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Crowley, Gabriel M.; Garnett, Stephen

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# Distribution and decline of the Golden-shouldered Parrot *Psephotellus chrysopterygius* 1845–1990

Gabriel M. Crowley<sup>A,B</sup> and Stephen T. Garnett<sup>A,C</sup>

<sup>A</sup>Artemis Nature Fund, Australia. Email: gabriel.m.crowley@gmail.com

<sup>B</sup>Firescape Science, Atherton Qld 4883, Australia

<sup>C</sup>Research Institute for the Environment and Livelihoods, Charles Darwin University, Darwin NT 0909, Australia

## Abstract

The Golden-shouldered Parrot (GSP) *Psephotellus chrysopterygius* (Gould, 1857) is a distinctive threatened species that is endemic to Cape York Peninsula (CYP), and a totem for First Nations Peoples. Its distribution has contracted since European occupation. We trawl the literature and public and private archives to provide a definitive set of historical records for the period 1845 to 1990 to help establish the species' former distribution and pattern of decline, and to compare these with the progression of pastoralism across the peninsula. We assessed the positional accuracy and veracity of all records, and consolidated records that had been replicated in multiple sources. We eliminated records from outside CYP; with a positional uncertainty of more than 15 km; or with errors that could not be corrected. This filtering process rejected 42% of records from BirdLife Australia, 62% of WildNet records and 37% of records from Atlas of Living Australia, and identified numerous others as duplicates, even though they had sometimes been allocated widely different coordinates. Hence, we advise close scrutiny of each individual record used for mapping and modelling species' distributions.

The GSP's distribution has been obscured by confusion between the three antbed-nesting parrot species; difficulty in differentiating GSP eggs from those of Varied Lorikeets; the anecdotal nature of most records; and attempts to massage qualitative locational information into a spatially-robust format. Addressing these issues, we accepted 212 unique GSP records from 103 locations. Of these, 9.4% were verified with specimens, 64.2% were highly reliable, and 67.3% were accurate to 1 km or better.

Until the early 20<sup>th</sup> century, GSPs were abundant across CYP, breeding wherever grassland or open tea tree woodland contained suitable magnetic or conical antbeds for nesting, including across extensive alluvial and coastal plains. Nesting progressively contracted to the flat edges and seepage area in hills, where conical antbeds predominate. This decline followed the displacement of First Nations Peoples and the establishment of the cattle industry, and the resultant loss of food plants, vegetation thickening and deterioration of the magnetic antbeds. The birds disappeared within 20–70 years of property development, remaining only in areas with access to rocky country with a lower level of disturbance (particularly grazing pressure), in which the birds can most easily find food in the early wet season. Recovery will depend on excluding cattle grazing from the remnant areas of the species' distribution – or carefully managing grazing pressure where this cannot be achieved – along with feral animal control, and fire management to control woodland invasion of open vegetation. First Nations Peoples are the original custodians of the parrot and its habitat, shared their knowledge about them with the first scientific collectors, and will be essential to the species' recovery.

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Indigenous readers are advised that this article contains the names of people who have died.

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## Introduction

The Golden-shouldered Parrot, *Psephotellus chrysopterygius* (Gould, 1857), is endemic to the tropical savannas on Cape York Peninsula (CYP) and is an important totem to First Nations Peoples (Garnett & Crowley 2002; Crowley *et al.* 2004; Golden-shouldered Parrot Recovery Team 2022). Indigenous Knowledge holds that the parrot had a continuous distribution through much of CYP, with at least four Indigenous Peoples having distinct language names for the species (Golden-shouldered Parrot Recovery Team 2022). The parrot's distribution has contracted since the species was first collected for science by Elsey, east of Normanton, in 1856 (Golden-shouldered Parrot Recovery Team 2020). Its population size and distribution have contracted so severely that it is recognised as an Endangered species at state, national and international levels (Golden-shouldered Parrot Recovery Team 2020).

Accurate knowledge of the parrot's former distribution should help us to understand the species' decline; identify the best places to undertake habitat restoration for its recovery; and find any unknown locations in which the parrots may persist (Ward *et al.* 2022). Historical records can also be used as a basis for modelling the species' habitat requirements and likely climate change response (von Takach *et al.* 2020). Such reconstructions require input of verified and geographically accurate records.

Well known by the current generation of birdwatchers as being found in the Morehead district of central CYP, Golden-shouldered Parrots (GSPs) can be difficult to find and identify in the field. They were initially combined with Hooded Parrots *Psephotellus dissimilis* (Collett, 1898); are sometimes confused with Pale-headed Rosellas *Platycercus adscitus* (Latham, 1790); and their nests in termite mounds (antbeds) may be confused with those of a number of species, notably the Red-backed Kingfishers *Todiramphus*

*pyrrhopygius* (Gould, 1840) (Hindwood 1959). It is therefore important to scrutinise all GSP observations to exclude unverifiable records before they are used for reconstructing the species' distribution.

Many GSP records have been collated in publicly available databases, which are an important source of data used for species' modelling (e.g. Vanderduys *et al.* 2016). However, these databases can include many erroneous or unverified records, and lack many *bona fide* records from obscure or unpublished sources (Martin *et al.* 2014; Crowley & Preece 2019). Many other records, especially those from private collections and unpublished accounts, may not have entered such databases. GSP records therefore need careful curation to produce a definitive list of unique observations and locations. We aim to provide such a list for the period 1845–1990 by examining each record in detail, and then use this list to examine patterns of GSP decline. We also assess the impact of cattle grazing on the species by reconstructing the progression of pastoralism across CYP, and comparing it with the pattern of the parrot's decline.

## Methods

### *Nomenclature*

In order to identify GSP records, it is important to understand how *P. chrysopterygius* is defined, and how this has changed over the years (Appendix 1). To identify GSP specimens and observations of GSPs, we document its historical taxonomic classification, along with that of the Hooded Parrot, the Paradise Parrot *Psephotellus pulcherrimus* (Gould, 1845) and the Red-rumped Parrot *Psephotus haematonotus* (Gould, 1838), which are important for understanding the GSP's taxonomic classification.

