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Provisional identification of historical grasswren (*Amytornis*: Maluridae) specimens in European collections draws attention to the incomplete phylogeny of the group

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SUMMARY.—The phylogeny and systematics of grasswrens *Amytornis* species are incompletely resolved, in particular for three widely distributed members of the genus. In part this is a consequence of the dispersal to European and North American collections of early specimens of now extinct populations. We describe three historical grasswren specimens from museums in Berlin and Stockholm, all of which represent taxa for which phylogenetic and / or other data are incomplete. We further identify other specimens that might contribute towards greater resolution of grasswren phylogeny.

Grasswrens of the genus *Amytornis* constitute a largely arid-zone continental Australian subfamily Amytornithinae within the family Maluridae of the basal Australian oscine infraorder Meliphagides (Marki *et al.* 2017). Eleven grasswren species are currently recognised (Black *et al.* 2010, Christidis *et al.* 2010, Black & Gower 2017, Gill & Donsker 2019) but there remain many unanswered questions concerning their systematics. Such uncertainty applies even to three of the most familiar and widely distributed: the Striated Grasswren *A. striatus* group and the sister species Western *A. textilis* and Thick-billed Grasswrens *A. modestus*.

A. striatus occurs in many isolated populations (Fig. 1) and shows widespread subtle phenotypic variation. Its infraspecific taxonomy is unsettled and division into three or four species has been proposed (Christidis *et al.* 2013, Black & Gower 2017). The group is widely disjunct across the Eyrean Barrier (Ford 1974, 1987, Schodde & Mason 1999), a periodic Plio-Pleistocene arid intrusion responsible for vicariance and speciation among several southern Australian birds (Dolman & Joseph 2015). Eastern populations include *A. s. striatus* (Gould, 1840) in central New South Wales, western Victoria and eastern South Australia, *A. s. rowleyi* Schodde & Mason, 1999, in central Queensland, and a small, isolated and undescribed form in south-west Queensland at the South Australia border (Ford & Parker 1974, Schodde 1982, Black & Gower 2017). Western populations include the large-bodied and large-billed *A. s. whitei* (Mathews, 1910) of the Pilbara in Western Australia, smaller forms on the North West Cape Peninsula (Western Australia) and through the sandy western and central Australian deserts, and isolated populations of larger individuals on the Eyre Peninsula, South Australia. In a phylogenetic study, Christidis *et al.* (2013) proposed to elevate the western desert form to species level as *A. oweni* (Mathews, 1911) on the basis of genetic distance (4.2% ND3) between an individual of that population and one of *A. s. striatus*. The form *A. s. whitei* was not included in the study and the group's systematics therefore remain incomplete.

A. textilis (Quoy & Gaimard, 1824) was described from collections made on the Peron Peninsula in Shark Bay, north-west Western Australia during the Baudin (1801–03) and Freycinet (1818) expeditions. Gould (1841) believed that the very similar birds that he collected on the lower Namoi River of inland New South Wales, in eastern Australia, in 1839 were the same 'Textile Wrens' *A. textilis*. Subsequently, Gould (1847) named grasswrens

