale for Torres-Mura & Lemus (1989) considering them to be the lectotype and paralectotype of Rahmer's name is unknown (J. C. Torres-Mura *in litt*. June 2024 could not recall any details), and it is notable that, in an earlier review of avian type specimens in Santiago, Gigoux & Looser (1930) admitted they were unsure as to the status of the same two specimens because neither of them was an adult male.[7] The almost complete mismatch between the specimen data (only the locality for MNHNCL 4786 agrees) with the information presented by Rahmer (1886), and the fact that neither specimen's plumage/bill pattern shows much approach to the latter's plumage description or to the plate in Rahmer (1887; see Fig. 8), mean that the claim of either individual to have been used in the original description is at best exceptionally weak. As their status as syntypes is therefore unproven, the lectotype and paralectotype designations automatically fall away (Art. 74.2).

Conclusions

We propose that *Phoenicopterus Jamesi* Rahmer, 1886, has priority over *Phoenicopterus jamesi* P. L. Sclater, 1886, in the absence of evidence to the contrary that Rahmer's name was published in August and Sclater's in October of that year (*cf*. Art. 21.2). Thus, NHMUK 1912.10.17.1, one of the syntypes of Sclater's name, is herewith proposed to be the holotype

[7] Contradictory evidence regarding the status of type material in MNHNCL between these two sources seems to be not infrequent. As just one example, *Muscisaxicola flavivertex* Philippi and Landbeck, 1864 (now in the synonymy of Ochre-naped Ground Tyrant *M. flavinucha*), was based on two adult males, two adult females and a young male, of which one of these was said to have been collected in February 1854 and another in December 1856, but no type was designated. Of this material, Gigoux and Looser (1930) stated that only an adult male collected at Las Condes in September 1863 survived (MNHNCL 395); however Torres-Mura & Lemus (1989) listed the same specimen as the 'holotype', which is patently incorrect, rather it seems to be the sole surviving syntype.

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of Rahmer's name, based on its provenance, age/sex, plumage and bill patterns all closely according with the information and descriptions presented in Rahmer (1886, 1887) and the plate in the second of these works (*cf.* Art. 73.1.1, 72.4.1 and 72.4.1.1). The other syntypes of Sclater's nomen, NMHUK 1892.2.10.397 and NHMUK 1892.2.10.398, were plainly also available to Rahmer prior to their being sent to Sclater, and therefore can be considered paratypes of *Phoenicopterus Jamesi* Rahmer, 1886, based on the evidence in Rahmer (1887). Given its collection date and locality, MNHNCL 4786 might also qualify as a paratype of Rahmer's name (but clearly not of Sclater's). However, the case for MNHNCL 4787 to be part of the type material is discounted by its locality and the lack of any other specific reference to it in Rahmer (1886, 1887). Nevertheless, although Rahmer doubtless had other specimens available to him at the time he prepared his description, i.e., before the collection was dispatched to Sclater, the evidence of his published description concerns the adult male alone and there is no evidence that any of the other specimens mentioned forms part of Rahmer's type series. Table 1 summarises our and previous treatments of all of the relevant specimens.

TABLE 1

Specimens of *Phoenicopterus jamesi* P. L. Sclater, 1886, and *Phoenicopterus Jamesi* Rahmer, 1886, mentioned as being types of either of the two names, or referred to in either of the two original descriptions. MNHNCL = Museo Nacional de Historia Natural de Chile, Santiago; NHMUK = Natural History Museum, Tring.

Specimen registration no.	**Previous type designation (if any)**	**Our treatment**
NHMUK1912.10.17.1	Sclater's holotype (Warren 1966)	Rahmer's holotype / one of Sclater's syntypes
NHMUK.1892.2.10.397		One of Sclater's syntypes
NHMUK.1892.2.10.398		One of Sclater's syntypes
MNHNCL 4786	Rahmer's lectotype (Torres-Mura & Lemus 1989)	Not part of Rahmer's type series but probably part of his original collection from January 1886, is certainly a topotype and very probably paratype
MNHNCL 4787	Rahmer's paralectotype (Torres-Mura & Lemus 1989)	Different locality, not part of type series, nor arguably topotypical

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[8] Bruce (2023: 65) argued for 1896 based on a date of receipt stamp of 28 January 1896 on the reverse of the last plate. The date stamp of 13 January 1899 on the reverse of the last plate of vol. 26 corroborated the publication date interpreted by Mathews (1925: 26) based on a different source; both stamps can be seen in the BHL copies digitised from a British Museum (Natural History) set. However, an inserted editor's note argued that receipt dates may have other interpretations. An enquiry to the British Library by MDB, where UK publications are lodged for copyright purposes as legal deposits, and receive a blue receipt stamp date, revealed a date of 21 December 1895, but the information that legal deposits are not always received immediately, and may or may not indicate a publication date (A. Burnett *in litt*. to MDB, 2023) was received too late to be included in Bruce (2023). In this case, a printed note was inserted into the volume dated 20 December 1895 explaining that vol. 27 was being published ahead of vols. 24–26. Under the *Code* (Art. 8.1.3), 'publication' requires 'simultaneously available copies', which usually means a printed work being distributed. Seeking resolution to this conundrum, R. Prŷs-Jones arranged for an archival search by K. Rooke (*in litt*. 2025 to MDB). In the minutes of the Trustees meeting dated 26 October 1895, the status of vol. 27 was addressed based on a report dated 1 October by series editor Albert Günther on completion of the volume. Along with outlining the costs associated with the volume, it was specified that 600 copies would be printed for retail at £1 and 12 shillings, 35 copies would be sent to all those associated with it, including a few benefactors, with six copies for the author, Salvadori. All that remained to be done was preparation of an index. The inserted note in the volume dated 20 December 1895 suggests that, with printing of the index being the last completed task, the volume was by then also collated and bound. The British Library copy receipt stamped 21 December could imply a publication date. The distribution of 'simultaneously available copies', however, is not confirmed by the date of a single copy. The proposed distribution of the free copies to individuals and libraries may have been delayed by days or weeks, as the 28 January 1896 date stamp suggests. What the minutes reveal is that upon publication approval by the Trustees, there are still various processes to be carried out before a publication date can be determined. Based on available evidence, we have a publication date somewhere between 21 December 1895 and 28 January 1896. For now, the date specified (Art. 21), 1895, is accepted.

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Breeding season, nest, egg and nestling of the Vogelkop Bowerbird *Amblyornis inornatus* in the Arfak Mountains, West Papua

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Summary.—The Vogelkop Bowerbird *Amblyornis inornatus* is renowned for constructing the most elaborately decorated structure in the animal world, excluding humans, yet despite its bowers attracting much attention, the species' breeding biology is poorly known. Two nests, both with a single egg, were found in the Arfak Mts., West Papua, during the early 1990s. Between 2008 and 2014, we found nine nests in the Arfak Mts., five with one egg and four with one nestling. Estimated egg-laying months from these nests and three nesting records from eBird suggest a biannual breeding season, with peaks in May–June and October–January. We describe the sites and dimensions of three nests, and the plumage and mouth colour of two nestlings, and compare all breeding details with those for the better-studied, closely related Macgregor's Bowerbird *A. macgregoriae* and other bowerbirds.

Widely regarded as the most complex and elaborately decorated structure built by an animal other than *Homo sapiens*, bowers of the Vogelkop Bowerbird *Amblyornis inornatus* have attracted much attention from behavioural ecologists interested in polygyny and the evolution of bowers. Endemic to the Bird's Head and Neck of New Guinea in the Indonesian province of West Papua, it is one of four (or five) species in its genus, all of which occur in montane forest in New Guinea, build maypole bowers and are often referred to as 'gardener bowerbirds' (Frith & Frith 2004, Beehler & Pratt 2016). Whilst the breeding biology of the widespread Macgregor's Bowerbird *A. macgregoriae* is reasonably well known (Mayr & Gilliard 1954, Diamond 1972, Pruett-Jones & Pruett-Jones 1982, Frith & Frith 2004), that of the other three species is poorly known.

Only two nests of Vogelkop Bowerbird have been described to date, both found in the Arfak Mts. on the east side of the Vogelkop Peninsula. In May 1991, W. Betz photographed a nest containing a single whitish egg near Hungku, Anggi Lakes. Three years later D. Gibbs found a single egg in a nest above Mokwam (at 1,430 m), Arfak Mts., on 5–6 October 1994, describing the nest as a 'rather untidy structure of sticks with lining of leaves' (D. Gibbs *in* Frith & Frith 2004). The nestling has never been described. In this paper, we describe the breeding season and nests, as well as one egg and two nestlings, of Vogelkop Bowerbird in the Arfak Mts., West Papua, Indonesia.

Methods

We collated breeding records of Vogelkop Bowerbird in the vicinity of Syoubri village (01°06'S, 133°54'E) in the Arfak Mts., from opportunistic observations by ZW during 2008–14, and from eBird (2025) records since 1989. RN photographed nests shown to him by ZW during a bird tour which he co-led with SP in 2013, and during the making of a film about the species' bowers by NHK-TV in 2014.

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To standardise breeding records, we have adopted the conventional definition of avian breeding seasons as the months in which eggs are laid. As egg-laying is rarely directly observed, we have extrapolated the egg-laying months of Vogelkop Bowerbirds by subtracting the dates on which eggs or nestlings were recorded from the estimated incubation and nestling periods. Although the incubation and nestling periods of *Amblyornis* bowerbirds are unknown (Frith & Frith 2004), those of the closely related Archbold's Bowerbird *Archboldia papuensis* of New Guinea's Central Ranges are 26.5 (n = 1) and 30.0 days (n = 5), respectively (Frith & Frith 1994). However, the latter species is 45% larger in body mass, and occurs at higher elevations, than Vogelkop Bowerbird. On the other hand, the maypole-building Golden Bowerbird *Prionodura newtoniana* of north-east Australia is 44% smaller in body mass than Vogelkop Bowerbird, and has median incubation and nestling periods of 21.9 (n = 2) and 18.6 (n = 5) days, respectively (calculated from Frith & Frith 1998). We assumed that the incubation and nestling periods of Vogelkop Bowerbird are thus midway between the median periods for Archbold's and Golden Bowerbirds, i.e. 24.2 and 24.3 days, respectively. When estimated egg-laying dates fell within three days of the end of one month and start of the next (e.g., 28 April–3 May), each of those two months scored 0.5 for that nest.

Results

Between 2008 and 2014, ZW found nine nests of Vogelkop Bowerbird in forest above Syoubri, at elevations between *c*.1,500 m and *c*.2,000 m. All nests contained either one egg (n = 5) or a single nestling (n = 4) when discovered (Table 1). Analysis of eBird (2025) data revealed that, since 1989, the species was recorded from the Arfak Mts. on 399 days (excluding duplicate dates), all but 14 of which were within 5 km of Syoubri. Although breeding behaviour was reported on eight non-consecutive days, five were based on observations of a singing male, courtship or copulation (unspecified), or a bird visiting a probable nest site (stage unknown). The remaining records involved: (1) a nest with young,

TABLE 1
Dates of records and estimated egg-laying months of 12 confirmed nests of Vogelkop Bowerbird *Amblyornis inornatus* in the Arfak Mts., West Papua. All nests in this study were found by ZW.

Year	Egg	Nestling	Estimated laying	Source
1991	15 May		Apr/May	W. Betz
1994	5 Oct		Sep/Oct	D. Gibbs
2008	10 Jan		Dec/Jan	This study
2008		23 May	Apr	This study
2008	20 Jul		Jun/Jul	This study
2008	19 Nov	16 Dec	Oct/Nov	This study
2008	30 Nov	16 Dec	Nov	This study
2012	30 Jan		Jan	This study
2013		11 Jul	Jun	This study
2014		18 Jun	May	This study
2014	18 Jun		May/Jun	This study
2017		19 Nov	Oct	eBird (2025)

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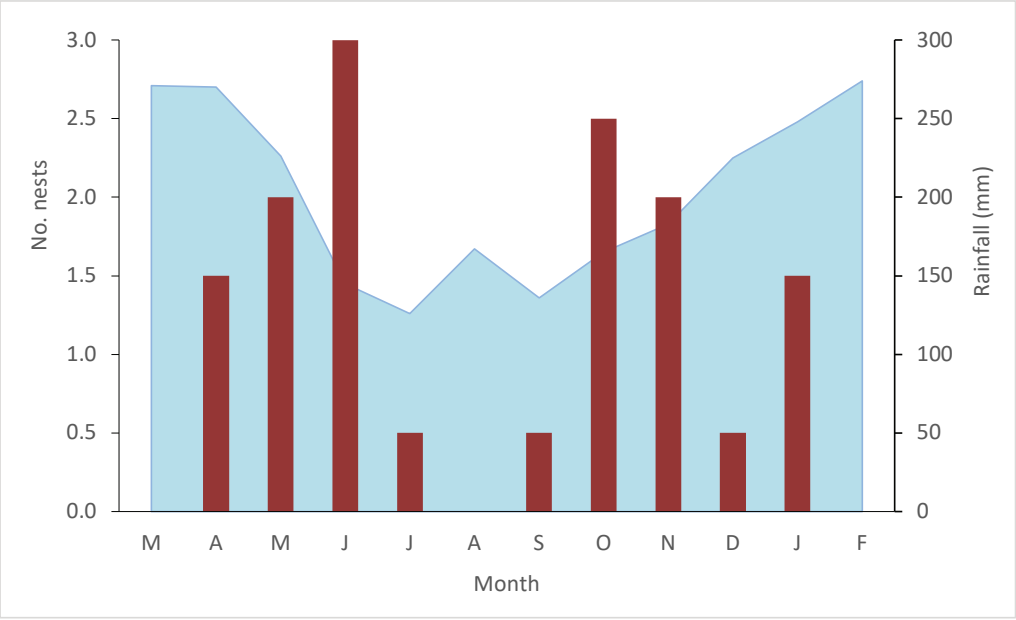

Figure 1. Estimated egg-laying dates at 14 nests of Vogelkop Bowerbird *Amblyornis inornatus* near Syoubri, Arfak Mts., West Papua, based on the data in Table 1 and two additional eBird records (see text). Months presented from March to February to accentuate peaks and troughs. Mean monthly rainfall data from Menyembo, 1960–75 (Ridder 1995), which is 4.5 km west of Syoubri.

observed and photographed at the study site on 19–20 November 2017 (Table 1); (2) a bird building a nest near the village of Minggre (*c*.2 km from Syoubri) on 17–18 June 2025, which we presume laid its egg later in June; and (3) an abandoned nest found by ZW, from which a chick had recently fledged, on 23 December 2017, suggesting the egg was laid in late October or early November.