Soon after Gould described the Paradise Parrot as *Platycercus pulcherrimus* (Gould 1845), he erected the genus *Psephotus* Gould, 1845, seemingly on

the presence of a defined wishbone, a characteristic lacking in *Platyercus* Vigors, 1825 (Gould 1857). He first applied this genus to the Red-rumped Parrot, then – four pages later in the same document – to the Paradise Parrot (Gould 1848). Eight years later, he described *Psephotus chrysopterygius* (Gould 1857). Although we now know that the GSP's closest relative was the Paradise Parrot (with a genetic distance of 1.77%; Irestedt *et al.* 2019), the two have always been considered separate species. However, the more-distantly related Hooded Parrot (genetic distance: 6.85%) has frequently been treated as a GSP subspecies. This would have been a reasonable conclusion when it was thought that their distribution was continuous across the Northern Territory (NT) and Queensland (Barnard 1914). However, the two species are separated by a substantial biogeographic barrier (Joseph *et al.* 2011; Schweizer *et al.* 2013; Provost *et al.* 2018; Irestedt *et al.* 2019) formed by rivers flowing into the southern Gulf of Carpentaria and their adjacent treeless floodplains (Crowley & Preece 2019). This barrier also separates their commensal moth species, Queensland's Antbed Parrot Moth *Trisyntopa scatophaga* (White, 1922) and its Northern Territory relative *T. neossophila* Edwards, 2007 (Edwards *et al.* 2007; Bowman *et al.* 2010), and disrupts genetic flow in the termites that build the antbeds in which the parrots nest (Ozeki *et al.* 2006).

Yet, GSPs and Hooded Parrots have similar plumage. The most obvious distinctions are the amount of yellow in the male's wing, and the extent of its black cap, with the GSP having a yellow band above the bill. However, the extent of yellow can vary, and – as first observed by North (1898) – some GSPs also have turquoise feathers between their yellow facial band and their black crown. Such plumage variations were considered taxonomically significant. Mathews (1918) described a new GSP subspecies (*Psephotellus chrysopterygius nova* Mathews, 1918) based on a bird from Watson River having a narrow yellow facial band, and a brown band between the crown and the nape. This subspecies was synonymised by Condon (1941), and is no longer recognised (Australian Biological Resources Study 2009; BirdLife Australia 2022).

Such variations possibly obscured the significance of plumage differences between GSPs and Hooded Parrots. Gould apparently considered the male

Hooded Parrot's full black crown merely a GSP plumage variation (see Mistaken identities). Collett (1898) was the first to identify the Hooded Parrot as a species separate from the GSP, but added to the confusion by erroneously describing its crown as chestnut, rather than black. On finding a Hooded Parrot with a black crown, North (1909) erected an entirely new species (*Psephotus cucullatus* North, 1909) from that described by Collett. Seemingly unaware of North's description, van Oort (1910) similarly erected a new taxon for the "black-crowned form" of Hooded Parrot (*Psephotus chrysopterygius blaauwi* van Oort, 1910), but treated both Hooded Parrot "forms" as GSP subspecies. This confusion was corrected by Mathews (1913b), who – on examining the male on which Collett had based his description – found it actually had a black crown, rather than a chestnut one.<sup>i</sup> He consequently lumped both North's and van Oort's taxa back under Collett's original concept. However, Mathews retained the Hooded Parrot as a GSP subspecies. The RAOU Checklist Committee (1913) disagreed, keeping them separate, and by 1920, Mathews had accepted this arrangement (Mathews & Iredale 1920). Subsequent treatments have oscillated between combining the Hooded Parrot and GSP as a single species and separating them.

Mathews (1913a) also split *Psephotellus* Mathews, 1913 from *Psephotus*. He nominated the Paradise Parrot as its type, and later applied it to the GSP (Mathews 1915). He reserved *Psephotus* for the Red-rumped Parrot – the first species to which Gould allocated this name – and the Mulga Parrot (now *Psephotellus varius* (Clark, 1910)). He later described the distinctive features of *Psephotellus* as its "northern range ... black cap ... style of coloration and the longer broad-feathered tails", and sharply-hooked bill tip; as well as the relative length of its primary feathers (Mathews 1916–1917: 419).

Initially, *Psephotellus* was not widely adopted at the species level. The RAOU Checklist Committee (1926) used it as a subgenus, but this was soon dropped until it was resurrected 24 years later by Alan Lendon (1950b), who later demoted it to a subgenus (Lendon 1968). Subsequent treatments have varied between recognising *Psephotellus* as a genus or a subgenus, and ignoring it altogether. One interesting anomaly is that Storr (1973, 1977) returned all *Psephotus* species to *Platyercus*, but

without explanation. It was not until genetic analysis confirming the distinctiveness of the Red-rumped Parrot in 2011 that all the other *Psephotus* parrots were firmly cemented in the genus *Psephotellus* (Joseph *et al.* 2011; Schweizer *et al.* 2013; Provost *et al.* 2018). This classification has now been almost universally accepted, notably by BirdLife Australia (2022; BA), and we adopt their classification in this article. However, at the start of our research for this article, GSP specimens in many museums were still curated under the genus *Psephotus* and – in some cases – Hooded Parrots as either GSPs or GSP subspecies.

First Nations language names for the GSP include Alwal (*Uw Olkola* language), Arrmorrall (*Awu Alaya*), Thaku (*Lama Lama*) and Minpin (Wakaman People; Golden-shouldered Parrot Recovery Team 2022). The English common name has also been on a journey, beginning with Gould's Golden-backed Parrakeet (Gould 1869) or Golden-shouldered Parrakeet (Gould 1865), which occasionally reappeared through to the 1950s (Lendon 1950a). Anthill Parrot (McLennan 1922c) and Antbed Parrot (Lendon 1950a) are commonly used on CYP. McLennan in White (1922b) appears to have been the first to call the species the Golden-winged Parrot; although he only used the scientific name in his diaries and notebooks. This common name was in use up until 1976 (RAOU Checklist Committee 1926; Storr 1973; Kikkawa 1976), but has since been supplanted by Golden-shouldered Parrot, which was adopted by the RAOU Checklist Committee (1913) and is the name currently accepted by BirdLife Australia (2022). Higgins (1999) also listed the Chestnut-crowned Parrot and Chestnut-crowned Parrakeet, but we could only find these two names applied to Collett's Hooded Parrot (Campbell 1901).

#### *Study period and area*

The study period starts with Gilbert's first mention of "a new parrot" in the Queensland Gulf in 1845, which may have been the first European record of GSPs (see below). It ends in 1990, because intensive research on the species began in 1992 (Garnett & Crowley 1993). The resultant records, primarily nest locations, are not publicly available, as the species is subject to trapping and egg collecting (Garnett & Crowley 2002). We limited the study area to the section of CYP that encompasses a 100 km buffer around all verified GSP specimens (12°S to 20°S and 140°E to 145°E).