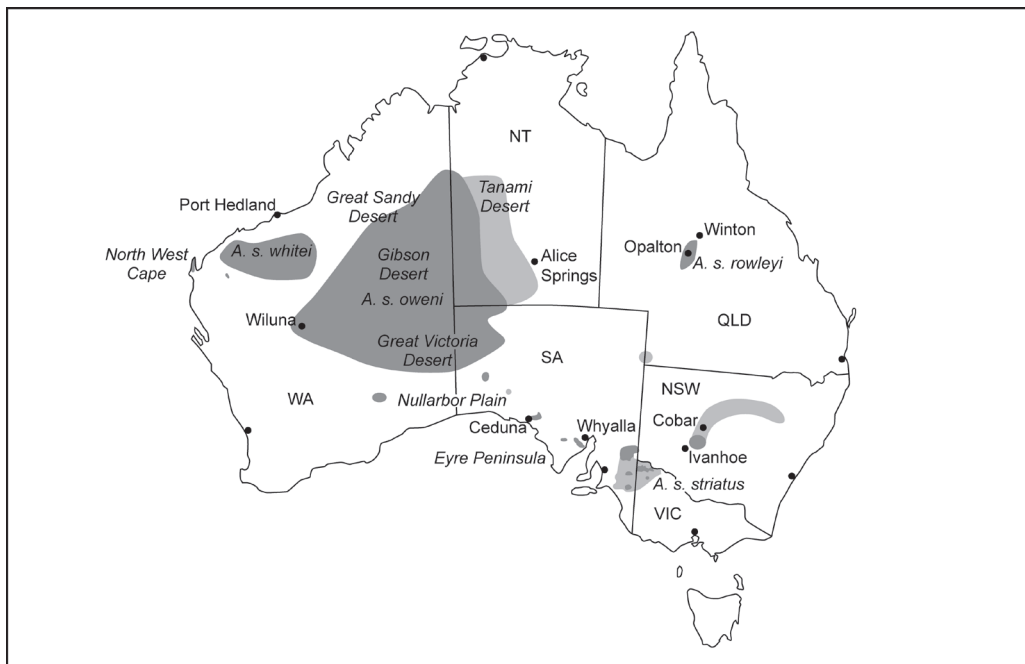


Figure 1. Distribution of Striated Grasswren *Amytornis striatus*. All known populations and named subspecies are shown. Paler shading indicates former or possible occurrence, recently unconfirmed. The Eyrean Barrier is understood to have run north–south through the present-day South Australia gulfs east of the Eyre Peninsula (© Belinda Cale)

taken by John Gilbert in south-west Western Australia *A. macrourus*. Gould's Namoi River birds in eastern Australia continued to be identified as *A. textilis*, as he had termed them (e.g. Ramsay 1888). Two further grasswren taxa were discovered in central Australia in 1894. One, *A. purnelli* (Mathews, 1914), was initially also assigned to *A. textilis*. The other, *A. modestus* (North, 1902), appeared to its author to be the same as Gould's inland New South Wales birds and these latter were consequently included in *A. modestus*. The accepted split between *A. textilis* and *A. modestus* was contested by Parker (1972), who recognised that *A. purnelli* was both phenotypically and ecologically distinct from the other two. He combined *A. textilis* and *A. modestus*, while observing pronounced variation across their vast distribution, with those in the far east and the west being very similar, whereas specimens from the intervening Lake Eyre Region tended to be paler and to have deeper bills.

Today, *A. textilis* and *A. modestus* are again considered species (Black *et al.* 2010, Christidis *et al.* 2010) and each is polytypic (Figs. 2–3). Darker, longer tailed and more heavily streaked *A. textilis* includes up to five subspecies (Black 2011, Austin *et al.* 2013), of which only *A. t. textilis* and *A. t. myall* are extant, while smaller, paler and truly thick-billed *A. modestus* comprises seven named subspecies (Black 2016), all but two of which are extant. Extinctions within *A. modestus* include the nominate subspecies from central Australia and the easternmost populations, comprising Gould's Namoi River birds and others in the Willandra Creek district of New South Wales c.600 km to the south-west. These latter were observed and sampled in the 1880s by K. H. Bennett, and the two New South Wales populations were implicitly combined as Eastern Grasswren *A. inexpectatus* (Mathews, 1912). Mathews (1922–23) subsequently included the Eyre Peninsula (South Australia) population *A. textilis myall* in that species. By combining into a single taxon