We combined the estimated egg-laying months of all 12 confirmed records of nests with an egg or nestling (Table 1) with the two eBird records (above) involving building and recent fledging (Fig. 1). The resulting pattern suggests a biannual breeding season with peaks in May–June and October–January, the first peak corresponding with the two months following the wettest period in the region (February–March), and the second with the gradual increase in rainfall after the drier season (Fig. 1).

In July 2013, ZW found nest 1 with a young chick (Fig. 2), which was *c*.7.5 cm long from bill tip to 'tail', and had a covering of long greyish-brown down over the head and dorsal surface. Its bill was flesh-grey, darkening towards the blackish tip, and the rictal flanges were creamy white. The forelimbs already bore bluish pins from

Figure 2. Young nestling Vogelkop Bowerbird *Amblyornis inornatus* in nest 1, Arfak Mts., West Papua, July 2013 (Richard A. Noske)

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Figure 3. Side view of Vogelkop Bowerbird *Amblyornis inornatus* nest 1 containing the young chick shown in Fig. 2 (Richard A. Noske)

Figure 4. Partial aerial view of the internal cup of Vogelkop Bowerbird *Amblyornis inornatus* nest 1, shown in Fig. 3 (Richard A. Noske)

which the secondary feathers would eventually emerge. The nest was suspended in the horizontal fork of a drooping branch of a small tree, *c*.1.8 m above ground. External diameter and depth measured *c*.25 × 30 cm and the internal cup diameter *c*.12 cm. The bulky nest was composed of thin supple plant (vine?) stems and dead leaves, with few straight twigs. The internal cup was lined with very thin but stiff plant stems, possibly from ferns, that were coiled around the cup, some of which formed almost complete rings near the rim, which was covered with at least one layer of dead leaves (Figs. 3–4). The coiled stems suggested that the female had bent and weaved them into the fabric of the nest.

In June 2014, two nests were found while filming Vogelkop Bowerbirds at their bowers for NHK-TV. Nest 2 contained a single pure white egg that measured 41.4 × 29.2 mm (Fig. 5). The nest was suspended between 3–4 frond stems of a young tree fern, *c*.2.0 m from the ground, with some support from a bent branch of an adjacent small tree (Fig. 6). The top of the nest was *c*.400 cm above the junction of the base of the fronds, where there was a loose collection of twigs, plant stems and dead leaves, which may have been the remains of a previous nest. The external nest diameter and depth were *c*.15 × 10 cm, and the internal diameter was 11 cm. It was constructed almost entirely of dried twigs and some

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Figure 5. Egg of Vogelkop Bowerbird *Amblyornis inornatus* in nest 2, Arfak Mts., West Papua, June 2014 (Richard A. Noske)

Figure 6. Nest 2 of Vogelkop Bowerbird *Amblyornis inornatus* containing the same egg shown in Fig. 5 (Richard A. Noske)

other plant stems up to 45 cm long, many extending beyond the edge of the nest. A few dead, partly skeletonised leaves hung on the outside, but they had possibly fallen from the forest canopy. Although untidy on the outside, the nest was neatly lined with short and relatively straight dead plant stems, possibly of ferns.

The other 2014 nest (nest 3) contained a single chick covered in greyish-brown down, like that in the 2013 nest (nest 1), albeit clearly older. Its eyes were open, and the bill was mostly dark, possibly blackish, whilst the rictal flanges and palate were pale pink. This nest was 2.5 m above ground, and rather than being suspended like the above-mentioned nests, it was supported from below, resting atop a small vine-covered sapling. External diameter and depth were 18 × 14 cm; internal diameter and depth 11 × 6 cm. Like nest 1, it incorporated many dead leaves, but the framework resembled nest 2, in being largely comprised of long sticks, many of which extended 20 cm or more beyond the edge of the nest.

Discussion

Breeding season.—Our observations, and previously published records, of nests suggest that the main egg-laying months for the species in the Arfak Mts. are April–June and November–January. The earliest confirmed nest records were from (1) the vicinity of Hungku, Anggi Lakes (W. Betz *in* Frith & Frith 2004), which is 24 km south of Syoubri, and (2) above Mokwam (D. Gibbs *in* Frith & Frith 2004), a village 1.5 km east of Syoubri. In the Kumawa Mts. on the Bomberai Peninsula, south of the Vogelkop Peninsula, only two of the eight males mist-netted in September had enlarged testes, but all three trapped females had ovaries with well-developed eggs (Diamond 1987). In contrast, few eggs in the Arfak Mts. were laid in September (Fig. 1), although it may be significant that in the Kumawa Mts., Vogelkop Bowerbird occurs at considerably lower elevations (1,050–1,450 m) than

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in the Arfaks (1,200–2,000 m) as even small differences in elevation can affect the start of annual nesting in bowerbirds (Frith & Frith 2004). Two species of bowerbirds in north-east Australia nest about one month earlier at lower (vs. higher) elevations in their breeding ranges (Frith & Frith 2004).

Of 14 male specimens held in museums, testes were enlarged in two specimens in each of the following months (and localities): January (Wandammen Mts.), July (Tombrok, Anggi Lakes, Arfak Mts.), August (Tamrau Mts.) and September (Wandammen Mts.), though only two were collected during the other eight months of the year (Frith & Frith 2004; C. Frith *in litt*. 2025). Except January, these months do not coincide with the egg-laying peaks indicated by our data, and although Vogelkop Bowerbird in the Wandammen and Tamrau Mts. occurs at similar elevations to those in the Arfaks, it is likely that male bowerbirds, like male birds of paradise (Frith & Beehler 1998), can have enlarged testes throughout much of the display season, which is far longer than the nesting season.

Photographs of bowers belonging to Vogelkop Bowerbirds taken on the 'Garden House' trail above Syoubri during two-day treks in February 2016, March 2005, May 2008 and May 2015 (RAN unpubl. data) show that most were dilapidated, indicating that courtship and presumably breeding activity were depressed in those months. By contrast, in June 2014, July 2013 and December 2007 all bowers were well decorated, and in September 2011 and October 2012, some were dilapidated and others well decorated. These observations are generally consistent with a hiatus in breeding activity during February and March, but not with a second pause from July through September (Fig. 1). Nevertheless, it is somewhat surprising that there are no breeding records on eBird during July–September, given that 59% of all records of the species (n = 399) are in those three months alone.

The majority of eggs of Macgregor's Bowerbird have been recorded from September to January (n = 12), with a possible peak in October (n = 6), suggesting a unimodal breeding season, although one nest with an egg was found in July at Mt. Hagen, Papua New Guinea, and males with enlarged gonads have been reported from May onwards (Frith & Frith 2004). Moreover, in Crater Mountain Reserve in Papua New Guinea, several species of birds of paradise plus White-eared Catbird *Ailuroedus buccoides* (n = 2) have been recorded breeding during both April–May and October–November, indicating biannual breeding (A. Mack *in* Frith & Frith 2004: 47, 164, 231). In Australia, bowerbird egg-laying peaks during October–December, at the start of the wet season, when fruit and invertebrates are at or near their peak abundance or biomass (Frith & Frith 1985, 1998, 2004). In many parts of Papua, most rain falls between January and April, but seasonality is much reduced above 2,000 m (Prentice & Hall 2007), as evidenced by the lack of a pronounced dry season in the Arfaks (Fig. 1). An explanation for the May–June peak in egg-laying, and possible breeding hiatus in July–September, in Vogelkop Bowerbird may depend on future studies of fruiting phenology and insect seasonality in the region.

Nests, egg and nestling.—The three Vogelkop Bowerbird nests found in 2013–14 ranged in height from 1.8–2.5 m, though one found in January 2008 was only 1.0 m above ground. Nest sites varied considerably, two nests being suspended within the forked branch of a small tree (nest 1) or the fronds of a tree fern (nest 2), and another being placed on top of a vine-covered sapling (nest 3). These sites are consistent with the two previously reported nests, which were built into the forking branches of sparsely foliaged saplings at 1.2 m and 2.5 m above ground (D. Gibbs and W. Betz, respectively, *in* Frith & Frith 2004). In Macgregor's Bowerbird, six of nine nests were in pandanus crowns, one in a tree fern crown, and two in saplings, at heights of 1.8–3.0 m, averaging 2.3 m (Frith & Frith 2004). Six active Macgregor's Bowerbird nests were sited 69–130 m (mean 116 m) from a bower

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(Pruett-Jones & Pruett-Jones 1982), but in the present study we did not measure the distance between Vogelkop Bowerbird nests and bowers.

The dimensions of nests 2 and 3 were similar being 15–18 cm wide and 10–14 cm deep, but nest 1 was substantially wider (25 cm) and almost twice as deep (30 cm). Three nests of the similar-sized Macgregor's Bowerbird varied in external diameter from 14.0–17.5 cm, and in external depth from 10–20 cm, whilst the internal cup diameter and depth of two nests varied from 11.0 × 8.5 cm to 10 × 6 cm (Frith & Frith 2004). Thus, our nests 2 and 3 were similar in external dimensions to nests of Macgregor's Bowerbird, but nest 1 was 43% wider and 50% deeper than the largest of the other species' nests. Nevertheless, the internal diameter of nest 1 (12 cm) was not substantively wider than that of nests 2 and 3, or those of Macgregor's Bowerbird (10–11 cm). In composition, the nests of Vogelkop Bowerbird were similar to those described for Macgregor's Bowerbird, comprising a sparse stick foundation, leafy cup and an internal lining of supple twiglets and rootlets (Frith & Frith 2004). Sticks below and around one nest were up to 43.5 cm in length, whilst another had strips of dry grass blades 30–60 cm long (Frith & Frith 2004).

The mean length and width of ten eggs of Macgregor's Bowerbird were 42.9 × 28.4 mm (Frith & Frith 2004). This compares favourably with our measurements of a Vogelkop Bowerbird egg (41.4 × 29.2 mm), as might be expected given the near-identical body size and mass of the two species (table 4.1 *in* Frith & Frith 2004). Nestling Macgregor's Bowerbird possess long, dense, greyish-brown down in large patches on the crown, wings and body (Frith & Frith 2004), but the plumage and soft parts of Vogelkop Bowerbird were hitherto undescribed. Like Macgregor's Bowerbird, the young Vogelkop Bowerbird chick in nest 1 and older chick in nest 3 had long greyish-brown down on the head and dorsal surface. The bill of the young chick was flesh-grey, darkening towards the blackish tip, whilst that of the older chick was mostly dark. The rictal flanges of the former were creamy white, while those of the latter were pale pink, like its mouth. These colours suggest that the species has a duller, paler mouth than adult Archbold's Bowerbird and Golden Bowerbird, which have bright yellow to orange-yellow mouths (Frith & Frith 1994, 2004).

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Updates to the avifauna of the north-east Brazilian state of Rio Grande do Norte

by François Sagot-Martin, Jorge B. Irusta, Carlos Salustio-Gomes, Victor Leandro-Silva, Alan Glauco, Victor G. Maia, Eugênio S. B. Oliveira, Franciel Gomes, Jorge L. S. Dantas, Geraldo J. Felipe, Anderclaudio Ribeiro, Felipe D. R. O. Silva, Sandra K. Araújo, Tiego L. A. Costa & Mauro Pichorim

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Summary.—We present an update to our checklist of the birds of the Brazilian state of Rio Grande do Norte published five years ago, including newly recorded species, status revisions, and corrections. Citizen science provided a significant number of the total of 28 species added to the primary list. In addition, six species were added to the secondary list, three to the tertiary list and 18 to the potential list. Notably, ten species not included in our former potential list, of which seven represent instances of long-distance vagrancy, are now confirmed in the primary list. Currently, 18 species are long-distant vagrants to the state. The new consolidated list includes 448 species, with 418 on the primary list and 30 on the secondary list.

This is our second publication updating the avifauna of Rio Grande do Norte. In our previous work, we recorded 425 bird species for the state: 391 on the primary list, with documentary evidence, and 34 on the secondary list, without documentary evidence (Sagot-Martin *et al*. 2020). Here, we provide revised status information for 54 species including new records up to 31 March 2025, as well as correcting earlier mistakes. The primary list has increased by 9.35% and the consolidated list by 9.48%.

Methods

Following Sagot-Martin *et al*. (2020), we compiled bird records from mainland Rio Grande do Norte and offshore areas to the edge of the continental shelf. We reviewed the literature, online databases, museums and citizen science platforms including the Coleção Ornitológica da Universidade Federal do Rio Grande do Norte, Natal (COUFRN), Macaulay Library (www.macaulaylibrary.org; ML), WikiAves (www.wikiaves.com.br; WA), Xeno-canto (www.xeno-canto.org; XC) and eBird (https://ebird.org). We also included our own unpublished records up to 31 March 2025 (i.e., precisely six years after our previous cut-off). Records were the product of regular or incidental field observations, environmental consultancy and other standardised surveys. As noted by Carvalho *et al*. (2020) for the Brazilian state of Maranhão, most of the recent records were obtained via citizen science websites (mainly WikiAves) showing that an interest in wildlife photography has become fundamental to recording species and understanding occurrences, habits and habitats. Taxonomy follows the Brazilian Ornithological Records Committee (CBRO) (Pacheco *et al*. 2021). Species with published state records but for which the available evidence is either questionable or invalid, and whose occurrence appears improbable based on present knowledge, are demoted to the tertiary list. Species of probable/possible occurrence are

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placed on the potential list. The proposed subspecies for 13 species on the primary list are all based on distribution (Supplementary Material). We comment on all additions to the primary, secondary, tertiary and potential lists, as well as providing errata to Sagot-Martin *et al*. (2020) for 23 species (see Supplementary Material S1).