#### *Data sources*

In order to produce a definitive list of historical GSP records, we examined:

- [1] Published accounts of GSPs in the wild by birdwatchers, explorers, expedition naturalists, field biologists, and their patrons or biographers (Macgillivray 1918; White 1922a, b; Thomson 1935; Veivers 1951; Macdonald & Colston 1966; Mattinson 1975; Bruce 1979; Weaver 1979, 1982; Redhead 1988; Britton 1990, 1991; Ross 1990); and associated field notes, diaries and correspondence (Gilbert 1844–1845; Leichhardt 1847; Australian Joint Copying Project 1894–1931; Kemp 1913–1914; McLennan 1922a, b, c; Turner 1923; Thomson 1929; Weaver 1970–1982; Fisher 2014).
- [2] Taxonomic descriptions (Gould 1857, 1869; Mathews 1916–1917).
- [3] Descriptions of birds recently brought into captivity (Cresswell 1898; North 1898; Phillips 1898, 1900; Seth-Smith 1899, 1901, 1910; Le Souëf 1902; Le Souëf & Kinghorn 1924).
- [4] Published checklists, field guides and species descriptions with distributional information based on first-hand experience, museum specimens and/or field notebooks (Cayley 1938; Lendon 1950a, 1968, b; Storr 1953, 1973, 1984; Roff 1967; Kikkawa 1976; Garnett & Bredl 1985).
- [5] Public databases: Atlas of Living Australia (2021a, 2022a,b,c; ALA), eBird (Cornell Lab of Ornithology 2021), WildNet (Department of Environment and Science 2021c), and Global Biodiversity Information Facility (2021; GBIF).
- [6] Private datasets: (Weaver 1970–1982; Storr & Johnstone 1970–2019); egg collection records of Ian Mason (personal communications Jan.–Oct. 2022); and the databases associated with BirdLife Australia's Atlas of Australian Birds (Blakers *et al.* 1984; Barrett *et al.* 2003; BirdLife Australia undated; BA).
- [7] Collection records of museums that we identified as holding GSP specimens: Museums Victoria (2022b; NMV), Australian Museum (1897; AM), American Museum of Natural History (2021; AMNH), Britain's Natural History Museum (2014; BMNH); California's Museum of Vertebrate Zoology (2021; MVZ);

and the Kolichis Oological Collection (KOS) in the Western Australian Museum (WAM; Anon. 2019); and associated publications (North 1900; Warren 1966; Greenway 1978; O'Dowd 2018; McCarthy 2019; Online Archive of California 2021).

- [8] Published accounts (Turner 1923; Thomson 1934; Hindwood 1951, 1959) and ALA and museum records of the Antbed Parrot Moth, whose breeding is restricted to GSP nests (White 1922a).
- [9] Anecdotal records and personal communications from Sue and Tom Shephard (personal communications 1992–2022), Mark Weaver (personal communication 1992), Irene Taylor in Garnett and Crowley (1993), Peter O'Shea (personal communication 1993), Eileen Wassell (personal communication 15 July 1994), Sandy Hunt (personal communication 21 Jan. 1994), Ann Colman (personal communication 1992), Anne Creek (personal communication 1998), Keith and Lindsay Fisher (24 Dec. 2021), Ian Mason (personal communications Jan.–Oct. 2022), Lana Little (personal communication 8 Feb. 2022), Ron Johnstone (personal communication Feb.–Oct. 2022), and Mick Godwin (personal communication to Lana Little 26 Oct. 2022).
- [10] Other published attempts to reconcile unverified or spatially uncertain GSP or Paradise Parrot records (Chisholm 1918, 1919, 1922a,b; Julian 1989; Garnett 1998; Olsen 2007).

#### *Explorers, expedition naturalists and field biologists*

##### Gilbert and Leichhardt

John Gilbert (1810–1845) was the naturalist on Ludwig Leichhardt's expedition from Moreton Bay to Port Essington (1844–1845), which traversed inland Queensland and southwest CYP before entering the NT (Leichhardt 1847). Before embarking on this expedition, Gilbert had made the first scientific collection of Paradise Parrots on the Darling Downs. He considered these parrots to have a “form like *Platycercus*” (Fisher 2014: 12) and sent them to Gould for description. Gould (1845) initially concurred that they were *Platycercus*, and did not classify them as *Psephotus* until after Gilbert's death (Gould 1848). Gilbert recorded this “new *Platycercus*” on the Port Essington expedition as far north as Comet Creek,

just north of Rolleston in central Queensland (Fig. 1; Appendix 2). On entering the Queensland Gulf country, he again recorded his “new *Platycercus*” in abundance. These birds must have been either Paradise Parrots or GSPs (Olsen 2007). To trace the locations at which Gilbert's “new *Platycercus*” was recorded, we cross-referenced the entries from Gilbert's (Gilbert 1844–1845) and Leichhardt's diaries (Leichhardt 1847) with remapping of the Leichhardt expedition route (National Centre of Biography 2014).