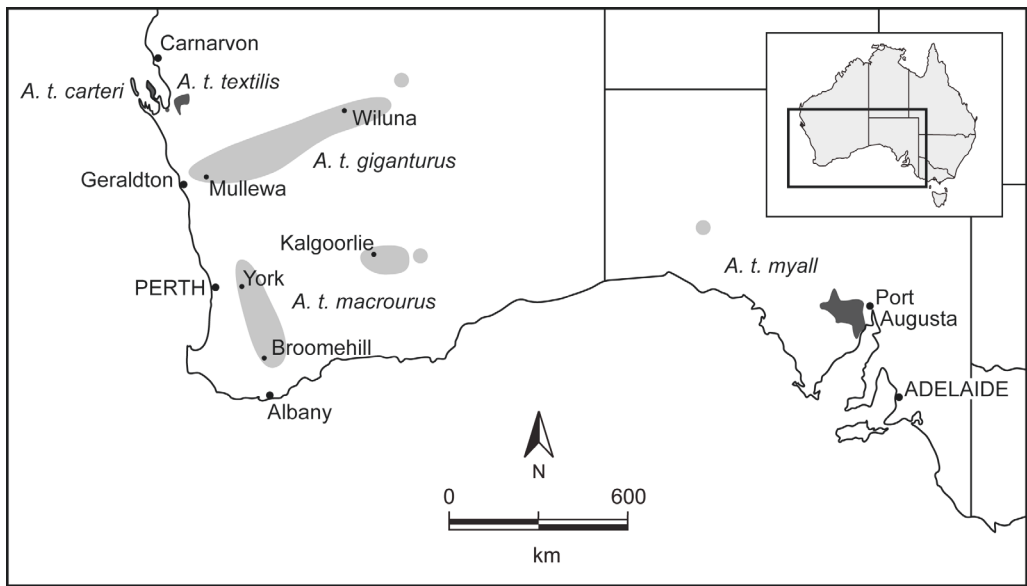


Figure 2. Distribution of Western Grasswren *Amytornis textilis*. Extant populations are: *A. t. textilis* on and near the Peron Peninsula, Western Australia, and *A. t. myall* on the northern Eyre Peninsula, South Australia. Widespread probable extinction of intervening populations is evident (© Belinda Cale)

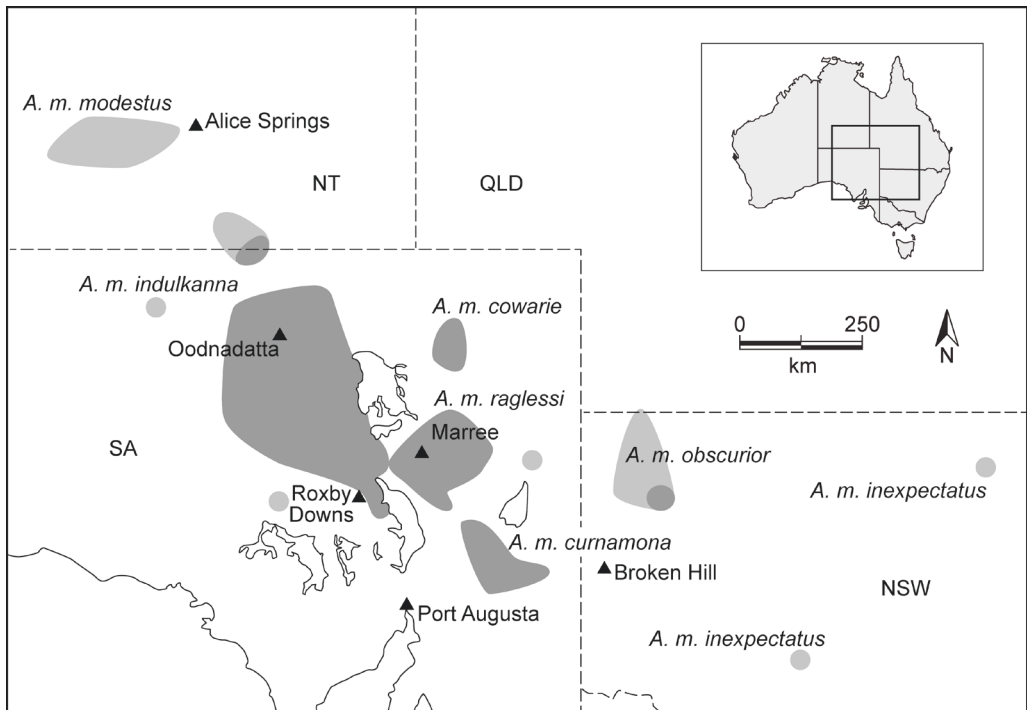


Figure 3. Distribution of Thick-billed Grasswren *Amytornis modestus*. Gould’s ‘Textile Wrens’ were taken from the more easterly locality of *A. m. inexpectatus*. Extant populations occur either side of Lake Eyre and Lake Torrens, shown north of Port Augusta, at the longitude of the Eyrean Barrier (© Belinda Cale)



these representatives of what are now accepted as different species, he had unwittingly highlighted the confounding similarity of eastern and western examples of the sister species.