Results

During the last six years 28 species have been added to our primary list. Six species were added to the secondary list, three to the tertiary list, and 18 to the potential list. One species appears in both the tertiary and potential lists; thus 54 species are discussed. Additions to our primary list include two Vulnerable Brazilian endemics, Moustached Woodcreeper *Xiphocolaptes falcirostris* and Yellow-faced Siskin *Spinus yarrellii*. Killdeer *Charadrius vociferus*, a vagrant to Brazil, is Near Threatened. On the secondary list, the Brazilian endemic Long-tailed Woodnymph *Thalurania watertonii* is Endangered (IUCN 2025-1).

Among those species new to the primary list, ten were upgraded from our previous secondary list, namely: Red-winged Tinamou *Rhynchotus rufescens*, Scaled Pigeon *Patagioenas speciosa*, Sick's Swift *Chaetura meridionalis*, Bulwer's Petrel *Bulweria bulwerii*, Brown Booby *Sula leucogaster*, Buff-necked Ibis *Theristicus caudatus*, Swallow-tailed Kite *Elanoides forficatus*, Spectacled Owl *Pulsatrix perspicillata*, Buff-fronted Owl *Aegolius harrisii* and *Spinus yarrellii*. Eight species were upgraded from our previous potential list: Blackish Rail *Pardirallus nigricans*, Rufous-thighed Kite *Harpagus diodon*, *Xiphocolaptes falcirostris*, Grey-crowned Flycatcher *Tolmomyias poliocephalus*, Planalto Tyrannulet *Phyllomyias fasciatus*, Eastern Wood Pewee *Contopus virens*, Masked Yellowthroat *Geothlypis aequinoctialis* and Guira Tanager *Hemithraupis guira*. Ten unexpected species, not included in our first potential list, were also added to the primary list: Southern Screamer *Chauna torquata*, *Charadrius vociferus*, White-backed Stilt *Himantopus melanurus*, Terek Sandpiper *Xenus cinereus*, Scarlet Ibis *Eudocimus ruber*, Bare-faced Ibis *Phimosus infuscatus*, Long-winged Harrier *Circus buffoni*, Black-tailed Tityra *Tityra cayana*, Scarlet Tanager *Piranga olivacea* and Rusty-collared Seedeater *Sporophila collaris*. These indicate that our selection of 'potential species' was not as complete as it might have been. Seven new records involved long-distant vagrants: *Chauna torquata*, *Charadrius vociferus*, *Xenus cinereus*, *Circus buffoni*, *Tityra cayana*, *Piranga olivacea* and *Sporophila collaris*.

Of six species added to the secondary list, Black Jacobin *Florisuga fusca* and Black Hawk-Eagle *Spizaetus tyrannus* were upgraded from our potential list. Black-browed Albatross *Thalassarche melanophris* was inadvertently omitted from the potential list in our first paper and is the only new species from southern South America. Three species not mentioned in our first potential list, *Thalurania watertonii*, Silver-beaked Tanager *Ramphocelus carbo* and Olivaceous Elaenia *Elaenia mesoleuca* are possible vagrants, and one is difficult to identify.

Three species were new to the tertiary list, among which American Pygmy Kingfisher *Chloroceryle aenea* was also added to the potential list.

In all, 18 species were added to the potential list. Eurasian Collared Dove *Streptopelia decaocto* (not accepted as part of the Brazilian avifauna by Pacheco *et al*. 2021), Racket-tailed Coquette *Discosura longicaudus* and Orange-fronted Yellow Finch *Sicalis columbiana* were moved from our tertiary list; and Frilled Coquette *Lophornis magnificus*, Sombre Hummingbird *Aphantochroa cirrochloris* and *Chloroceryle aenea* were inadvertently omitted previously. Western Willet *Tringa inornata*, a case of difficult identification, has been suspected to occur on several occasions. Marbled Godwit *Limosa fedoa*, Giant Snipe *Gallinago undulata*, Scopoli's Shearwater *Calonectris diomedea*, Ascension Frigatebird *Fregata aquila*, Great Frigatebird *F. minor*, Black-necked Aracari *Pteroglossus aracari*, Crested Doradito *Pseudocolopteryx sclateri*, Caribbean Martin *Progne dominicensis*, Cuban Martin *P. cryptoleuca*,

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Summer Tanager *Piranga rubra* and Red-necked Tanager *Tangara cyanocephala* were the other additions.

We previously treated records of three overshooting migrants—Chilean Swallow *Tachycineta leucopyga* (*c*.1,900 km north), Spectacled Tyrant *Hymenops perspicillatus* (*c*.1,400 km north) and Short-eared Owl *Asio flammeus* (*c*.1,000 km north-east)—as range extensions (Sagot-Martin *et al*. 2020) but they are better treated as vagrants. Including these three species, we consider 18 species as vagrants to Rio Grande do Norte: *Chauna torquata*, Blue-winged Teal *Spatula discors*, *Charadrius vociferus*, Bar-tailed Godwit *Limosa lapponica*, *Xenus cinereus*, Black Tern *Chlidonias n. niger*, Black-bellied Storm Petrel *Fregetta tropica*, Southern Fulmar *Fulmarus glacialoides*, Cape Petrel *Daption capense*, *Eudocimus ruber*, *Circus buffoni*, *Tityra cayana*, *Contopus virens*, *Piranga olivacea* and *Sporophila collaris*.

New species to the Primary List

All localities are municipalities of Rio Grande do Norte, unless otherwise stated

RED-WINGED TINAMOU *Rhynchotus rufescens*

The first documented state record involved a singing bird that was sound-recorded in Lagoa Nova, Serra de Santana, on 30 April 2020 (WA 3795681; EO). Rio Grande do Norte may harbour three small remnant populations, probably (if not introduced or escaped) pertaining to the rare *R. r. catingae*, in the extreme south-east, south and centre of the state. In the neighbouring state of Paraíba, it has been sound-recorded twice in Aguiar, on 31 March 2014 (WA 1623179; P. B. Nunes) and 5 June 2017 (WA 2596392; F. A. Sonntag).

SOUTHERN SCREAMER *Chauna torquata*

Via social media, we became aware that a Southern Screamer had been killed by poachers (Fig. 1) near Pendências (05°15′S, 36°43′W), a region where other unexpected or rare

Figure 1. Poached Southern Screamer *Chauna torquata*, near Pendências, Rio Grande do Norte, Brazil, date unknown but prior to July 2019 (photographer unknown)

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wetland birds have been recorded, including Jabiru *Jabiru mycteria* (Sagot-Martin *et al*. 2020) and Roseate Spoonbill *Platalea ajaja* (WA 5215903; A. Varela). A photograph and video of the bird were received in July 2019, but the date of the record—*c*.1,800 km from the nearest documented records in the state of Goiás (WA 3562528; K. Borges-Road)—is unknown. This seems to be the first case of vagrancy of *C. torquata* in north-east Brazil (WikiAves 2025).

SCALED PIGEON *Patagioenas speciosa*
Two adults photographed atop a *Cecropia* tree in Espírito Santo on 1 April 2023 (WA 5325828; TC) is the first documented state record. This locality is close to Goianinha, where we previously observed but did not document the species (Sagot-Martin *et al*. 2020).

SICK'S SWIFT *Chaetura meridionalis*
Four seen in Santa Cruz on 20 December 2023, of which one was photographed (WA 5808165; EO); first documented state record. Like sightings on 5 November 2006 and 30 December 2010 in Goianinha (Sagot-Martin *et al*. 2020), this record is within the species' potential breeding period; it nests in the adjacent state of Ceará (Somenzari *et al*. 2018). Individuals observed over Santa Cruz in late August–early September 2024 (VGM) perhaps mark the arrival of a small breeding population. This highly migratory species vacates central and southern South America to overwinter in northern South America and is prone to vagrancy (Lees & Gilroy 2021), but, for now, there is no evidence that the species occurs in Rio Grande do Norte during the austral winter.

BLACKISH RAIL *Pardirallus nigricans*
An adult photographed in Ceará-Mirim on 10 March 2024 (WA 5964542; GJF) is the first state record for this species, which was expected to occur. *P. nigricans* was also photographed at the same locality in April–May (WikiAves 2025), consolidating this as the northern limit of the species' distribution.

KILLDEER *Charadrius vociferus*
A single photographed by JBI in Ceará-Mirim on 18 April 2022 is the first record in Brazil (Irusta 2024). The nearest record, also of a vagrant, is from French Guiana and undocumented (Claessens 2017).

WHITE-BACKED STILT *Himantopus melanurus*
Seven photographs involving four different individuals are available: an adult female with an adult Black-necked Stilt *H. mexicanus* at Fazenda Dinamarca, Serra Negra do Norte, on 19 November 2023 (WA 5906787; SKA), an adult with *H. mexicanus* in Caicó on 4 March 2024 (WA 5959930, 5959943, 5959952, 5960045; M. Lobo), an adult male in Santa Cruz on 28 April 2024 (WA 6062214; M. Melo), and an adult in Currais Novos on 19 March 2025 (WA 6748654; FG). The nearest documented records are from north-east Ceará in December (WA 5806730; I. Alencar) and Paraíba in August (WA 6319536; H. Leite). Listed as a separate species by Pacheco *et al*. (2021), White-backed and Black-necked Stilts are treated as conspecific in other works (e.g., Remsen *et al*. 2024). In Brazil, there is no distinct geographical limit between these two taxa. In north-east Brazil, black-crowned and white-crowned birds sometimes occur side by side, and the former also occur in the south-east and south. The photographs mentioned above show the *H. melanurus* phenotype, but it is unclear whether these individuals truly represent visitors from the south, or instead variation within *H. mexicanus*, which hypotheses remain to be tested (J. F. Pacheco *in litt*. 2024).

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TEREK SANDPIPER *Xenus cinereus*

One photographed by JBI at Praia do Forte, Natal, on 29 April 2023 (Fig. 2) is the fourth record for Brazil, the second for the north-east, and the first for the state. Elsewhere in Brazil, one was observed in Porto Seguro, state of Bahia, in March 1997 (Mazar Barnett 1997), one was photographed at Paraty, Rio de Janeiro, in November 2005 (White *et al*. 2006), and there was one in Conceição da Barra, Espírito Santo, in February 2023 (WA 5260027; C. M. Joenck).

Figure 2. Terek Sandpiper *Xenus cinereus*, Praia do Forte, Natal, Rio Grande do Norte, Brazil, 29 April 2023 (Jorge B. Irusta)

BULWER'S PETREL *Bulweria bulwerii*

Previously included in our secondary list based on datalogger information (Sagot-Martin *et al*. 2020). One seen off Extremoz (*c*.05°41′52″S, 34°56′02″W; water depth 720–840 m) on 31 January 2021 (F. Olmos, R. D. Lima) was the first direct observation near the state's continental shelf. Another was seen just *c*.15 m from land at Pirambúzios (06°00′11″S, 35°06′32″W), Nísia Floresta, on 2 November 2021 (MP), whilst one found dying ashore at Jacumã, Ceará-Mirim, on 17 December 2021 was preserved as a specimen (COUFRN 1418; Fig. 3). On 8 September 2024, two were seen: one *c*.12 km off Nísia Floresta (06°01′40″S, 35°01′33″W; water depth 26 m) and one *c*.10 km off Parnamirim (05°55′53″S, 35°03′22″W; 15 m) (FS-M). The presence of *Bulweria* off extreme north-east Brazil, predicted by Lees *et al*. (2015), is thus confirmed. Its status in Brazil, previously considered unclear (Pacheco *et al*. 2021), appears to be that of a regular boreal winter visitor (*cf*. Pennington 2021).

Figure 3. Fresh corpse of Bulwer's Petrel *Bulweria bulwerii*, Ceará-Mirim, Rio Grande do Norte, Brazil, December 2021 (© Adriano Souza)

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BROWN BOOBY *Sula leucogaster*

One photographed in Guamaré in early March 2019 was mentioned by Sagot-Martin *et al*. (2020), but the photograph was unavailable. Now, it is available (Fig. 4). Six photographed at Icapuí, Ceará, on 4 June 2017 (WA 2754849; R. D. Lima), may have entered Rio Grande do Norte waters. There are no records on the Brazilian coast between Rio Grande do Norte and the state of Alagoas (WikiAves 2025), but seawatching at Touros, in the former state, would probably detect Brown Booby and other seabirds.

Figure 4. Brown Booby *Sula leucogaster*, off Guamaré, Rio Grande do Norte, Brazil, early March 2019 (© Adisson Gleydson)

SCARLET IBIS *Eudocimus ruber*

An adult photographed at Lagoa de Guaraíras on 31 October 2024 is the first documented state record (Fig. 5). Another vagrant was seen at the Potengi estuary, Natal, by A. S. Santiago (*per* JBI) in 2003 or 2004, but was not documented. The species' vagrancy potential is clouded by escapes, but at least some records in the West Indies are accepted as wild birds (Kirwan *et al*. 2019). The species occurs regularly in north-west Ceará (WikiAves 2025), with an increasing population at Maragojipe mangroves, Recôncavo Baiano, Bahia (D. Souza *in litt*. 2009), and an adult was recorded in Alagoas during 2003–08 (e.g., WA 385843; B. J. Almeida).

Figure 5. Adult Scarlet Ibis *Eudocimus ruber*, Lagoa de Guaraíras, Rio Grande do Norte, Brazil, 31 October 2024 (photographer unknown)

BARE-FACED IBIS *Phimosus infuscatus*

At least ten in Ipueira (06°48′55″S, 37°11′29″W) on 3 August 2024, some of which were photographed (WA 6473844, 6473845; AG). Previously, on 8 July 2024, one was caught by a fisherman (Fig. 6), and groups of 3–5 were reported at waterbodies around Ipueira, with one group remaining until at least early November. Appears to be expanding its range in north-east Brazil, with multiple records in the states of Pernambuco and Ceará (WikiAves 2025).