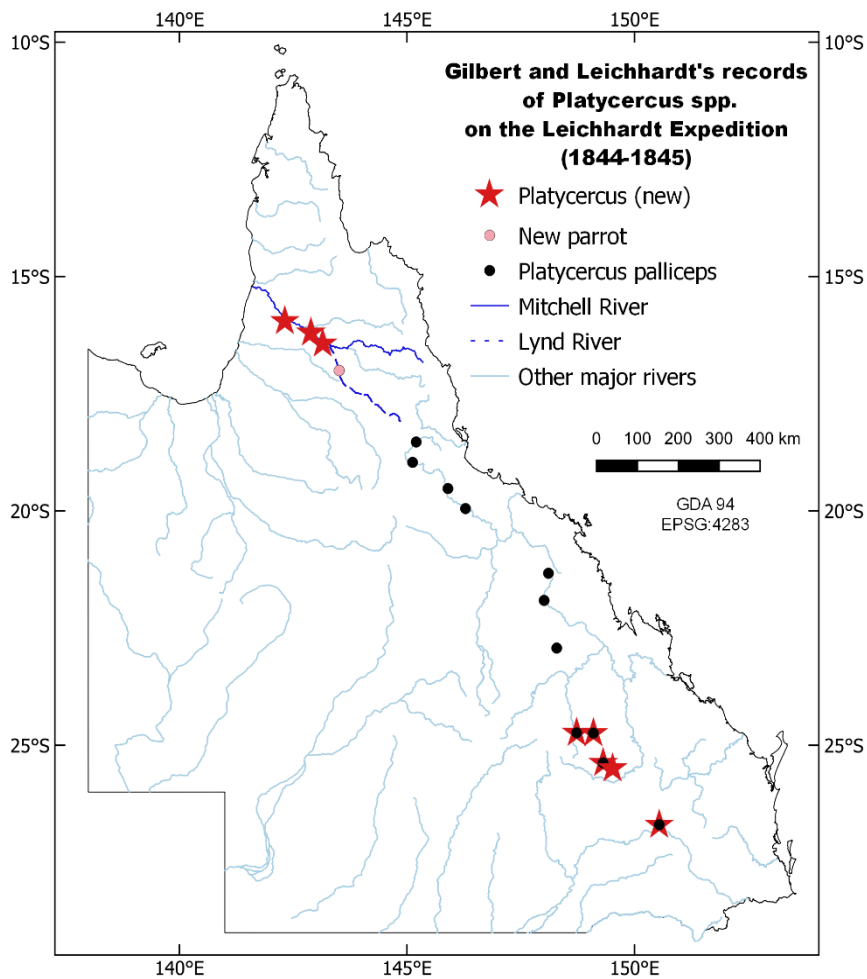
##### Elsley

Joseph Ravenscroft Elsley (1834–1857) was the surgeon and naturalist on Augustus Gregory's “North Australian Exploring Expedition”. He collected the three type specimens of GSPs on 14 September 1856, as the expedition crossed the base of Cape York (Garnett 1998).

##### McLennan

William Rae McLennan (1882–1935; Fig. 2) was among the most prolific collectors of scientific specimens on CYP in the early 20<sup>th</sup> century (White 1922b). Between 1898 and 1925, he collected at least 2,665 specimens, 988 of them from CYP (Atlas of Living Australia 2022c). In his initial trips to CYP (1909–1915), when he collected his first GSP specimen, McLennan was working for William David Kerr Macgillivray (Mathews 1917), and his field notebooks for these trips are held by Queensland Museum, Brisbane. Macgillivray's collection, including 315 clutches collected from a range of bird species by McLennan, was donated to the Australian Museum (AM) by his son Ian Macgillivray in 1937/8 (Australian Museum Trustees 1938).

McLennan returned to CYP on 27 August 1921, this time collecting for Henry Luke White in the “Coen District”. Most of the specimens from this trip are held in NMV, and the related diaries and notebooks are held by BA in their Melbourne archive. McLennan left CYP on 23 May 1922, and had returned by September the same year to prospect for gold. He was apparently “working a *show* at Coen” almost until his death in 1935 (D'Ombra 1936: 293) and did quite well on the Batavia River goldfield (Mason & Pfitzner 2021).<sup>ii</sup> He had continued collecting specimens (16 skins and seven clutches of a range of bird species in the H. L. White collection in NMV, and 40 specimens in AM) in the Coen District, with the last specimen being collected in December 1923.



**Figure 1. Gilbert and Leichhardt's records of *Platycercus* and a new parrot on the expedition from Morton Bay to Port Essington (1844-1845).** Dates and details of sightings were extracted from the expedition journals of John Gilbert (1844-1845) and Ludwig Leichhardt (1847). Locations of camp sites associated with each sighting were extracted from National Centre of Biogeography (2014).

On his collecting trips, McLennan juggled several notebooks covering his movements and observations, the details of specimens he collected, and his financial accounts (including the cost of posting specimen boxes); sometimes keeping dedicated notebooks for each of these topics, and sometimes mixing them up. However, the notes available in various collections appear to be incomplete. At one stage, he recorded in his field notebook "Lost my notebook today. After lunch go back most of route traversed, but could not find it" (McLennan 1922b: 11 Apr. 1922). Which of his notebooks it was that he had lost was not recorded. Some appear to have been lost in the post. "Wire from H. L. White stating that the boxes of specimens had arrived but no data or letters" (McLennan 1922c: 101, 6 Jan. 1922). Efforts to track down the missing notes

appear to have been unsuccessful. At intervals, entries in his field notebook (e.g. "Notes written to date" McLennan 1922b: 1 May 1922) indicate that he later wrote up his findings from his notebooks, probably in his diary (McLennan 1922c). Sometimes information missing from his notebooks, where gaps had been left, was completed in the diaries. Sections of different versions of his diary have found their way into various publications (e.g. Macgillivray 1918; White 1922b; Turner 1923), as have excerpts from his letters, most of which have been lost. When he finally left CYP, he left his remaining notebooks with Herb Thompson at Silver Plains homestead. They were collected by Sandy Hunt, who intended to donate them to a public institution for safe-keeping (Eileen Wassell, personal communication 15 July 1994), and are now curated



**Figure 2. William McLennan (left) feeding Golden-shouldered Parrots at Belltrees with H.L. White's nephew, Henry Hordern (right) in 1922.**

Photo: White (1922a).

in the Queensland Museum. We used all available entries from McLennan's notebooks, diaries, papers and correspondence relating to GSPs (Appendix 3), along with museum specimen details, to plot the location of his GSP collections and observations.

#### Anderson

James Donald (Don) Young Anderson (1895–1957) was the school-teacher at Coen between 1917 and 1929 (Mason & Pfitzner 2021). He sometimes helped McLennan find nests. He first went out with McLennan on 1 October 1921 and later lent him his 3A autographic camera for photographing the birds (McLennan 1922c). Anderson collected his first clutch for Macgillivray on 17 November 1921. He collected about 200 clutches of eggs from around Coen between 1922 and 1925 (Mason & Pfitzner 2021), including one or two GSP clutches on 30 July 1923, now held in a private collection (Ian Mason, personal communication 17 Jan. 2022).

#### Thomson

Donald Finlay Fergusson Thomson (1901–1970) was an anthropologist and zoologist who spent considerable time based at Port Stewart (Yintjingga), CYP, studying the customs of the Umpila people (Rigsby & Chase 1998). In 1928, he traversed “1,000 miles” of CYP, undertaking zoological collections in order to understand the relationship between Aboriginal people and their environment (Thomson 1935: 7). He returned to Port Stewart in 1929, from where he visited Violet Vale specifically to look for GSPs. We were given copies of his field notes from this trip (Thomson 1929) by his wife, Dorita Thomson, in 1993. He also summarised his findings from both expeditions in Thomson (1934, 1935).

#### Databases

Several databases of biological specimens and observations contain GSP records. Many of these records are held in more than one database, and periods of record collections overlap imprecisely. We found that no single database included a comprehensive collection. Wherever possible, we used these databases to locate original records in order to obtain further details and verify identification. Except for first-hand records that were specifically collected for inclusion in the database, and records derived from checklists in birdwatching newsletters that we could not access directly, we matched all database records to the original records in our definitive dataset (rather than including them as individual records).