In a phylogenetic study of the *A. textilis* / *modestus* species group, Austin *et al.* (2013) sequenced the mitochondrial gene ND2 and found a net nucleotide divergence between *A. textilis* and *A. modestus* of 3.3%. Two clades within *A. textilis* showing a nucleotide divergence of 1.2% largely represented Western Australian and South Australian populations. Sampling among Western Australian representatives was restricted to between one and five specimens from each of four long presumed extinct populations, thus limiting interpretation of the extent of lineage sorting. Resolution was greater within *A. modestus*. A nucleotide divergence of 1.7% was present across the Eyrean Barrier, with two subspecies forming a western clade and four an eastern clade. Ironically, the only specimen in an Australian collection of what is now known as *A. m. inexpectatus* (Australian Museum Sydney; AM O.10581) alone failed to yield DNA, perhaps because it had spent 'many years in spirits' (Parker 1972). The phylogenetic placement within *A. modestus* of the extinct Namoi and Willandra populations of *A. m. inexpectatus* is therefore uncertain, whether they were indeed part of a single gene pool, and how they are related to other taxa. We do not know whether *A. m. inexpectatus* forms part of the eastern *A. modestus* clade, is sister to both clades within *A. modestus* or, conceivably, is sister to the species pair of *A. modestus* and *A. textilis*.

The answer to questions concerning these three species, as currently recognised, can only be realised via further DNA sequencing of all pertinent populations. In the case of the *A. striatus* group, much work remains to be undertaken among specimens present in Australian collections, but many of these are of unknown provenance and will remain so until knowledge of the phylogeny is further advanced. Moreover, the small and isolated North West Cape population is known from just three specimens in the American Museum of Natural History (AMNH), New York. Further sampling among the extinct populations of *A. textilis* is required to clarify its phylogeny, while resolving the placement of *A. m. inexpectatus* will depend on sampling known examples in European and North American museum collections.

Historical specimens of all three species, those of the *A. textilis* / *modestus* complex generally labelled *A. textilis*, include those of the Gould collection in the Academy of Natural Sciences of Drexel University, Philadelphia (ANSP) and the Mathews collection at AMNH. Others have been identified in the Western Australian Museum, Perth (WAM), Muséum national d'Histoire naturelle, Paris (MNHN) (Black *et al.* 2013), Naturalis Biodiversity Center (Naturalis), Leiden, formerly Rijksmuseum voor Natuurlijke Historie (RMNH) (Black *et al.* 2014), Institut royal des Sciences naturelles de Belgique, Brussels (IRSN), and the Natural History Museum, Tring (NHMUK) (Black 2014). More recently, we have examined historical grasswren specimens in Museum für Naturkunde, Berlin (ZMB) and Naturhistoriska Riksmuseet, Stockholm (NRM). We briefly describe these specimens, including measurements of bill (length from skull attachment of maxilla to tip, plus depth at frontal feathering); wing (max. flattened chord) and tail (central rectrix from point of emergence to tip). We assess their probable identifications and discuss their potential place in our overall understanding of the genus.

The Berlin grasswren specimens

ZMB 55/478

Recent label (at the time of examination): *Amytornis textilis modestus* Maluridae age? Sex?

Old museum label: *Amytornis goyderi* [erased] Gould [erased] *modesta* [added].



Figure 4. Berlin specimen ZMB 55/478 (relabelled); juvenile Thick-billed Grasswren of the extinct nominate subspecies *Amytornis m. modestus*. Note combination of Old German and modern notations, the latter used for the indigenous language word (© Carola Radke, Museum für Naturkunde, Berlin)

Original label: Ntjulkuta fem. Vogel Rötl.[iche] Eier. Frisst: grün. Futter. [= female, reddish eggs, eats green food—*sic*]; on reverse: ritjirberitjere. Nest in Erdhöhle Weibl.[iche] Lerche [= nest in hollow in ground; female lark—*sic*].