Figure 6. Adult Bare-faced Ibis *Phimosus infuscatus*, Ipueira, Rio Grande do Norte, Brazil, 8 July 2024 (Alan Glauco)

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BUFF-NECKED IBIS *Theristicus caudatus*
An adult photographed in Cruzeta on 12 March 2024 (WA 5968361; TS) is the first documented state record; a former population is now extinct (Sagot-Martin *et al*. 2020). There are records in neighbouring Paraíba and Ceará (WikiAves 2025), and the species was formerly very common in the latter (Teixeira *et al*. 1993). The origin of the bird in Cruzeta is unknown, but is unlikely to have been a long-distance vagrant (see Lees & Gilroy 2021).

SWALLOW-TAILED KITE *Elanoides forficatus*
Four were seen in Tibau (04°54′35″S, 37°25′36″W) on 29 December 2017 (VL-S), of which one was photographed (Fig. 7). This first documented state record was already mentioned by Lima *et al*. (2022). Another was seen over Nísia Floresta (05°59′52″S, 35°06′49″W) in January 2022 by A. F. Martins (*per* VL-S). The origin of these records is uncertain; North American migrants cannot be excluded.

Figure 7. Swallow-tailed Kite *Elanoides forficatus*, Tibau, Rio Grande do Norte, Brazil, 29 December 2017 (Victor Leandro-Silva)

RUFOUS-THIGHED KITE *Harpagus diodon*
A soaring adult photographed in Currais Novos on 27 April 2023 (WA 5362998; FG) is the first record for the state. Potentially an austral migrant.

LONG-WINGED HARRIER *Circus buffoni*
A dark-morph young photographed in Ceará-Mirim on 21 January 2024 (WA 5876471; GJF) is the first state record for this unexpected species; it was repeatedly photographed until 22 June 2024 (WA 6154034; A. Felipe). A pale-morph adult was present at the same locality from 25 January 2024 (WA 5886649; B. França) until 21 June 2024 (WA 6152365; A. Felipe). Thus, both spent at least five months in wetlands along the rio Ceará-Mirim. A sighting from Juazeiro, Bahia (Reiser 1926: 201) is now questioned (Lima 2021), but, although records in the Caatinga are rare (e.g., Mucugê, Bahia), the species is known to migrate as far as northern Brazil (Sick 1997, van Perlo 2009, Kirwan *et al*. 2015, WikiAves 2025). Not treated as a potential vagrant species by Lees & Gilroy (2021), but we consider the records reported here to involve vagrant individuals.

SPECTACLED OWL *Pulsatrix perspicillata*
One sound-recorded at Mata da Estrela, Baía Formosa, on 23 January 2023 (WA 5502253; CS-G) is the first documented state record, made during passive acoustic monitoring (Crunchant *et al*. 2021) at several remnant patches of Atlantic Forest in the state analysed via the ARBIMON platform (arbimon.org). This was the only record of the species, which was sound-recorded at the same locality in 2017 (P. F. Costa-Neto pers. comm.), although the documentation is unavailable. The taxon involved could be *P. p. perspicillata* or Atlantic Forest *P. p. pulsatrix*, or even an undescribed taxon from the Pernambuco Centre of Endemism.

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BUFF-FRONTED OWL *Aegolius harrisii*
Reported from Serra Negra do Norte (Pichorim *et al*. 2016, Sagot-Martin *et al*. 2020), the species has now been documented in the state at multiple sites. One of two singing individuals was sound-recorded in São Tomé on 7 May 2024 (WA 6067846; AR) and it was photographed there on 15 June 2024 (WA 6139519; W. Vieira). Others were photographed in Lajes Pintadas on 18 June 2024 (WA 6155015; W. Vieira) and Cerro Corá on 30 June 2024 (WA 6170073; AM). This poorly known species (Girão & Albano 2010) has now been widely recorded in north-east Brazil (Pereira *et al*. 2012, Oliveira *et al*. 2020, Silva *et al*. 2021, WikiAves 2025).

MOUSTACHED WOODCREEPER *Xiphocolaptes falcirostris*
One photographed at Serra das Melancias (06°49′01″S, 37°14′30″W), Ipueira, on 15 January 2024, is the first state record (Fig. 8). The dominant vegetation comprises trees such as *Myracrodruon urundeuva*, *Amburana cearensis* and *Anadenanthera colubrina*, the latter of which it favoured, all three of which are typical of arboreal Caatinga and occur at localities in central Pernambuco where *X. falcirostris* is common (Kaminski *et al*. 2013). Nevertheless, it has also been recorded at very degraded sites (R. D. Lima *in litt*. 2025).

Figure 8. Adult Moustached Woodcreeper *Xiphocolaptes falcirostris*, Ipueira, Rio Grande do Norte, Brazil, 15 January 2024 (Alan Glauco)

BLACK-TAILED TITYRA *Tityra cayana*
The photograph of a young male in Nísia Floresta on 7 May 2021 (WA 4299307; FS, identified by A. Salvador) was the first state record for this unexpected species and was presumably a dispersing vagrant. The nearest documented records to Rio Grande do Norte are from eastern Pernambuco and northern Piauí state (WikiAves 2025). The taxon concerned is considered a species by some authors, Eastern Black-tailed Tityra *T. braziliensis* (e.g., del Hoyo & Collar 2016).

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GREY-CROWNED FLYCATCHER *Tolmomyias poliocephalus*
One heard by M. Silva and sound-recorded (WA 5283566; J. Dantas) in Baía Formosa on 22 May 2021 is the first state record for this expected species.

PLANALTO TYRANNULET *Phyllomyias fasciatus*
One seen and sound-recorded at Floresta Nacional de Nísia Floresta on 14 October 2022 (WA 5087131; ML 494164721; CS-G) is the first documented state record, with another record of three birds at the same locality (Salustio-Gomes *et al*. 2023). *P. fasciatus* is an indicator of 'Brejos de altitude' (Andrade-Lima 1982, Lima *et al*. 2019) and can be expected on the state's less deforested serras.

EASTERN WOOD PEWEE *Contopus virens*
A good photograph of one perched in Nísia Floresta on 1 December 2024 (WA 6538845; VGM) is the first state record of the genus *Contopus* and the only photographic record of *C. virens* for north-east Brazil (WikiAves 2025). Identification as *virens* rather than Western Wood Pewee *C. sordidulus* is coincident with their status: the latter is a vagrant to northern South America, whereas the former, also a long-distance boreal migrant, overwinters from Colombia to western Brazil in October–May (Somenzari *et al*. 2018). A young female collected in semi-deciduous forest at Chapada do Araripe, southern Ceará, on 24 March 1989 (Teixeira *et al*. 1993; specimen in Museu Nacional, Rio de Janeiro), is the nearest documented record to Rio Grande do Norte.

YELLOW-FACED SISKIN *Spinus yarrellii*
A flock feeding on *Brachiaria* seeds at Lagoa Nova, Serra de Santana, in the first week of March 2009 (A. Amaro pers. comm.); several seen in the fragments of mature caatinga on the same plateau during October 2009–October 2010 (Pichorim *et al*. 2014); and an adult male at Fazenda Fulô da Pedra, Serra de São Bento, on 28 February 2021 (FS-M). These observations

Figure 9. Yellow-faced Siskin *Spinus yarrellii* at nest, Serra de Santana, Rio Grande do Norte, Brazil, February 2024 (Eugênio Oliveira)

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and many interviews with local people suggest that *S. yarrellii* still occurs in Rio Grande do Norte during February–March, but this now rare Brazilian endemic (Clement & Sharpe 2020) is possibly not a year-round resident in the state, migrating elsewhere during the local dry season. A successful reintroduction project, planned by Coronel A. Cirne and based in the Serra de Santana, commenced in early March 2023, when two confiscated pairs were released; at the end of the same month, one of the pairs nested in a cashew *Anacardium occidentale* tree. By the end of 2023, 14 had been released, mainly pairs, which bred during 2024 (Fig. 9) and some were observed up to 5 km from the release site.

MASKED YELLOWTHROAT *Geothlypis aequinoctialis*
The spontaneous song of an adult male was heard by M. Silva before photographs and sound-recordings were made in Baía Formosa on 6 December 2020 (WA 4303976, 5049049; JD). This is the first record of a species expected in the state. Other records in the Atlantic Forest of Rio Grande do Norte (JD) and almost year-round presence in neighbouring Paraíba (WikiAves 2025) prove the species is neither an accidental visitor nor an austral migrant (Capllonch & Ortiz 2007) to extreme north-east Brazil, where the taxon concerned is *G. a. velata*. Thus, Baía Formosa is the new northern distributional limit for the Atlantic Forest population. Note that some authorities treat the two subspecies—*aequinoctialis* and *velata*—as separate monotypic species (AviList Core Team 2025).

SCARLET TANAGER *Piranga olivacea*
A Northern Hemisphere vagrant to Brazil (Somenzari *et al*. 2018, Pacheco *et al*. 2021). A photograph of a breeding-plumaged adult male at Lagoa Nova, Serra de Santana, on 9 June 2022 (WA 4874290; EO) is the first state record. None of the other Brazilian records in WikiAves and Somenzari *et al*. (2018) (October–December, March and July) was in June. The only previous record in north-east Brazil was also on an unexpected date, 2 July, of a male in Bahia (WA 3861533; N. Cafezeiro), which was unlikely to have been an escapee or deliberately released individual.

GUIRA TANAGER *Hemithraupis guira*
Two observed at Baía Formosa (06°25′30″S, 35°6′54″W) on 14 May 2016 (JD) is the first state record of this expected species. *H. guira* was first documented via photographs of an adult female (WA 5197416; J. Filho) and one sound-recorded without playback (WA 5198832; A. P. Souza) at the same locality on 27 December 2022. An adult male in Cerro Corá on 13 September 2022 (WA 5030533, 5030540; AM) seems to indicate that *H. guira* persists in Atlantic Forest remnants as well as in the state's serras.

RUSTY-COLLARED SEEDEATER *Sporophila collaris*
A photograph of an adult female reportedly with an adult male in a marsh at Ceará-Mirim on 4 May 2024 (WA 6055556; GJF) is the first record of this unexpected species in the state. The nearest documented records are from coastal Ceará during the rainy season (WA 4401106; C. H. Cruz) and two localities in Piauí in the Amazonia/Caatinga contact zone, but to the south only in southern Bahia (Kirwan 2007; WA 4834425; N. Fialho). Caged individuals of this species have not been seen in Rio Grande do Norte (FS-M).

New species to the Secondary List

Because of the relative accuracy of geolocators, it is impossible to be sure if the three procellarids—Zino's Petrel *Pterodroma madeira*, Desertas Petrel *P. deserta* and Boyd's

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Shearwater *Puffinus boydi*—in our secondary list (Sagot-Martin *et al*. 2020) occur in the state's continental waters. They are maintained there for now, not because of any doubt as to species identification, but because they might be only extralimital records.

BLACK JACOBIN *Florisuga fusca*
Omitted in error from our secondary list (Sagot-Martin *et al*. 2020). The species was cited for Rio Grande do Norte without locality by Grantsau (1989), but there is no specimen documentation. The nearest records are from neighbouring Paraíba, in Areia on 25 June 2020 (WA 3852196; T. Zanetti), with photos from four other municipalities in the same state (WikiAves 2025).

LONG-TAILED WOODNYMPH *Thalurania watertonii*
A male at the edge of shrubby vegetation in Floresta Nacional de Nísia Floresta (06°04′40″S, 35°10′42″W) on 1 July 2019 was undocumented (Gomes 2020). Probably a vagrant, we cannot eliminate the possibility of a subpopulation in the far northern Atlantic Forest. In fact, the species was mentioned by Ruschi (1964) and was listed for the littoral from Ceará to Bahia by Grantsau (1989), but this resident hummingbird, which is possibly endemic to the Pernambuco Centre of Endemism, has been documented only in Pernambuco and Alagoas (Pacheco & Whitney 1995, Las-Casas & Azevedo 2009, Berryman *et al*. 2023, WikiAves 2025). The nearest documented locality to Rio Grande do Norte is the Serra do Mascarenhas, São Vicente Férrer, Pernambuco at the frontier with south-east Paraíba (Berryman *et al.* 2023), 180 km south of Floresta Nacional de Nísia Floresta.

BLACK-BROWED ALBATROSS *Thalassarche melanophris*
Inadvertently omitted from the potential list of Sagot-Martin *et al*. (2020). Museum specimens and band recoveries from north-east Brazil have been available for at least 35 years (Nacinovic & Teixeira 1989, Olmos 2002, Lima *et al*. 2004, Silva e Silva 2008, Mestre *et al*. 2010, Almeida *et al*. 2019). Also, a juvenile off Aracaju, state of Sergipe on 29 September 2012 (WA 761267; M. Vasconcelos). Thus this migrant from the south was expected off Rio Grande do Norte. Three albatrosses were seen, one documented via a poor-quality video by the fishermen F. N. Ramos and A. F. Ramos, who noted the 'yellow bill, all white below including the wings, uniform grey above, heavy bodied, … *c*.70–150 m from the boat at Paredes (06°01′35″S, 34°55′57″W; water depth 90 m), 22 km off Nísia Floresta on 27 May 2023'. Another record, of two, was made a few days later by another fisherman, E. P. de Assis, who saw the 'all-yellow bill and dark eyebrow', 17 km off Nísia Floresta (06°03′S, 34°57′W; 35 m) on 2 June 2023. Despite the poor quality of the video, meaning the species is placed on our secondary list, the descriptions including the all-yellow bill provide strong support (see Bugoni & Furness 2009).

Black-browed Albatross prefers cold waters and has been documented regularly in the Northern Hemisphere, on both sides of the Atlantic (Lees & Gilroy 2021) including adults as far north as Greenland (66°N) (Bourne 1967), even once at 80°N in June 1878 (Davis 2014), and northern Labrador (56°N), Canada (McDaniel 1973, Coffey 2012, Pippen *et al*. 2014, Kirwan *et al*. 2019, Lees & Gilroy 2021). Brazilian records originate mostly from the largest breeding colonies on the Falklands (Bugoni & Furness 2009, Somenzari *et al*. 2018) and our records of adults are from the post-nuptial period. We expect further sightings or beached individuals of this globally increasing species in the state (IUCN 2025-1).