#### BirdLife Australia

The First Atlas of Australian Birds (Blakers *et al.* 1984) was a Royal Australasian Ornithologists Union (RAOU, now BA) project that ran between 1977 and 1981, recording bird observations from five-minute or one-degree grids (resulting in uncertainties of 10 km and 70 km, respectively). Records were vetted by an expert panel before inclusion, and included seven GSP records. These were subsequently transferred to Atlas of Living Australia (2021a, 2022a,b). The Second Atlas of Australian Birds (Barrett *et al.* 2003) contained no GSP records within our study period.

As an adjunct to the First Atlas of Australian Birds, the Historical Bird Atlas (BirdLife Australia undated) covered the period 1629 to 1976, and also listed bird species from ten-minute or one-degree grids based on museum collections, personal notebooks,



and published and unpublished literature. This list included 37 GSP records, including nine from outside our study area. It also included one purported Hooded Parrot record and three purported Paradise Parrot records in the BA dataset, included here on the assumption that they were GSPs based on their distribution.

#### eBird

Atlas of Living Australia (2021a) contained three GSP records from eBird for our study period. As of 26 September 2022, only one of these records was still listed on Atlas of Living Australia (2022b), but another had been added. Two of the four were listed as being collected from 10-minute cells, and two had no positional uncertainty details, but could be located to within 9 km based on our knowledge of Artemis station. Three records were within the accepted breeding range at the time of their collection. However, one record was 90 km to the north. We contacted the original observers, and their memory was of seeing the birds, not at the listed location, but 100 km further south (Keith & Lindsay Fisher, personal communication 24 Dec. 2021). We therefore excluded this record as having a likely transcription error.

#### WildNet

A download from Queensland Government's WildNet database on 19 November 2021 contained 58 GSP records that were dated between 1856 and 1990 (Department of Environment and Science 2021c). This dataset contained second-hand reports of original observers (e.g. McLennan (1922a,b and/or c) via Chisholm (1922b)); and compilations of checklists (e.g. Kikkawa 1976), but no first-hand observations. In some cases, a single observation had been extracted from multiple secondary sources, each with different coordinates, thus appearing to be multiple distinct records. For example, Elsey's specimens collected from a single location (Garnett 1998) were reported at three separate locations, up to 59 km apart, as derived from Cayley (1938), Macdonald and Colston (1966) and "Garnett and Crowley (1992)". Bibliographic details of the publications on which many WildNet records were based include only the author and date (Dot Lim, personal communication 29 Nov. 2021). Hence, some were ambiguous, such as "White (1922)" and "Chisholm (1922)", each of which could have been from two different publications. Several records were

attributed to "Garnett and Crowley (1992)", but we have no record of this publication. The dataset also contained multiple GSP records attributed to "Weaver (1979, 1982)", which were derived from sketch maps in each of his publications. The coordinates of these WildNet records correspond poorly to those in Weaver's actual dataset. The only records that we sourced from WildNet alone were therefore those derived from checklists in birdwatching newsletters that we could not access directly (i.e. Queensland Ornithological Society 1988, 1991; Redhead 1988; Britton 1990, 1991; Ross 1990).

#### Atlas of Living Australia

ALA records for our period of interest were derived from several other sources, including museum collections, the first and historical Australian bird atlases, eBird and WildNet. We used two downloads. The first (Atlas of Living Australia 2021a; extracted 19 Nov. 2021) contained all "*Psephotus (Psephotellus) chrysopterygius*" records. It included 904 records, of which 86 were dated within our period of interest. In later downloads of this dataset from the same URL, some records or their dates had been removed; and the Record ID of others – particularly those sourced from WildNet – had changed. To find any GSPs that might have been misidentified, we later downloaded all "*Psephotus*" records from north of 20° S and east of 138° E (Atlas of Living Australia 2022b; extracted 27 Sep. 2022). Our final ALA dataset included 174 records, two of which were not present in the second download; and a further 30 for which the unique records number had changed between extraction dates, and so were simply duplicates. Hence, the dataset had 144 unique records. In both downloads, we requested all available records, including those tagged as "spatially suspect" or "spatially un-defined" (Atlas of Living Australia 2021b). A further download of GSP records was undertaken on 9 November 2022 to identify those records tagged as "spatially-valid" (Atlas of Living Australia 2022a). Of the 142 ALA records current at this time, 83 (58.5%) were tagged as "spatially valid".

#### Global Biodiversity Information Facility

A download from GBIF (Global Biodiversity Information Facility 2021) on 17 December 2021 listed 21 non-captive GSP collections from Queensland that are held in Australian Museums;

18 in NMV and three in AM. These records are all duplicates of records in ALA, so we have not re-added them to our dataset. GBIF also listed 15 specimen collections held in museums outside Australia and curated as GSPs that were possibly collected in Queensland up until 1990. Again, we primarily used GBIF to identify overseas collections that contain GSP specimens, and obtained specimen details directly from these institutions.

#### Storr-Johnstone Bird Data Bank

The Storr-Johnstone Bird Data Bank was compiled by Glenn Milton Storr and Ron Eric Johnstone between 1970 and 2019, and includes information Storr collected in preparation for his “Birds of the Cooktown and Laura districts, north Queensland” (Storr 1953) and two checklists of Queensland birds (Storr 1973, 1984). This collection provided information from personal manuscripts unavailable from other sources.

#### Weaver dataset

Mark Weaver worked on CYP in the Queensland National Parks and Wildlife Service (QNPWS) in the 1970s and 1980s, and developed a keen interest in GSPs. He surveyed suitable GSP habitat around Musgrave between May 1975 and 1982, and compiled a list of parrot and nest sightings from local residents and visiting birdwatchers (Weaver 1979, 1982). When we commenced working on the GSPs in 1992, he gave us a copy of this list (Weaver 1970–1982). We included all records from this list in our definitive dataset.

#### Museum and private collections

Most Australian Museum collections can be accessed through the Online Zoological Collections of Australian Museums (OZCAM; <https://ozcam.ala.org.au>). OZCAM is an offshoot of ALA, so the same specimen details are available through both portals. We accessed the further details of specimens identified through ALA/OZCAM either from the source museum’s online catalogue or through correspondence with museum staff, as listed in the acknowledgements. KOS, which was acquired by WAM in 2018–2019 (Anon. 2019) is not accessible through OZCAM/ALA. It contains six GSP clutches, each of four eggs, the details of which were provided by Ron Johnstone (personal communications 9 Feb. 2022, 25 Oct. 2022). We similarly identified the presence of GSPs in international collections through GBIF, and then through online catalogues and direct communication with staff.