On examination (ABB, 1 June 2016): skin of a young bird of the *Amytornis textilis / modestus* group, loose plumage, foxed, bill small, mandible pale proximally (Fig. 4); bill 9.7×4.9 mm, wing 59 mm, tail 75.1 mm.

The specimen was not inventoried until 1955, when curator Erwin Stresemann wrote that it had reached the collection pre-1921. The combination of early German script and Australian indigenous words suggests it was collected by a Lutheran missionary, perhaps from Killalpaninna Cooper Creek, South Australia, but neither word belongs to the Dieri language of the area (H. Kneebone pers. comm.); ‘ntjulkuta’ was recognised as an Aranda word from Central Australia (P. Sutton pers. comm.) and appears in Carl Strehlow’s Aranda-Loritja-German-English Dictionary (G. Breen pers. comm.) as the name of a local bird described with rufous plumage, tail movement and ‘porcupine’ [*sic* presumably porcupine grass *Triodia* spp.; see below]. G. Breen was unable to identify ‘ritjirberitjere’. The handwriting was identified by John Strehlow, grandson of the dictionary author, as that of Oskar Liebler who worked at Hermannsburg Mission on the upper Finke River between 1910 and 1913.

Initially obscure wording on the original label therefore proved crucial in identifying this specimen as a juvenile male Thick-billed Grasswren of the extinct central Australian subspecies *A. m. modestus*. *Triodia* spp. is habitat for another locally occurring grasswren, the more rufous-plumaged Striated Grasswren *A. striatus*.

ZMB 19496 [also B 7143 (March 1869) *Amytornis striatus* South Australia]

Label 1: *Amytornis striatus* Gould S. Australien. Waterhouse.

Label 2: *Amytornis striatus merrotsyi* Zoolog Museum Berlin.

Label 3: *Amytornis merrotsyi* Maluridae loc. Australien Oceania leg. Waterhouse, Frederick George det. Age? Sex? Museum für Naturkunde, Berlin.

On examination (ABB, 1 June 2016): skin, former mount, of an adult Striated Grasswren, foxed, with heavily streaked upper breast, unstreaked chin, amber breast-sides; bill 11.9 × 4.4 mm, wing 64 mm, tail 95.7 mm.

Adult female *Amytornis s. striatus*. The attribution ‘merrotsyi’ is an unexplained misidentification (but see Discussion), its tail length being incompatible with that taxon, long treated as a subspecies of *A. striatus* but recognised now as a species. F. G. Waterhouse, curator at the South Australian Museum, Adelaide, between 1859 and 1882, exchanged at least eight Striated Grasswren specimens of presumed South Australian provenance between September 1867 and March 1869 when this example was received in Berlin, but their collector and precise origin are unknown (Horton *et al.* 2018). This specimen formed part of a shipment of 18 and was one of a total of 126 specimens in four shipments received from Waterhouse between 1866 and 1871 representing different Australian regions.

The Stockholm grasswren specimen

NRM 537674

Accession Register: among a collection of mostly Australian specimens, listed under ‘Frank i[n] Amsterdam Cont. inköp. [bought with cash] 1841 - för 1 fl. [florin = guilder] per stycke [piece] (utom 7 dyrare [except 7 dearer]); ‘*Amytis textilis*; Lesson [sic] do [refers to species above ‘N. Holl.’ = New Holland] (c [illegible] aff. *Malurus*) 5004 [catalogue number in ‘Aves Exotica’] t d [ditto, referring to ‘Saml.’ above [= to the exhibitions] 1867’.

Pedestal label: Grässmyg *Amytornis t. textilis* (Dumont) Västaustrialien [Western Australia] 1841 G. A. Frank 5004.

Earlier pedestal label, under current label: *Amytis* [erased] *textilis* Qu. & G. *Amytornis* [added in pencil] (Australia) (Frank 1841) 5004.

On examination (USJ, 3 December 2018): a mounted grasswren of the *textilis / modestus* group in good condition (Fig. 5), bill 8.7 mm, tail 76 mm, amber breast-side patches.