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BLACK HAWK-EAGLE *Spizaetus tyrannus*
The identification of a series of 4–6 scratchy whistles recorded inside the forest at Baía Formosa on 6 August 2022 (WA 4968484; C. Simão) cannot be definitely attributed to this species (J. F. Pacheco *in litt*. 2024, R. D. Lima *in litt*. 2024). Thus, without more conclusive documentation, this expected resident species is included only on the secondary list.

OLIVACEOUS ELAENIA *Elaenia mesoleuca*
An austral migrant (Chesser 1994, Parker *et al*. 1996, Ruiz-Esparza *et al*. 2011) whose movements are poorly known. Photographic records from Rio Grande do Norte to Sergipe suggest its presence in north-eastern Brazil during April–June (records identified and analysed by R. D. Lima). One at Mata da Estrela, Baía Formosa, on 2 June 2019, indicates the species' presence in the state (WA 3383584; A. Lucas). However, visual distinction of *Elaenia* is challenging, and the lookalike Chilean Elaenia *E. chilensis* occurs in the region during the same period. Because migratory *Elaenia* are often silent on their non-breeding grounds, obtaining sound recordings may be impractical, probably explaining the lack of audio records in the region. We include *E. mesoleuca* on our secondary list, awaiting a definitive identification.

SILVER-BEAKED TANAGER *Ramphocelus carbo*
An adult male of either *R. r. carbo* (northern Brazil) or *R. r. centralis* (eastern Brazil) was at a bird feeder in Currais Novos on 25–29 October 2023 (e.g., WA 5695609, 5696480; FG). Although its behaviour was more suggestive of a vagrant than a cagebird, the species was unexpected in the state. Because of doubts as to the subspecies involved and the individual's provenance (escapee, deliberate release or vagrant?), the species is placed on our secondary list. In the Atlantic Forest, it is associated with enclaves belonging to other phytophysiognomic domains (Moreira-Lima 2013). The species' Amazonian population apparently reaches as far east as Piauí and western Ceará (WikiAves 2025). The nearest records to Rio Grande do Norte are by J. Almeida of a juvenile male at a bird feeder (WA 5057, 5986) on 2 January 2009, and an adult (WA 6418) on 31 January 2009, both in Guaramiranga, Serra de Baturité, Ceará, but possibly involved released or escaped birds.

New species to the Tertiary List

A list of 22 species of hummingbirds said to be part of the state's avifauna but without detailed records or evidence (Ruschi 1964; a reference omitted in our first paper) includes three species for which we have no other information and are extralimital to their current known distributions, White-vented Violetear *Colibri serrirostris*, included in the tertiary list, and Frilled Coquette *Lophornis magnificus* and Sombre Hummingbird *Aphantochroa cirrochloris* in the potential list.

WHITE-VENTED VIOLETEAR *Colibri serrirostris*
Included for the state by Ruschi (1964; see above). Not in the potential list because the records nearest to Rio Grande do Sul are too distant, in Sergipe (WA 506901; M. C. Sousa) at Itabaiana on 9 September 2010, and northern Bahia (WikiAves 2025).

AMERICAN PYGMY KINGFISHER *Chloroceryle aenea*
Inadvertently omitted from the tertiary list in Sagot-Martin *et al*. (2020). A sight-only record in Macau in May 1988 (D. Souza *in litt*. 2007) was considered improbable because during continuous studies in 1998–2018 the species was never reported in estuarine complexes in

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the north of the state. Because of the low probability of occurrence, we discarded the only other undocumented (and undated) but published record, at Extremoz, 24 km north of Natal (Silveira *et al*. 2001). See potential list.

CLIFF SWALLOW *Petrochelidon pyrrhonota*
Seven observed at Pedra do Rosário, Natal, on 22 March 2023 by R. Morris (https://ebird.org/checklist/S131520006). Except for south-west Bahia, there is no documented record for this migratory species in the Brazilian north-east (WikiAves 2025). We consider that the species involved was more likely to have been Barn Swallow *Hirundo rustica*.

New species to the Potential List

EURASIAN COLLARED DOVE *Streptopelia decaocto*
Not admitted to the Brazilian avifauna (Pacheco *et al*. 2021) but included in the South American list by Remsen *et al*. (2024). Escapees have been seen in Rio Grande do Norte, e.g., at Pium, Parnamirim, on 28 October 2010 and 12 October 2016 (FS-M), but there is no feral population at this locality. At Pirangi do Sul, Nísia Floresta, cagebirds were bred for more than 10 years prior to *c*.2000 (H. Silva pers. comm.). The first published documentation for the state is a photo from Parelhas on 30 October 2022 (WA 5109889; R. Barros). Other documented records in north-east Brazil, in the states of Ceará, Pernambuco and Bahia, all in the 2020s. Until breeding in the wild is documented in the state, Eurasian Collared Dove will remain on our potential list.

RACKET-TAILED COQUETTE *Discosura longicaudus*
Another species mentioned for the state by Ruschi (1964) without details or evidence. Because of abundant potential food—flowers of *Inga* spp and cashews *Anacardium* (Grantsau 1989)—and the species' probably larger distribution in the Atlantic Forest biome formerly, we include it in our potential list. We estimate a low chance of occurrence because the global population is declining, with few records in Pernambuco, just one in Alagoas (Lima *et al*. 2022) and a lack of recent records in Paraíba (WikiAves 2025).

FRILLED COQUETTE *Lophornis magnificus*
Included for the state by Ruschi (1964) without details or evidence. A Brazilian endemic only recently recorded for the first time in the Caatinga biome (Lima 2021). Little-known migratory movements (Moreira-Lima 2013) and the relative proximity of a record in Taquaratinga, Pernambuco, near the border with Paraíba, on 1 December 2018 (WA 3201230; A. Gomes), lead us to include the species in our potential list.

SOMBRE HUMMINGBIRD *Aphantochroa cirrochloris*
The sole report for the state (Ruschi 1964) is undocumented. Included on our potential list based on records in Taquaratinga, Pernambuco: photographs on 7 April 2019, 21 August 2021 and 28 January 2024 (e.g., WA 5891375; M. Nascimento). This locality is the northernmost in the Atlantic Forest (WikiAves 2025).

MARBLED GODWIT *Limosa fedoa*
Recorded on the littoral of northern and north-eastern Brazil, with undocumented but regular records in the state of Pará during August–February 2001–03 (Kober *et al*. 2006), the first documented Brazilian record in Maranhão on 25 January 2012 (WA 1317163; M. Holderbaum), which is the only record in that state (Carvalho *et al*. 2020), and one in north-

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west Ceará on 20 January 2023 (WA 5267525; R. Cazassa, identified by A. C. Lees). A vagrant from the north, it can be expected on beaches in the north of the state.

GIANT SNIPE *Gallinago undulata*
Popular accounts of the mysterious 'haja-pau', an onomatopoeic local name attributed to *G. undulata*, are restricted to eastern Rio Grande do Norte, in the municipalities of Maxaranguape, Ceará-Mirim, Macaíba, Nísia Floresta, Goianinha, Canguaretama and Vila Flor, and in Paraíba, in Rio Tinto, Lucena, Cabedelo and João Pessoa. This, together with characteristics suggestive of Giant Snipe, e.g., habitat (wetlands), onomatopoeic sounds given from dusk to dawn, and their source remaining invisible (VGM). We believe the species occurred in the state at least until the end of the 20th century, may well still do so, and we encourage targeted searches.

WESTERN WILLET *Tringa inornata*
We follow Pacheco *et al*. (2021), but Western Willet is not treated as a species by Remsen *et al*. (2024). Several potential *T. inornata* have been photographed on the north coast of the state in January, February, July and August, between 2005 and 2018 (JBI), based mainly on comparison between their size and that of the accompanying shorebirds and the pale greyish overall plumage. However, the species is hard to separate from the previously conspecific Eastern Willet *T. semipalmata* (Martínez-Curci *et al*. 2014, Oswald *et al*. 2016) and none of our photos sent to the Wader Quest Board could be identified to a willet species (R. E. Simpson *in litt*. 2025). It seems that *T. inornata* will only be confirmed if an individual can be trapped.

SCOPOLI'S SHEARWATER *Calonectris diomedea*
Pacheco *et al*. (2021) treated this species as separate from Cory's Shearwater *C. borealis* and Cape Verde Shearwater *C. edwardsii*, and endemic as a breeder to the Mediterranean. An adult female tracked with a geolocator from Pantaleu Island, Baleares, reached the southern Brazilian continental shelf (Oro *et al*. 2008). Most of the population spends the non-breeding period, October–April, in the Atlantic, mainly off West Africa (Péron & Grémillet 2013) but an adult from Lavezzi Island, Corsica, reached southern Brazil (Péron *et al*. 2012). The first Brazilian record was in the state of Rio Grande do Sul in March 2013 (Oliveira *et al*. 2019). Occurrence over the continental shelf off Rio Grande do Norte is possible but not very likely.

ASCENSION FRIGATEBIRD *Fregata aquila*
A juvenile satellite-tracked from Ascension flew 45,000 km in 3.5 months, including crossing Brazilian waters within *c*.180 km of Fernando de Noronha and the São Pedro e São Paulo archipelago (the first documented record for the Americas) (Williams *et al*. 2017). This reinforces the validity of a well-described sight record on Fernando de Noronha of a juvenile at the Magnificent Frigatebird *F. magnificens* colony on Sela Ginete islet on 20 October 1987 (Antas *et al*. 1988, 1990; see also Schulz-Neto 2004 and Silva e Silva 2008), which record was questioned by Nacinovic & Teixeira (1989). We consider the possibility of this vagrant (Pacheco *et al*. 2021) occurring in the state's continental waters to be low, although it has wandered as far north as the Western Palearctic on three occasions (Lees & Gilroy 2021).

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GREAT FRIGATEBIRD *Fregata minor*
The critically threatened taxon *nicolli* is nowadays restricted to Trindade Island (Pacheco *et al*. 2021). Photos of a juvenile being chased by Magnificent Frigatebirds *F. magnificens* near their colony on the east side of Ilha da Rata, Pontal da Macaxeira (03°48′30″S, 32°22′49″W), Fernando de Noronha, on 8 March 2008, 'presumably from Trindade, the species' nearest breeding site, possibly with the south-east trade winds' (Silva e Silva & Carlos 2019), suggest to us a small likelihood of vagrancy to the continental waters of Rio Grande do Norte.

AMERICAN PYGMY KINGFISHER *Chloroceryle aenea*
Although several were reportedly trapped and photographed in mangroves of the Mamanguape and Paraíba do Norte Rivers in neighbouring Paraíba (Araújo *et al*. 2006, H. Araújo *in litt*. 2011), there is no documentation available. However, recently published photos of an adult female in João Pessoa on 12 May 2023 (WA 5381966; P. Arruda) and an adult male in Santa Rita on 30 September 2023 (WA 5638591; B. Castro) document its presence, albeit perhaps only occasional, in Paraíba. Thus, we now believe this species might be found in the mangroves of southern Rio Grande do Norte. See tertiary list.

BLACK-NECKED ARACARI *Pteroglossus aracari*
The nominate subspecies occurs in southern Amazonia and the Atlantic Forest from Paraíba to Rio de Janeiro, mainly below 500 m (Moreira-Lima 2013, WikiAves 2025). It has been documented in ten municipalities of Pernambuco including at the border with Paraíba, with an adult in a *Cecropia* in Macaparana on 2 April 2012 (WA 915264; M. Braun) the nearest record to Rio Grande do Norte (WikiAves 2025). A possible but not expected species for the state.

CRESTED DORADITO *Pseudocolopteryx sclateri*
This patchily distributed marsh-dweller inhabits parts of the Atlantic Forest biome (Ridgely & Tudor 2009, WikiAves 2025), but had not been recorded between Alagoas and Rio Grande do Norte (Almeida & Teixeira 2010, Pereira *et al*. 2012, 2014). A juvenile was photographed in Feliz Deserto/Penedo on 16 May 2020 (WA 3801576; S. Leal), the only record for Alagoas at the time (Lima *et al*. 2022). A photograph from April 2023 confirmed the species in Penedo (WA 5354278; L. Catende), and it was documented in Araioses, Maranhão, on 24 May 2014 (WA 1338355; F. Vasconcelos) and 3 June 2014 (WA 6081354; R. Lebowski). There is a large gap in distribution between southern Alagoas and north-east Maranhão. The lack of records in the states of Amapá and Maranhão in June–September (WikiAves 2025) suggests birds in this region are not austral migrants and could be resident. In Rio Grande do Norte, the marshes formed by the seasonally flooded beds of rivers, known locally as *paús*, where the species could occur lack systematic ornithological studies.

CARIBBEAN MARTIN *Progne dominicensis*
A female equipped with a geolocator on the island of Dominica migrated via the Brazilian states of Roraima, Pará, Tocantins and Maranhão to its wintering area in western Bahia, *c*.3,550 km south-east of its breeding area (Perlut *et al*. 2017). Since then, the species has been documented in Minas Gerais, Roraima, and, closest to Rio Grande do Norte, repeatedly in central-east Piauí. Its Brazilian status now seems to be a regular visitor during the boreal winter between 20 October and 19 February (Perlut *et al*. 2017) or 12 September–20 March (WikiAves 2025). The identification challenges posed by some of the blue *Progne* martins, along with their rarity in Brazil, hamper our knowledge of their distribution, and may

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explain why *P. dominicensis* has not been identified in the state. It should be looked for in Rio Grande do Norte.

CUBAN MARTIN *Progne cryptoleuca*
A breeding male tagged with a geolocator in Havana was tracked to its wintering grounds on the edge of the Caatinga and Cerrado biomes in western Bahia, northern Minas Gerais and western Piauí (García-Lau *et al*. 2021). A photograph of four, including an adult male, in central-east Piauí on 2 January 2022 (WA 4673828; E. Feitosa) further confirms that the species winters in north-east Brazil. The latter is, like for *P. dominicensis*, the nearest locality, *c*.500 km, to Rio Grande do Norte.