#### Record management and verification

In order to produce a definitive Golden-shouldered Parrot dataset for the period 1845–1990 (Table S1 in Appendix 5), we examined all records labelled as “*P. chrysopterygius*” from the above sources for the study period. We rejected records from outside our study area, assuming that these were from other *Psephotellus* species or captive birds. We also examined all other records labelled as “*Psephotus*” or “*Psephotellus*” from within our study area. We established objective criteria for rating confidence in the species’ identification (Table 1). The highest level of confidence was limited to records supported by verified skins. High confidence was restricted to records from people with a proven track record in researching or surveying GSPs. A medium rating was allocated to records made by other experienced birdwatchers within the species’ known breeding range, and to explicit records of experienced Paradise Parrot observers. All other accepted records, including unverified GSP clutches with poor provenance trails, were allocated a low level of confidence. Such clutches could be from aviaries (Ian Mason, personal communication 28 Nov. 2022) or could be from a different species altogether (see Mistaken identities). There is also reason to believe that some of these clutches were collected at different times and places than is indicated on their labels, as detailed below.

For each record, we attempted to find a first-hand account, from which we extracted all collection details. Unless it was clear that the record collector had provided accurate coordinates, we assumed that positional information was of a general nature only. For example, most of McLennan’s specimens were labelled as coming from Coen or Port Stewart, whereas his detailed field notes indicate they were collected up to 30 km from their listed locations. For each record that we accepted, we reassessed the provided coordinates based on the locality description, the scale of mapping used, and topographic and/or habitat constraints (e.g. distance along a road or extent of habitat type), and corrected them wherever necessary. We allocated a positional uncertainty to indicate our confidence in these coordinates. We retained the original positional uncertainty only where this appeared to have a rational basis (e.g. when based on the records being made within either a ten-minute or half-degree grid). For a record of one or

**Table 1. Confidence ratings for Golden-shouldered Parrot species' identification.**

See Appendix 5, Table S2 for further details.

<b>Verified</b>	<ul style="list-style-type: none"> <li>Records supported by verified Golden-shouldered Parrot (GSP) specimen with a verified provenance trail</li> </ul>
<b>High confidence</b>	<ul style="list-style-type: none"> <li>GSP records by experienced antbed parrot observers (John Gilbert, Ludwig Leichhardt, Willie Massey, William McLennan, Tommy Tucker, Don Anderson, Gostelow family, Mark Weaver, Sandy Hunt, Tom and Sue Shephard, Len Robinson, Hans and Judy Beste, Stephen Garnett, Lana Little, and Danny Chew)</li> <li>regardless of location (see Table S3 in Appendix 5 for periods of expert classification) GSP record confirmed by experienced antbed parrot observer (as above)</li> </ul>
<b>Medium confidence</b>	<ul style="list-style-type: none"> <li>GSP observations by other experienced birdwatchers or unverified GSP clutches within known GSP breeding range</li> <li>Observations of “new <i>Platyercus</i>” north of Burdekin River by experienced antbed observers</li> </ul>
<b>Low confidence</b>	<ul style="list-style-type: none"> <li>GSP observations by other experienced birdwatchers or unverified GSP clutches from outside known GSP breeding range</li> <li>Uncertain GSP records from experienced antbed parrot observers</li> </ul>
<b>Rejected</b>	<ul style="list-style-type: none"> <li>Positional uncertainty too large (&gt;15 km positional uncertainty)</li> <li>Outside Cape York Peninsula study area (12° S to 20° and 140° E to 145°E)</li> <li>Derived records that cannot be reconciled with an original collection event</li> </ul>

two clutches collected by Don Anderson “40 km from Coen”, we estimated the location based on his association with William McLennan. As GPS units were rarely used before 1991 (Tomkiewicz *et al.* 2010), we assumed that positional uncertainty was at least 100 m in all cases, and therefore restricted the coordinate values of all records to three decimal places. We rejected any record for which we could not pinpoint the collection location with a positional uncertainty of 15 km or less, as having too poor a resolution for useful mapping or modelling.

For each record in our definitive dataset, we allocated a Record ID number that reflected the chronological order of collection. We also allocated a unique site code based on chronological order of the first record made at each location (e.g. GSP-012). We then allocated a record code that included the appropriate site code, followed by a sequential letter indicating the collection order at that site, and a code that indicated the type of record (observation, eggs, skin or live capture; e.g. GSP-012c-skin).

We attempted to match all accepted records to those derived from them, by comparing date,

specimen type (i.e. whether a collection was of an egg, clutch, or bird; and the bird's sex and maturity), and general locational information, regardless of inaccuracies in that information. For example, we accepted all records purporting to be of Elsey's type locality, even those that were listed as being up to 63 km from our accepted collection location. We rejected derived records with collection details that could not be reconciled with an original collection event. For example, we could not reconcile WildNet records derived from low-resolution maps in Weaver (1979, 1982) with the original collection records provided to us by Weaver (1970–1982). In Appendix 5, we also tabulated GSP records from BA (Table S4), WildNet (Table S5) and ALA (Table S6), matching their records to one or more of the records in our dataset, wherever possible, otherwise providing reasons the records were rejected. In each of these spreadsheets, we also identified where BA and WildNet records were the source of ALA records.

We compiled statistics on the relationship between our records from our definitive dataset and those from the BA, WildNet and ALA databases. For the latter database, we made separate assessments for all records, and those that were flagged as “spatially

valid". We also compared the positional accuracy of the four different species' identification confidence ratings using a Kruskal-Wallis rank test.

#### *Antbed preference and nest outcome*

Where possible, we extracted antbed type and nest outcome for all nests directly observed by McLennan, Massey and/or Tucker in 1922, and compared them with nest data from the Morehead catchment between 1992 and 1997 (STG and GMC unpublished data) using chi-squared tests.

#### *Pastoralism*

We searched the literature for mentions of the establishment of cattle stations on CYP and in the Queensland Gulf, and compared the advance of pastoralism with the contraction of the GSP's distribution.

## Results

### *First records*

The first GSP specimens collected for scientific purposes, and illustrated by Gould (Fig. 3) were an adult male [Record 7 in Appendix 5, Table S1], adult female [8] and immature male [9] shot between Normanton and Croydon by Joseph Ravenscroft Elsey on 14 September 1856 on Gregory's expedition across northern Australia (Garnett 1998). Elsey described the parrot's flight as "swift and decided; and adds that he never saw it on the ground, although the contents of its crop would indicate that it obtained its food there" (Gould 1857: 221). All three specimens collected by Elsey are considered type specimens of equal value (syntypes; Warren 1966), and are held in BMNH (Natural History Museum 2014), although GBIF only lists this museum as holding a still image, which it describes as an Elsey syntype. Fifteen tissues samples from these birds are held in NMV: five from the female and – presumably – five from each of the males. All fifteen specimens are listed in ALA/OZCAM as associated records, but only eleven of the associated Record IDs are provided.