Identification of this female grasswren is challenged by documentation suggesting its origin in Western Australia and acquisition via the Frank dealership in 1841. The only Western Australian grasswren specimens known to have been present in Europe in



Figure 5. Stockholm mount NRM 537674; female probable Thick-billed Grasswren of the extinct subspecies *Amytornis modestus inexpectatus* (Ulf S. Johansson)

that year were the type series in Paris (Black *et al.* 2013). Gilbert sent his two grasswrens from Western Australia to Gould in December 1843 (Sauer 1999: 260) and they were not described until 1847. A possible source of a Western Australia grasswren at the time was George Grey (1841), who explored Western Australia and travelled to Shark Bay in February 1839. Grey provided more than 400 natural history specimens to the British Museum but fewer than 60 of these prior to February 1842, following his appointment as Governor of South Australia in October 1840 (Sharpe 1906; ABB review of NHMUK zoological accession registers). Grey sent his earliest collections, including specimens from north-west and south-west Western Australia, to Gould, who forwarded them to the British Museum on 12 October 1840, noting nine species of interest but these did not include a grasswren (Sauer 1998: 217). Nor did Gould include a grasswren in Grey's (1841) appendix list of birds known from Western Australia. Grey's largest donation of around 267 specimens contained some Western Australia material and included a specimen of *A. textilis* of unstated provenance (Black *et al.* 2014; see also Sharpe 1883) but was not received until July 1843 (ABB as above). Grey's extensive correspondence with Gould (Sauer 1998, 1999) makes clear that all of his specimens were intended ultimately for the national collection. We can find no evidence that Grey sold any natural history material and it seems improbable that NRM 537674 came from him.

The current pedestal label must post-date Mathews' (1917) proposal that Dumont was the species' author (see Black *et al.* 2014 for its rebuttal) and the locality information probably reflects contemporaneous distributional knowledge. The original documentation named Australia (as New Holland) as did the earlier label. More likely, this specimen is from the other side of the continent and is *A. modestus inexpectatus*, of which Gould obtained 'many examples' on the lower Namoi. After retaining them for depiction in his *Birds of Australia* (as *Amytis textilis*), Gould disposed of the excess in December 1840, sending one to C. J. Temminck; others were evidently sold through the Frank agency (Black *et al.* 2014). Gould traded extensively with Frank, via whom many of his specimens reached Naturalis (JJFJ review of archival documents; Jansen & van der Mije 2015).

Discussion

Uncertainty in grasswren identification.—Gould was only the first of many to misidentify grasswrens (Black & Gower 2017), giving eastern birds the name of a western species and western birds a new and separate name. He even mistook Lesson's illustration of *A. textilis* as *A. striatus*, but he was not alone in such uncertainty (Black *et al.* 2013). While much of the earlier difficulty is now resolved and specimens of *A. striatus* can be confidently identified to species, this is not the case for subspecific identification, which is hampered by still unresolved taxonomy. In addition, *A. merrotsyi* was long included within *A. striatus* and has caused diagnostic uncertainty. The reason why ZMB 19496 was re-identified as *A. (striatus) merrotsyi*, described in 1913 and then long undetected, is unknown. It is possible that its renaming followed Mathews' (1922–23) view that *A. merrotsyi* was a distinctive South Australian form close to *A. striatus* but not part of that species, which he listed only from New South Wales and Victoria. The distinction between the sister species *A. textilis* and *A. modestus* remains a challenge, especially in the case of old museum specimens, as illustrated here. Another enigma is the uncertain phylogenetic placement of the distinctive, extinct and as yet unsequenced *A. modestus inexpectatus*, the longest-tailed and least thick-billed subspecies, and the only one to separate fully from all others in factor analysis of morphometrics (Black 2016). The answer to that question can only be determined by sampling known specimens of this taxon. We list them here, together with some that are

probably of that subspecies, and others whose uncertain identity might be resolved via genetic analysis.