SUMMER TANAGER *Piranga rubra*
A vagrant adult male photographed at Guaramiranga, Ceará on 17 December 2023 (WA 6003427; N. Júnior, identified by F. Nunes), is the first documented record for north-east Brazil. In country, this North American breeder winters mainly in Amazonia during October–February (WikiAves 2025).

ORANGE-FRONTED YELLOW FINCH *Sicalis columbiana*
Three distinct populations occur in South America (Jaramillo 2020), with south-eastern *S. c. leopoldinae* in the Cerrado and Caatinga; the closest record to Rio Grande do Norte was in southern Pernambuco (Pereira *et al*. 2012). More recently, photographs have become available from other nearby areas: an adult male in Quixadá, Ceará, on 20 January 2021 (WA 4200184; 'Gualhardo'), an immature male in Palmácia, Ceará, on 13 March 2022 (WA 4766338; P. Reis, identified by W. Nogueira) and an adult female in Exu, Pernambuco, on 17 January 2023 (WA 5233669; K. C. Oliveira), with a male observed gathering nest material nearby. We expect *S. columbiana* to be found in both southern and eastern Rio Grande do Norte.

RED-NECKED TANAGER *Tangara cyanocephala*
A population of *T. c. cearensis* was discovered in Maturéia, Paraíba on 28 September 2019 (WA 3507319; C. José), thus this subspecies can no longer be considered endemic to Ceará, and lead us to include it in our potential list, although suitable habitat in the state is scarce.

Conclusion

Twenty-eight species new to our consolidated list breed in Brazil. Three of them are endemic species: *Thalurania watertonii*, *Xiphocolaptes falcirostris* and *Spinus yarrellii*, and another three involve endemic subspecies *Rhynchotus rufescens catingae*, *Phyllomyias fasciatus cearae* and *Hemithraupis g. guira* (Pacheco *et al*. 2021, Remsen *et al*. 2024, WikiAves 2025). An accurate bird list can be a fundamental tool to expand knowledge of birds of a given region and to improve their conservation prospects. Also, updated secondary and potential lists stimulate birdwatchers and researchers to target their efforts.

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Supplementary Material

S1: all bird species new to our consolidated, tertiary and potential lists, plus errata relating to our first paper (Sagot-Martin *et al*. 2020).

S2: updated database of the Rio Grande do Norte avifauna.

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The genus name for the extinct New Zealand Eagle (Accipitridae) and a suggested replacement for an inappropriate vernacular name

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Summary.—The recently extinct New Zealand Eagle was described originally in the monotypic genus *Harpagornis*. Its relationships to other eagles have been debated for more than 150 years. Cladistic analysis of skeletal characters was inconclusive, leaving the eagle in its own genus, near *Aquila*. A genetic study resulted in its being moved to *Hieraaetus* in 2005. Since 2010 it has been included in *Aquila*, on the basis that *Hieraaetus* and *Aquila* form a monophyletic group. Most recently, genome-based genetic research has re-affirmed that New Zealand Eagle is sister to the Australian Little Eagle *Hieraaetus morphnoides*. I coined the current vernacular name, Haast's Eagle, in the early 1990s but on reflection it seems inappropriate. Here I advocate that a more suitable vernacular name is Fuller's Eagle, honouring its discoverer.

The recent publication of a new, genome-based phylogeny of the Accipitridae (Catanach *et al*. 2024) makes it appropriate to revisit the debate surrounding the generic position of the recently extinct New Zealand Eagle. It was described in a monotypic genus as *Harpagornis moorei* Haast, 1872 (Greek: *harpagē* a hook for seizure, seizing. Genitive: harpagos, robbing, rapacious, with as an example, Harpag-ornis, *ornis*, bird [Jaeger 1950]). The holotype femur was much larger than that of any other raptor whose skeletons Haast had to hand. A second species was named *H. assimilis* Haast, 1874, but it later proved to be the smaller male. In New Zealand publications *H. assimilis* was first synonymised with *H. moorei* only a century later (Checklist Committee 1970). Holdaway (1990a) provided data subsequently to support that decision. Despite his reservations that *H. assimilis* 'may be the male of *moorei*', Oliver (1955: 605) included it as a separate species, the 'Lesser extinct eagle', in the major textbook on New Zealand birds until the volume of *Handbook of Australian, New Zealand and Antarctic birds* dealing with the Accipitridae appeared (Marchant & Higgins 1993).

Taxonomic history

The eagle's relationships have long been debated. In the early 20th century Oliver (1930) initially agreed with Shufeldt (1896) that it was related to the genus *Aquila*. He then, based on his interpretation of the skull, sternum and pelvis, suggested a relationship with the sea eagles (*Haliaeetus*) (Oliver 1945), and repeated this view ten years later (Oliver 1955). Meanwhile, Duff (1949: 23) had expressed the view that it 'closely resemble[ed] the Wedgetailed (*sic*) Eagle of Australia', 'differing only in the reduction of the wing-bones and the lengthened leg (the beginning of that fatal New Zealand tendency to change from a flying habit to a pedestrian one). However, it is almost certain that it did fly…'. This interpretation he repeated, almost verbatim, two years later (Duff 1951). These two publications (a popular account of discoveries from a new rich deposit of fossil birds, and a

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widely read school journal article) greatly influenced the New Zealand public of the day in its perception of the eagle and of the extinct fauna of which the bird was part.

Unwittingly perhaps, Duff had drawn attention to two of the eagle's characteristics that set it apart from *Aquila* eagles. The difference in wing bone proportions and the relatively large legs and feet compared to Wedge-tailed Eagle *Aquila audax* are precisely those that the New Zealand bird shared with the much smaller Little Eagle *Hieraaetus morphnoides*, also of Australia. In suggesting that the eagle's relatively short ulna and radius and larger legs meant that it was on the road to flightlessness, Duff did not venture to explain how a huge raptor with extremely large talons could catch its obviously large prey if it could not fly well (Holdaway 1990a, 2002).

Cladistic analysis

At the time, comparative anatomy was the only method available to investigate evolutionary relationships of taxa represented solely by skeletons. Fortunately, the necessary comparisons were facilitated by the recent introduction of computer-based analyses of large sets of character states by programmes such as PAUP® (Swofford 1985). For the eagle, I employed coded variations between features on the major bones of specimens of representatives—often more than one—of as many accipitrid genera as were available in the skeleton collections of the Natural History Museum [then British Museum (Natural History)], Tring, the National Museum of Natural History, Smithsonian Institution, Washington DC, and the National Museum of New Zealand, Wellington (now Te Papa Tongarewa Museum of New Zealand). In all, I examined the skeletons of 66 species representing 51 of the *c*.60 genera of Accipitridae, as then understood, to try and identify a sister group for *Harpagornis moorei*.

I included two *Aquila* eagles, Golden Eagle *A. chrysaetos* and *A. audax*, sometimes thought, as above, to be the New Zealand bird's closest relative. Skeletons of the great birds of prey are not abundant even in these major collections—the genus *Hieraaetus* was represented by specimens labelled Bonelli's Eagle *H. fasciatus* in Tring (NHMUK 1847.10.31.50) and Washington (USNM 430796).

However, based on genetic evidence, *H. fasciatus* was moved subsequently to *Aquila* (Helbig *et al*. 2005, Lerner & Mindell 2005). Therefore, my study did not, in the event and most unfortunately as proven subsequently, include any representatives of *Hieraaetus*. It is unsurprising therefore that my analysis placed New Zealand Eagle as sister to *Aquila* (Holdaway 1992, 1994). I noted (Holdaway 1992: 117) that 'In Chapter 1, I showed that *Harpagornis moorei* is the sister group of *Aquila*. It would, however, be premature to submerge *Harpagornis* in *Aquila*, at the present stage of knowledge of the generic systematics of *Aquila* (Amadon 1982), so I retain Haast's genus here.' Recent genetic research has placed *Hieraaetus* and *Aquila* as sister genera (Lerner *et al*. 2017, Catanach *et al*. 2024).

The conclusions in Holdaway (1992, 1994) were consistent with those in several publications by Wink and co-authors, who were very active in the early 2000s, but who published mainly—as I had done in 1994—in symposium proceedings (Wink & Seibold 1996, Wink *et al*. 1996, Wink 2000, Wink & Sauer-Gurth 2000, Roulin & Wink 2004), and by Helbig *et al*. (2005) and Lerner & Mindell (2005). So, when the 2010 edition of the New Zealand bird checklist (Worthy 2010) was being compiled, it is not surprising that New Zealand Eagle was placed in *Aquila*. This generic assignment was repeated in the 2022 edition (Checklist Committee 2022). With apparently broad agreement in the secondary and tertiary literature (Barthel & Helbig 2005, Sangster *et al*. 2005, Mebs & Schmidt 2006, Commission de l'Avifaune Française 2007), all cited by Worthy (2010), that *Aquila* and

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Hieraaetus do not constitute separate lineages, the conclusion reached by Bunce *et al*. (2005), apparently supported by Holdaway (1992, 1994) that the New Zealand bird belonged in *Hieraaetus*, became redundant.

I had compared the New Zealand Eagle's wing and leg structures with those of many of the great eagles, as well as similarly large vultures, and those comparisons convinced me later that the bird did not belong in *Aquila* (Holdaway 1992, 1994). Harking back to Oliver's (1945) observation that the skull and bill were narrow and much longer than expected in an *Aquila*, and the hypertrophied legs and feet, it was clear that the eagle had the body (and habits) of a great eagle, but the head of a vulture (Holdaway 1992: 438–439, Holdaway 2002: 324–325), fitting for a bird that dealt with the large carcases of moa (Dinornithiformes) (Holdaway 1992, 2002). So, if there were good structural reasons for believing that it did not belong with *Aquila*, was the species better assigned to *Hieraaetus*, as suggested by Bunce *et al*. (2005)?

Genetic evidence

The phylogenetic trees in Lerner *et al*. (2017) and Catanach *et al*. (2024) confirmed the separation of *Aquila* and *Hieraaetus* at generic level. Catanach *et al*. (2024) relied on a robust phylogeny generated from genome-level sequencing using ultraconserved elements. Both analyses placed the New Zealand Eagle as sister to the New Guinea Pygmy Eagle *Hieraaetus weiskei*, Booted Eagle *H. pennatus* and the Australian Little Eagle *H. morphnoides*. The link to *H. morphnoides* is just as Bunce *et al*. (2005) had found nearly 20 years before (see above). After Bunce *et al*. (2005) was published, I attempted, with the help of Alan Tennyson at Te Papa Tongarewa Museum of New Zealand, to acquire a skeleton of *H. morphnoides* from the Australian Museum, Sydney. With the retirement of the Australian Museum curator, the donation was never completed, so I was unable to incorporate its character states in a new analysis. Such a study still needs to be undertaken.

Correct generic name

Based on the best available genetic data, the correct scientific name and up-to-date synonymy for the New Zealand eagle is as follows:

Genus *Hieraaetus* Kaup, 1844—type species (by original designation) *Falco pennatus* J. F. Gmelin = *Hieraaetus pennatus* (J. F. Gmelin)

Hieraaetus moorei (Haast); (Bunce *et al*. 2005).
Harpagornis moorei Haast, 1872: *Trans. NZ Inst*. 4: 193—Glenmark, Canterbury.
Harpagornis assimilis Haast, 1874: *Trans. NZ Inst*. 6: 64—Glenmark, Canterbury.
Hieraaetus moorei (Haast); Bunce *et al*. 2005, *PLoS Biol*. 3(1) e9: 1.
Aquila moorei (Haast); Worthy 2010, *Checklist Birds NZ*: 172.
Aquila moorei (Haast); Checklist Committee 2022, *Checklist Birds NZ*: 185.

A full synonymy was presented in Holdaway (1992). Regarding the species' vernacular name, the New Zealand checklists (Worthy 2010, Checklist Committee 2022) refer to the species as 'Haast's Eagle'. I have refrained from using that name here, because, although I coined it (Holdaway 1990b, Holdaway 1992)—the bird being known until then as just 'Harpagornis'—Haast's Eagle was, in retrospect, an unfortunate choice. It would have been more appropriate to have called it 'Fuller's Eagle' after the Canterbury Museum taxidermist who found the type material (femur, rib, and pedal phalanges) in the excavation Julius Haast (later Sir Julius von Haast) was directing at Glenmark, 40 km north of Christchurch. Fuller found the bones and recognised that they represented a massive bird of prey.

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In his description of the eagle—the first of an extinct New Zealand bird by a resident scientist—Haast (1872: 192) noted 'During the progress of excavations undertaken in the month of March of this year [1871] on the Glenmark property, Mr. F. Fuller, Taxidermist to the Christchurch Museum, found, amongst a considerable quantity of moa bones, mostly belonging to specimens of *Dinornis casuarinus*, *crassus*, and *didiformis*, five to six feet below the surface of the swamp and over a space of about thirty feet square, a few smaller bones in an excellent state of preservation, which he at once correctly referred to a gigantic raptorial bird.'

Haast has his immortality as the authority: he probably never ventured into the excavation trench himself. George Henry Moore, manager of the Glenmark (sheep) Station, possesses immortality via the species name. The only one left out has been the true discoverer, Fred Fuller. Five years later, Fuller committed suicide after his employment at the museum was suspended by Haast. Haast, the museum's founder and director, reported the suspension to the Museum Board, who dismissed Fuller on 10 July 1876. His son noted (von Haast 1948: 793) that 'For some time [Haast] had had trouble with Fuller, who had been drinking heavily.' 'This dismissal and the fact that he could not get any enquiry as to the circumstances of his dismissal preyed on Fuller's mind and he poisoned himself with arsenic, preventing the doctor who was called in from using the stomach pump.'

The original entry in the Register of Deaths in Christchurch, in red ink, records exactly the details included in his son's biography of his father. von Haast (1948) continued 'On his death a subscription was raised for his family [he had a wife and several children]. Haast contributed £5, promised to receive subscriptions and got a guinea from his friend, Professor Macmillan Brown. On 25 September, by five to four, the Board voted Mrs. Fuller a sum equal to two months' salary of her late husband. The opposition to the grant was merely on the ground that the Board had no funds for the purpose, the balance to the credit of the Museum being 5s 3d. Fuller's untimely death came at a very inconvenient time for Haast'. One may note that it was hardly 'convenient' for Fuller or his family either.