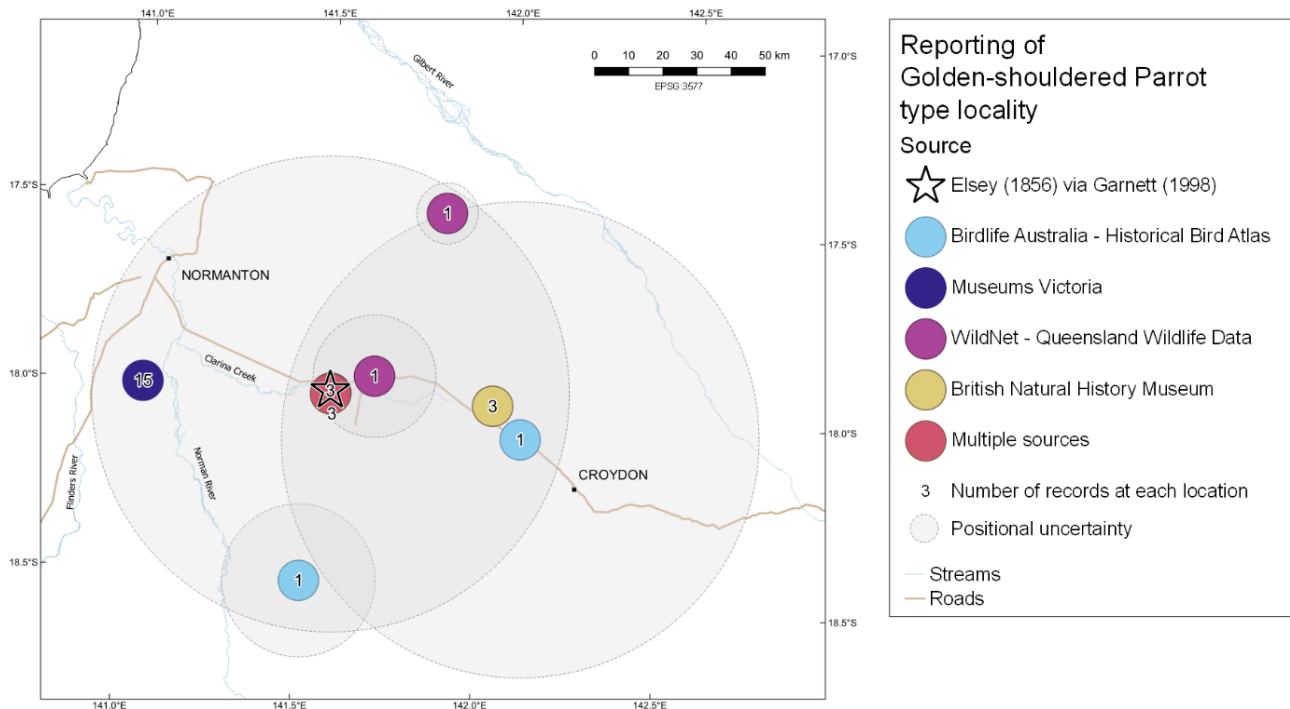
In our definitive dataset, we list Elsey's collections as three separate records at one location. Although (Gould 1857: 151) reported that "Mr. Elsey states that they were procured on the 14th of Sept., 1856, in lat. 18° S. and long. 141° 30' E.", by retracing the Gregory Expedition, Cayley (1938), Storr (1984) and Garnett (1998) placed the collection location on Clarina Creek (Fig. 4). Other



**Figure 3. John Gould's illustration of Golden-shouldered Parrots collected by Elsey.**

Source: Gould (1869).

secondary reports have provided different locations. Uncritical transcription of these reports has resulted in separate records at three different locations in BA and at three different locations in WildNet. In addition to the 15 tissue samples, this has resulted in 21 separate ALA records at eight locations referencing a single collection location (as well as an additional location listed in BMNH). The 15 tissue sample entries are listed as "associated occurrences" located at 18°S, 141.03°E, which is 55 km from the actual collection site. The other records, including the location listed on the skins held in BMNH, vary between 1 km and 63 km from our accepted collection site, with an average discrepancy of 33 km. The positional uncertainty attached to most records poorly reflected the actual error. The records furthest from the collection location, either provided no positional uncertainty (15 tissue samples), or had values that were too low to encompass the collection location.



**Figure 4. Locations reported for Golden-shouldered Parrot type locality.** Absence of positional uncertainty ring indicates that no value was provided.

In preparation for his “Birds of Australia”, Mathews (1916–1917) asked Robert (Robin) Kemp to search for GSPs in the area where Eley had found them. Despite collecting extensively in this area over 1912 to 1914 (Natural History Museum 2019), Kemp reported to Mathews that the birds had disappeared (Mathews 1916–1917).

Before Eley collected his specimens, the parrots appear to have been seen by Gilbert and Leichhardt on the expedition from Moreton Bay to Port Essington. On 17 June 1845, while camped to the west of the junction between the Lynd and Mitchell rivers, Gilbert wrote: “I was rather surprised to day, to meet with my new *Platycercus* of the Downs, a species which has not been observed with us since leaving the Deception Camp on the Comet Creek” (Gilbert 1844–1845: 216) [2]. He recorded them again from this camp the following day [3]. On 20 June, when the expedition was travelling down the Mitchell River, Gilbert (1844–1845: 217) saw the parrots in “great numbers” [4], and Leichhardt (1847: 297) wrote “Mr. Gilbert’s *Platycercus* of Darling Downs ... were very numerous, and it is probable that the plains round the gulf are their principal home, whence they migrate to the southward” [5]. Gilbert (1844–1845: 221) last saw the birds on 24 June 1845, just

before they departed the Mitchell River, when he wrote “The new *Platycercus* I saw in great numbers” [6].

It is a matter of contention whether birds seen by Gilbert and Leichhardt were GSPs or Paradise Parrots (Olsen 2007): Gilbert’s reference to the Downs and his lack of mention of a yellow wing has been used to support the birds being Paradise Parrots; subsequent failure to confirm the presence of a red-winged *Psephotus* on CYP supports them being GSPs. The Historical Bird Atlas interpreted Gilbert’s 18 June record as being of a Paradise Parrot (an identification that has been transferred to ALA; <https://biocache.ala.org.au/occurrences/9f814a4b-7ff1-450c-8cc0-eeb3649e0add>), but was silent on his other records. The three observations from along the Mitchell River between 17 and 24 June (Fig. 1) were within the known historical range of the GSP, between where Eley collected the type specimen in 1856 and the extant breeding population on Staaten River National Park (NP). We therefore accept them as GSP records with a medium confidence based on the location of the sightings; Gilbert’s familiarity with related parrots; and the difficulty of separating GSPs from Paradise Parrots when in flight (as later discussed).