Known and probable specimens of *A. modestus inexpectatus*

- ANSP 16887, male (Gould collection)
- ANSP 16888, female (Gould collection)
- ANSP 16889, male (Gould collection)
- AMNH 598073, male, holotype (Mathews collection)
- AMNH 598072, male (Mathews collection)
- RMNH AVES 172018, female (Gould to Temminck; Black *et al.* 2014)
- RMNH AVES 172019, male (via Frank dealership 1873; Black *et al.* 2014)
- RMNH AVES 172020, male (via Frank 1858, Black *et al.* 2014)
- AM O.10581, male
- NRM 537674, female (via Frank 1841)

Other historical specimens of uncertain subspecific identity or of poorly sampled taxa

A. modestus specimens

1. MNHN GC 10697B (CG 1879-715) male; labelled *Amytis striata*, but certainly *A. modestus*, it was received from the South Australian Museum but is of unknown provenance. A speculative subspecific identification of *A. m. inexpectatus* (Black *et al.* 2013) is now thought less likely given its relatively unstreaked underparts and tail length of 68.9 mm. All known male specimens of this taxon have tails longer than 79.5 mm (Black 2016).
2. NHMUK 1881.11.7.1229 female; this Cockerell collection specimen is of unknown provenance but bears a label *Amytornis modestus inexpectatus* and, being darker than most *A. modestus* and having a tail of 79.7 mm (ABB, 30 September 2011), it might represent that taxon.
3. NHMUK 1881.11.7.1230 male; the second Cockerell specimen, similarly labelled, is paler than that just mentioned and has a tail of only 73.2 mm (ABB, 30 September 2011), well below known measurements for the taxon, as above, but within the range (66.4–74.7 mm) for males of *A. m. raglessi*, a specimen of which Cockerell is thought to have acquired (Black 2014).

A. textilis specimens

The following extinct taxa were only lightly sampled by Austin *et al.* (2013) and historical specimens will contribute further to resolving the phylogeny of the species.

1. *A. textilis carteri* (Dirk Hartog Island, Western Australia)
AMNH 284760, 2984761, 2984763–766
2. *A. textilis giganturus* (inland Western Australia)
WAM 11474–477, 11843–844, AMNH 598058–059
3. *A. textilis macrourus* (southern Western Australia)
ANSP 16892–893 (syntypes), AMNH 598060–062, NHMUK 1931.8.1.3

A. striatus specimens

1. AMNH 598124 juvenile male; labelled *Amytis striata* Striated Grass Wren NW Cape 21.5.1900 Tom Carter.

2. AMNH 598125 male; labelled as above. On examination (ABB, 10 April 2013): skin; bill 12.1 mm × ? (damaged), wing 60 mm, tail 82.7 mm.
3. AMNH 598126 female; labelled as above, plus '*oweni*?'. On examination (ABB, 10 April 2013): skin; bill 12.1 mm × ? (damaged), wing 57 mm, tail 82.1 mm.

The above three *A. striatus* are the only skins known to have been collected from the North West Cape Peninsula, Western Australia population. They are of uncertain taxonomic status, although currently included in *A. striatus whitei* of the Pilbara. When compared concurrently with four AMNH Pilbara *A. s. whitei* and eight western sand desert *A. striatus 'oweni'*, their bills (12.1 mm) were shorter than the former (14.8–15.8 mm, $n = 4$) but within the range of the latter (11.8–12.9 mm, $n = 7$). Wing lengths (57 and 60 mm) were perhaps intermediate (57–62 mm and 52–57 mm, respectively) and tail lengths (82.7 and 82.1 mm) were within the range of both (72.1–88.0 mm and 76.8–88.1 mm, respectively). As with Pilbara *A. s. whitei*, their habitat is spinifex on rocky ground, unlike the spinifex on sand of *A. s. 'oweni'*, but it is on a dissected limestone plateau, not the rugged ironstone hills of the Pilbara ranges (Johnstone *et al.* 2013). No phylogenetic study yet published has sampled either the Pilbara or North West Cape specimens.

ZMB 19496 (B 7143) is one of eight known *A. striatus* specimens exchanged by F. G. Waterhouse via the South Australian Museum between 1867 and 1869. While most likely to represent eastern South Australia *A. s. striatus*, the provenance of all eight is uncertain and they warrant sampling in any future phylogenetic study.

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