Museum taxidermists in the late 19th century worked with toxic chemicals, including arsenical soap (for preserving bird skins). Arsenic is a cumulative poison and Fuller may have been affected by the chemicals of his trade. While there may have been other issues that led to his drinking, none of the circumstances surrounding his sad fate should detract from his discovery of the bones of New Zealand's huge eagle and his recognition of what they represented. If any vernacular name should be applied, 'Fuller's Eagle' is far more appropriate than 'Haast's Eagle'. In terms of potential Māori names, Miskelly (1987) showed that the name *Hakawai* for a 'mystery bird' referred to the flight sounds of the now extinct mainland populations of New Zealand snipe *Coenocorypha*. The name *Pouakai*, ascribed to the eagle by Taranaki Māori, is unlikely to refer to this species as it was never part of the North Island avifauna (Holdaway 2002).

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The possible collection site of Maximilian zu Wied's Carolina Parakeet *Conuropsis carolinensis* from 'upper Missouri'

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Summary.—The Baillon Collection in La Châtre, France, contains a Carolina Parakeet *Conuropsis carolinensis* labelled as having been collected by Maximilian zu Wied in 'upper Missouri'. However, Maximilian also wrote that he did not believe Carolina Parakeets occurred in 'upper Missouri'. We identify the likely collection site of the specimen as the 'Platte Purchase' region of north-western Missouri, which resolves the contradiction between the specimen's label and Maximilian's published work.

Prince Maximilian zu Wied[1] (1782–1867) travelled in North America during 1832–34, making ethnological and natural observations throughout his journey (Schach 1994). He recorded the Carolina Parakeet *Conuropsis carolinensis* at multiple locations, from New Harmony, Indiana, all the way to Weeping Water Creek in Nebraska. He also collected at least three skins of the species, two now in the American Museum of Natural History, New York (AMNH 2616 and 2618) and one in the Baillon Collection, La Châtre, France (MLC.2011.0.313; Fig. 1; Gouraud 2014a).

The Baillon Collection was the shared work of Louis Antoine François Baillon (1778–1855) and his father, Jean François Emmanuel Baillon (1742–1801). Maximilian first visited the younger Baillon in Abbeville in 1814 (Prarond 1857). The two met there again on 14 August 1834, when the former, just returned from his trip to North America, was en route home to Neuwied, Germany. Baillon and Maximilian held each other in high regard and exchanged numerous specimens, 78 of which are still present in the Baillon Collection, including type specimens and extinct species (Gouraud 2014a, 2015).

The Carolina Parakeet in the Baillon Collection is labelled enigmatically in French 'haut Missouri', literally 'upper Missouri'. The exact collection location of the Baillon specimen is unclear, and Maximilian's references to Carolina Parakeet in 'upper Missouri' are vague in his own work and in later scholarship around it.

The record of Maximilian's journey appears in several iterations: (1) The *Tagebuch* (Diary), an edited version of Maximilian's field notes, which was recently translated and published as *The North American journals of Prince Maximilian of Wied* (Witte & Gallagher 2008–12, hereafter *NAJ*). (2) *Reise in das Innere Nord-America* (Wied 1839–41, hereafter *Reise*), a condensed version of the above. (3) *Reise* then appeared in French (Wied 1840–43) and English (Wied 1843, hereafter *Travels*). The poor translation and editing of the latter led to some unfortunate ornithological conclusions about the Carolina Parakeet (McKinley 1965, 1978). (4) The 'Natural History Diary', which *NAJ* references multiple times, has never

[1] There is ongoing debate about how to reference the Prince's name. Botanists use the abbreviation 'Wied-Neuw.' when referring to plants described by him. For species descriptions, herpetologists and ornithologists often use 'Wied' (Myers *et al*. 2011, Hoffmann & Geller-Grimm 2013, LeCroy *et al*. 2014, Gouraud 2015, Vanzolini & Myers 2015). However, Bruce (2023) proposed that 'Maximilian' is the correct name for scientific usage. Here, we will use 'Wied' in literature citations, but 'Maximilian' in the text.

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Figure 1A. Carolina Parakeet *Conuropsis carolinensis* collected in 'upper Missouri' by Maximilian, and now in the Baillon Collection, La Châtre, France (MLC.2011.0.313) (© F. Lauginie / Musée George Sand et de la Vallée noire, La Châtre, France). Figure 1B. Original inscriptions from the base of the pedestal of specimen MLC.2011.0.313 (in Baillon's handwriting). They read: 'Psittacus / carolinensis. Vieill[ot] / perruche de la Caroline. Buff[on] / pl[anche]. enl[uminée] 499 / Psittacus ludovicianus Lath[am] / papegai à tête aurore Buff[on] / femelle / haut Missouri ; par / s[on]. Alt[esse]. le P[rince]. de Wied.' (C. Gouraud / Musée George Sand et de la Vallée noire, La Châtre, France).

been published. When we examined the entry for the Carolina Parakeet, courtesy of the Joslyn Art Museum in Omaha, Nebraska, we found that it did not contain information substantively different from Maximilian's standalone paper on the species, 'Ueber den Papagei von Nord America' (Wied 1857, hereafter *JfO*).

Meaning of 'upper Missouri' in *Reise*

The phrase 'upper Missouri' appears to be a reference to the upper reaches of the Missouri River in *Reise*. *Reise* draws a distinction between 'unteren', lower, and 'obern', upper. While travelling west and north in 1833, Maximilian used 'unteren' to describe various locations in Missouri (e.g., *Reise* 1: 264, 1: 290).

In *Reise*, Maximilian first indicated the 'upper Missouri' near the mouth of the Vermillion River, South Dakota, when he stated that woody growth was no longer strong and vigorous as it was on the 'unteren Missouri' (*Reise* 1: 310). This phrase does not appear in the *NAJ*, and the editorial addition was likely based on Maximilian's journal while descending the Missouri on 8 May 1834 at the Vermillion River, where he stated, 'In this area, the tall forests, so characteristic of the lower Missouri, begin' (*NAJ* 3: 298, see also *Reise* 2: 335). Thus, the Missouri River upstream of the Vermillion River appears to be what Maximilian defined as the 'upper Missouri' (see Fig. 2).

However, Maximilian recorded no parakeets on the 'upper Missouri' as defined in *Reise*, except for preserved specimens on Indigenous American objects (McKinley 1965). In *JfO*, Maximilian stated directly that the species did not occur on the upper Missouri, at least not west of the Niobrara River and Ponca Creek, which empty into the Missouri River about 7 km from each other, in Knox County, Nebraska, less than 100 km west of the mouth of the Vermillion River. He connected the range limit of the species with the limits of forests along the Missouri River (*JfO* 104, translated from German):

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> 'They [the parakeets] are probably as widespread upstream along this river as the forests are along it; for the open prairies do not suit their nature. They no longer occur on the upper Missouri, and, as far as we know, they have not been observed farther west than the l'Eau qui court [Niobrara River] and Ponca Creek.'

Maximilian reported similar information in his journals. He spent the winter of 1833–34 at Fort Clark, North Dakota (spelled 'Clarke' in *Reise*),[2] in territory that *Reise* would count as 'upper Missouri'. While there, he wrote of parakeets, but only to reiterate that the species did not occur beyond the Niobrara River and Ponca Creek (*NAJ* 3: 138).

Maximilian may have asserted that the species occurred as far as the Niobrara River based on the observation of his navigator, Johnson Gardner. As he was descending the Missouri in spring 1834, Maximilian observed Carolina Parakeets at Weeping Water Creek in Nebraska on 14 May 1834 (*Reise* 2: 345, the following is from *NAJ* 3: 310, brackets in published text): 'This afternoon we noticed the first parakeets. Gardner had [seen] these beautiful birds before we came across him, therefore, at about l'Eau qui Court [Niobrara River].'

Maximilian did not employ Gardner until 8 May 1834 (*NAJ* 3: 300), well after he had written his notes about Fort Clark. However, Maximilian edited the *NAJ* from field notes after the journey was over, and there are other anachronisms in the text (Gallagher in *NAJ* 1: xxviii), so it is possible that Maximillian added Gardner's observation into the earlier description.

Reise's definition of the 'upper Missouri' does not provide a solution to the collection location of the Baillon Collection's specimen, as Maximilian did not record the species in that area.

'Upper Missouri' on labels and catalogues at the American Museum of Natural History

The AMNH holds most of Maximilian's bird collection, which it purchased in 1869 (Vanzolini & Myers 2015) or 1870 (Allen 1889). Most of AMNH's Maximillian specimens are labelled only by country or continent of origin, although some include more precise locations.

Table 1 shows the Maximilian specimens for which the AMNH catalogue or labels provide more precise location data and compares those data to where *NAJ* notes collection of that species. Maximilian probably did not mention in his notes every specimen he collected, especially of common species. However, his journal is the only means to match specimens to locations. When location data of a specimen match a location mentioned in *NAJ* one can be fairly confident in the accuracy of the specimen data. One or both of the Carolina Parakeets from the Maximilian Collection at AMNH are likely from New Harmony, Indiana, on the Wabash River (Wied 1865, see also McKinley 1976). Wied's (1865) catalogue does not reference the 'haut Missouri' parakeet specimen because it had already been given to Baillon at least ten years earlier, before the latter's death in 1855.

The *NAJ* does not record that Maximilian collected any of the specimens labelled 'Missouri' within the 1834 boundaries of the state of Missouri. For example, AMNH 3155 is Maximilian's Harris's Sparrow *Zonotrichia querula* skin, which is labelled 'Missouri'

[2] McKinley (1965) reported a parakeet record for Fort Clark based on *Travels*. When McKinley (1978) examined *Reise*, he discovered that the parakeet was not listed in the original German. However, when McKinley reported this correction to his earlier work, he accidentally wrote 'Fort Union' instead of Fort Clark (1978: 6). Maximilian visited Fort Union, in far western North Dakota, but did not report parakeets there. Maximilian's full 'Bird Calendar' for Fort Clark is at *NAJ* 3: 456.

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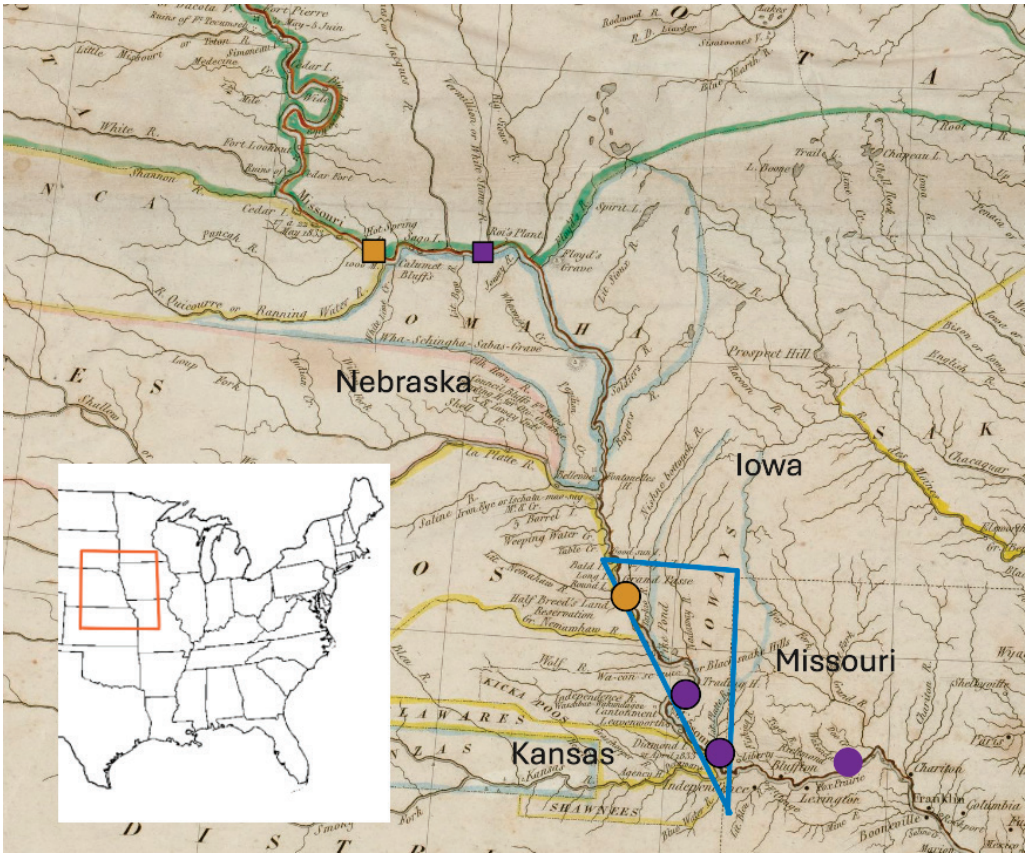

Figure 2: Detail of the map included in Maximilian's *Reise* (foldout at the beginning of the Atlas volume), before the Platte Purchase. Inset shows approximate area of detail (modern state borders).

Mouth of the Vermillion River, where Maximilian believed the border between the upper and lower Missouri River to lie.

Mouths of the Niobrara River (labelled 'R. Quicourre or Running Water R.') and Ponca Creek (labelled 'Puncah R.'). The limit of the distribution of the Carolina Parakeet *Conuropsis carolinensis* according to Maximilian, and the place Gardner sighted the species.

Location that *NAJ* notes that a Red-winged Blackbird *Agelaius phoeniceus* was collected.

Locations that *NAJ* notes that Carolina Parakeets were collected.

Indicates the area which became part of the state of Missouri in 1837; Baillon or Maximilian may have referred to this area as 'upper Missouri'.

but was almost certainly taken at Bellevue, Nebraska, on 13 May 1834 (*NAJ* 3: 308). The only specimen to bear the label 'upper Missouri' at AMNH is a Lark Bunting *Calamospiza melanocorys*, probably collected west of the Poplar River in Montana on 12 July 1833.[3] Adding to the confusion, a Bobolink *Dolichonyx oryzivorus* specimen was likely collected at the same location but is labelled only 'Missouri'.

[3] Maximilian described the species as 'the black finch with white shoulder feathers' in *NAJ* (2: 271) but added a later notation stating that the species was '*Fringilla leucoptera* of my diary'. Witte & Gallagher (2008–12) added that Maximilian had changed the designation in his Natural History Diary to '*Fringilla bicolor*', the name assigned to the species by Townsend (1837). AMNH's now discarded skin (3086) was almost certainly the first collected for science, beating Townsend for the honour by a few months.

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TABLE 1

Registration data for birds collected by Maximilian, correlated to Maximilian's notes for those species in his *North American Journals* (*NAJ*). These specimens are all skins from the collections of the American Museum of Natural History (AMNH), New York, and the Baillon Collection, Musée George Sand et de la Vallée noire, La Châtre, France. The notation '(m. R.)' is Maximilian's abbreviation for 'meine Reise' and indicates that he collected the specimen during his journey (Gouraud 2014a, LeCroy *et al*. 2014). 'Mas', 'Fem' and 'Jun' indicate male, female and young, respectively; if both sexes are indicated, Maximilian probably had at least one specimen of each sex for that species. Carolina Parakeet specimens are listed first, followed by AMNH specimens in order of collection date, and then the other Baillon specimens. The Baillon specimens were sent by Maximilian to Baillon at least ten years before Maximilian prepared his 1865 catalogue.

Reg. no.	Species	Location per label/ catalogue	Data for when *NAJ* records the species was collected. State is noted if in disagreement with label	Wied (1865) catalogue and AMNH catalogue notes
AMNH 2617	Carolina Parakeet *Conuropsis carolinensis*	NA	Various dates: 15 November 1832, 20 November 1832, 21 December 1832, 25 January 1833, 27 January 1833, 5 February 1833 New Harmony 38°08′N, 87°56′W *NAJ* 1: 222, 227, 250, 275, 277, 287	1865: Wabash, Indiana, (m. R.) Mas Fem Jun
AMNH 2619	Carolina Parakeet	NA	Same as above	Same as above
BAILLON MLC.2011.0.313	Carolina Parakeet	Upper Missouri	See text for probable collection site and date	Same as above
AMNH 2629	Barred Owl *Strix varia*	Pennsylvania	No record	AMNH: September (m. R.)
AMNH 2561	Red-headed Woodpecker *Melanerpes erythrocephalus*	Pennsylvania	1 August 1832 Rocky Valley south of Freiburg (now Coopersburg) 40°29′N, 75°21′W *NAJ* 1: 88	1865: Mas and Fem AMNH: juvenile male, (m. R.)
AMNH 3103	Eastern Bluebird *Sialia sialis*	Pennsylvania	1 August 1832 Rocky Valley south of Freiburg (now Coopersburg) 40°29′N, 75°21′W *NAJ* 1: 88	1865: Mas, Fem, Fem (m. R.) AMNH: male
AMNH 3087	Eastern Meadowlark *Sturnella magna*	Pennsylvania	2 August 1832 En route from Freiburg (now Coopersburg) to Bethlehem 40°32′N,75°25′W *NAJ* 1: 90	1865: Mas, Fem, Fem (m. R.) AMNH: male

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AMNH 3139	Red-eyed Vireo *Vireo olivaceus*	Pennsylvania	14 August 1832 (*NAJ* entry from Bethlehem, Pennsylvania, notes that a specimen was collected before this date) *NAJ* 1: 98 20 August 1832 Lecha Mountain 40°36′N, 75°21′W *NAJ* 1: 102	1865: Mas Fem (m. R.) AMNH: female
AMNH 3140	Red-eyed Vireo	Pennsylvania	Same as above	1865: Mas Fem (m. R.) AMNH: female
AMNH 7016	Red-bellied Woodpecker *Melanerpes carolinus*	Indiana	16 October 1832 Below New Albany 38°14′N, 85°51′W *NAJ* 1: 200 23 October 1832 New Harmony 38°08′N, 87°56′W *NAJ* 1: 207	1865: Mas fem
AMNH 3065	Western Lark Sparrow *Chondestes grammacus strigatus*	Missouri	21 May 1833 Cedar Island (between the White and Niobrara Rivers), South Dakota 43°22′N, 99°06′W *NAJ* 2: 129 10 June 1833 Artichoke Creek, South Dakota 44°53′N, 100°22′W *NAJ* 2: 173	1865: Mas Fem Missouri (m. R.)
AMNH 3291	Brown-headed Cowbird *Molothrus ater*	Missouri	10 June 1833 Artichoke Creek, South Dakota 44°53′N, 100°22′W *NAJ* 2: 173	1865: Mas Fem Nord America (m. R.)
AMNH 3086 (discarded)	Lark Bunting *Calamospiza melanocorys*	Upper Missouri	12 July 1833 Near the Poplar River, Montana 48°05′N, 105°11′W *NAJ* 2: 270–272	1865: oberen Missouri AMNH: oberen Missouri

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AMNH 3088	Bobolink *Dolichonyx oryzivorus*	Missouri	12 July 1833 Near the Poplar River, Montana 48°05′N, 105°11′W *NAJ* 2: 270–272	1865: Nord America (m. R.) Missouri
AMNH 5883	Eastern Whip-poor-will *Antrostomus vociferus*	Missouri	7 May 1834 Between the James and Vermillion Rivers, South Dakota 42°46′N, 97°08′W *NAJ* 3: 299	
AMNH 3155	Harris's Sparrow *Zonotrichia querula*	Missouri	13 May 1834 Bellevue, Nebraska 41°09′N, 95°54′W *NAJ* 3: 308	1865: Nord America Missouri (m. R.) AMNH: 1834 'Missouri' type of *Fringilla comata*?
AMNH 3293	Great Crested Flycatcher *Myiarchus crinitus*	Missouri	14 August 1832 (journal notes collected earlier) While in Bethlehem, Pennsylvania *NAJ* 1: 98 19 August 1833 Fort McKenzie (Chouteau County, Montana) 47°56′N, 110°29′W *NAJ* 2: 378 15 May 1834 One hour south of Nishnabotna River (Atchison County, Missouri or Nemaha County, Nebraska) *c.*40°17′N, 95°33′W *NAJ* 3: 310	AMNH: male 1832 Note: 1832 and Missouri cannot both be correct. Maximilian was not in Missouri until 1833. Note: The 19 August 1833 record may have been may have been a Western Kingbird *Tyrannus verticalis* based on range and 'pale yellow belly' description (*NAJ* 2:378) Note: This specimen was probably collected on 15 May 1834
AMNH 3080	Sooty Fox Sparrow *Passerella iliaca unalaschcensis*	Rocky Mts	No record	1865: Nord America Mas Fem (m. R.) AMNH: male
AMNH 7009	Slate-coloured Fox Sparrow *P. i. schistacea*	Rocky Mountains	No record	1865: Nord America Mas Fem (m. R.) AMNH: female
BAILLON MLC.2011.0.215	Red-winged Blackbird *Agelaius phoeniceus*	Upper Missouri	27 April 1833 North of the mouth of the Nishnabotna River 40°32′N, 95°45′W *NAJ* 2: 65	1865: Mas Fem Nord America (m. R.)
BAILLON MLC.2011.0.309	Labrador Duck *Camptorhynchus labradorius*	Upper Missouri	No record	1865: Labrador, Nord America

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The fact that any of Maximilian's specimens survive from the Dakotas and Montana is remarkable, because the vast majority were lost when the steamboat carrying them was destroyed by fire in 1835 (*NAJ* 3: 282, see also Casler 2005).[4]

Pennsylvania and Indiana are used as references to states on Maximilian labels in the AMNH catalogue, but 'Missouri' and 'upper Missouri' appear to reference the Missouri River, not the state. The AMNH catalogue appears to use 'upper Missouri' in an even wider sense than 'upper Missouri' as employed in *Reise*. Evidently, Maximilian's own understanding of 'upper Missouri' changed over time or he never intended the phrase as a detailed description.

'Upper Missouri' in the Baillon Collection

After Maximilian returned to Europe, he met his friend, Louis Antoine François Baillon on 14 August 1834 in Abbeville, France (*NAJ* 3: 423). The two shared supper and explored Baillon's collection, as well as a few other collections in Abbeville. Maximilian noted that Baillon 'no longer buys birds [and] limits himself especially to waterfowl' (*NAJ* 3: 423). While Baillon may not have been purchasing new material, he seemed happy enough to receive more specimens from Maximilian in the ensuing years.

The Carolina Parakeet specimen in the Baillon Collection is labelled in Baillon's hand (Fig. 1B), and his definition of 'haut Missouri' may not have aligned with Maximilian's usage in *Reise* or with the labels and catalogue at AMNH. Two other Maximilian specimens in the Baillon Collection, a Red-winged Blackbird *Agelaius phoeniceus* and a Labrador Duck *Camptorhynchus labradorius*, are also labelled 'haut Missouri' (see Table 1). The parakeet may have been given to Baillon during Maximilian's 1834 visit or with the duck which was probably a gift in 1847 (Gouraud 2014a).

Maximilian described collecting a Red-winged Blackbird only three times in *NAJ*: at Bethlehem, Pennsylvania (*NAJ* 1: 97–98), in New Harmony, Indiana (*NAJ* 1: 215), and near the Nishnabotna River on 27 April 1833 (*NAJ* 2: 65, see Fig. 2). The Nishnabotna empties into the Missouri River in the far north-west of modern Missouri, across from the south-eastern corner of Nebraska (40°29'N, 95°42'W). If the 'upper Missouri' location is at all accurate, it must refer to the latter date.

That location was not part of the state of Missouri at the time. Maximilian noted directly that they were leaving the territory of the United States as they passed the mouth of the Kansas River, and that the border between the United States and 'the territory of the free Indians' ran north to south (*NAJ* 2: 44). However, after his return to Germany, the United States Congress added the north-western triangle, known as the Platte Purchase, to Missouri in 1837 (see Fig. 2). Either Maximilian or Baillon, when labelling specimens collected from this area, may have coined 'upper Missouri' to describe the newly added territory.

If that is true, then one would expect the Carolina Parakeet labelled 'upper Missouri' also to be from that area. *NAJ* includes three records of Carolina Parakeets being collected in what is now the state of Missouri (Burgio *et al*. 2018, 2025; see Fig. 2): (1) 15 April 1833 above Wakenda Creek in Carroll County, Missouri (39°20'N, 93°15'W, *NAJ* 2: 31); (2) 21 April 1833 above the Kansas River in Platte County, Missouri (39°10'N, 94°38'W, *NAJ* 2: 47); and (3) 23 April 1833 above Independence Creek (Kansas) in Buchanan County, Missouri (39°34'N, 95°6'W, *NAJ* 2: 54).

[4] Maximilian had left seven large crates at Fort Clark to be shipped later. The specimens collected west of St. Louis were severely damaged by water due to a leak in the ship on 15 September 1833. Virtually the entire herbarium was lost to mould (*NAJ* 2: 451). This damage was in addition to the wear to the collection from constantly unloading and reloading it to lighten the ship (e.g., *NAJ* 2: 66).

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The latter two records are in the Platte Purchase area of Missouri, and either could be the location of the Baillon Collection's specimen. Although Maximilian recorded parakeets as far north as Weeping Water Creek in Nebraska (14 May 1834, *NAJ* 3: 310), the above dates are the only times that he noted collecting specimens besides the Wabash River near New Harmony, Indiana according to *NAJ*.[5]

The presence of the Labrador Duck specimen with the 'upper Missouri' label remains problematic. A Labrador Duck collected on the Missouri River would be completely at odds with what little is known of the species (Chilton 2020), and there is no evidence in *NAJ* or the 1865 catalogue that he did so.[6] Perhaps, Baillon received the Red-winged Blackbird, Labrador Duck and Carolina Parakeet from Maximilian in the same box, with a single location 'upper Missouri'. Of course, one cannot rule out that Baillon simply labelled these specimens incorrectly. There are a number of incorrect labels in the Baillon Collection, such as specimens with the wrong place of collection (probably promulgated by previous owners of the specimens; e.g., MLC.2011.0.721 and others from La Billardière, see Gouraud 2014b: 20–21) and two specimens labelled 30 February (CG pers. obs.).

In summary, there is no evidence that Maximilian observed, much less collected, a Carolina Parakeet in the area that his *Reise* would define as the upper Missouri. He observed the species as far north as Weeping Water Creek in Nebraska but did not mention collecting any specimens there or further north. The location must remain tentative, but the specimen in the Baillon Collection was most likely collected in the Platte Purchase area of Missouri in April 1833.

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[5] Maximilian shipped 23 parakeet specimens to Germany via New Orleans from New Harmony (*NAJ* 1: 408).

[6] The 1865 catalogue entry for this species lacks 'm. R.' which, when present, indicates that Maximilian himself collected the specimen. He apparently did not collect the four Labrador Duck skins that were once part of his collection (AMNH 3739, RMNH.AVES.110083 and RMNH.AVES.110084 at the Naturalis Biodiversity Center, Leiden, and MLC.2011.0.309). At best, he obtained them from a third party during his trip, but he could have acquired them later or even before travelling to North America. The Naturalis labels attribute them to the 'Voyage du Prince de Neuwied', which also does not mean that he collected them.

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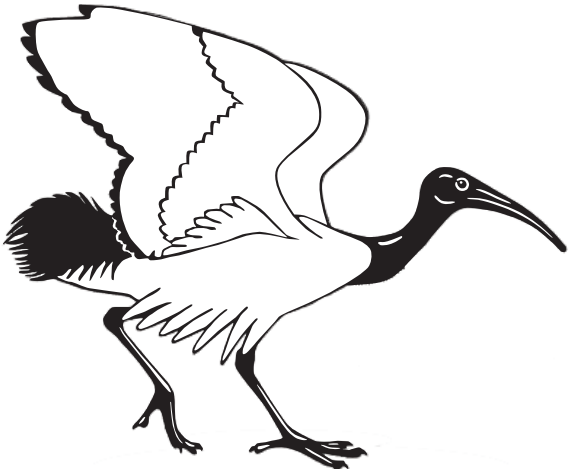

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