Less conclusive is the earlier record that Gilbert made while camped on the Lynd River, 64 km south of its junction with the Mitchell River, on 11 June 1845: “a new Pigeon and a new Parrot have been observed, but as yet none of us have been able to shoot either” [1] (Gilbert 1844–1845: 212). Gilbert usually reported his observations in the first person, so his turn of phrase suggests that he himself might not have seen either species, but had been provided with credible reports by his companions. This location is 12 km from the nearest known GSP nest on Bulimba. Of the other parrots that might be expected in the area, Pale-headed Rosella (which he called *Platycercus palliceps* = *P. adscitus* (Latham, 1790)), Rainbow Lorikeet (*Trichoglossus swainsonii* = *T. moluccanus* (Gmelin, 1788)), Little Lorikeet (*T. pusillus* = *Glossopsitta pusilla* (Shaw, 1790)), Red-winged Parrot (*Aprosmictus erythropterus* (Gmelin, 1788)) and Budgerigar (*Melopsittacus undulatus* (Shaw, 1805)) had previously been identified by Gilbert along the route, so he was unlikely to consider any of them a new species. This leaves the Varied Lorikeet (*Psitteuteles versicolor* (Lear, 1831)) and GSP as the most likely contenders. Gilbert was probably familiar with Varied Lorikeets, which had been collected at Port Essington while he was there on a collecting trip for John Gould (Museum of Comparative Zoology, Harvard University Specimen 88783, collected 8 Sep. 1840), although it is unclear whether he was the collector. His companions were unlikely to have been familiar with this species. Despite the scant details of this record, it appears to have been accepted by Storr (1984: 76). Because of its proximity to current nesting areas, we also accept it as a GSP record, but with a low level of confidence. We presume this record is the source of Sibley and Monroe (1990) reporting the species’ distribution as extending to Bulimba, as we can find no other records mentioning this location.

The locations of the camps at which Gilbert and Leichhardt made their notes have been accurately mapped (National Centre of Biography 2014). For the records made on 11, 20 and 24 June, when the party had been travelling between camps during the day, we have located the record halfway along the route between the morning and evening camps, and allocated a positional uncertainty that includes both camps. As the party was based at the same camp from 16–19 June, the records made on

17 and 18 June were allocated a positional uncertainty of 500 m to allow for short forays from the camp.

Only one of these records is currently held in ALA, where it is sourced from BA, and listed as being an observation of a Paradise Parrot in June 1845. Although the record is positioned 70 km to the southwest of our designated site, the 13 other species listed as being observed on the same occasion correspond to Gilbert’s sightings on 17 June.

#### *Mistaken identities*

When John Gould first described the GSP, which he called the Golden-backed Parrakeet, he referred to a painting by Ferdinand Bauer that he considered to be of the same species:

On comparing the bird with the drawing made at least forty years before, they proved to be so much alike that no doubt remained on my mind as to its having been made from an example of this species (Gould 1869: text accompanying Plate 64).

Bauer had been the illustrator on Matthew Flinders’ circumnavigation of Australia in 1802–1803. The expedition made landfall on CYP at the Pennefather River (McAllan 1992; which they called the “Coen River”, Brown & Bauer 1814). This was a potential location for GSPs at that time, as they were later recorded behind the mangroves at Watson River and near Pormpuraaw, 120 km and 300 km further south, respectively (see below). However, Bauer’s painting (Fig. 5) was clearly of the Hooded Parrot, and was probably painted from birds seen at Melville Bay on 16 February 1803 (McAllan 1992), where Brown recorded “A beautiful species of paroquet not known at Port Jackson was procured” (Mathews 1913b: 152). Bauer’s parrots are therefore not the first documentation of the GSP.

On 3 September 1861, when the Gregory brothers were travelling along the Oakover River, and skirting the Hamersley Range in the Pilbara, Western Australia (WA), they described “valleys yielding little else but triodia, with occasional patches of stunted gum forest, in which was found a little good grass, on which were feeding flights of pigeons and a variety of parrot new to us, but which I believe to be the golden-backed parakeet (*Psephotus chrysopterygius*) of Gould” (Gregory & Gregory 1884: 408). They had presumably been shown Eley’s specimens on their 1856 expedition. This was not the only GSP record from WA. The



**Figure 5. Ferdinand Bauer's painting of Hooded Parrots observed during Flinders' circumnavigational survey of Australia (1801–1803), believed by John Gould to have been of Golden-shouldered Parrots.**

Source: Library and Archives, Natural History Museum, London.

Historical Bird Atlas contains one from Carnarvon in 1900 (BirdLife Australia undated). The only related species known from either location is the Mulga Parrot.

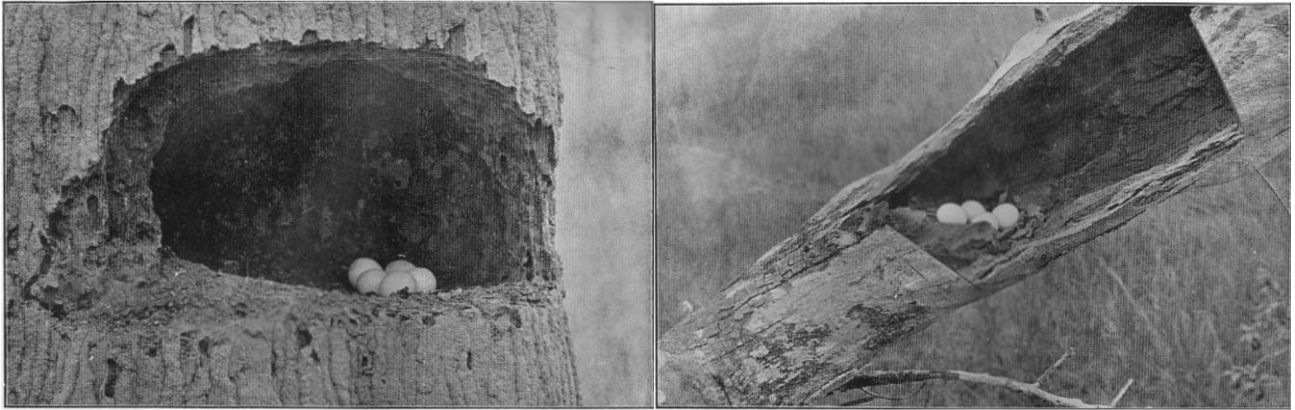
In 1902, W. H. Dudley Le Souëf described the nest and eggs of what he thought were GSPs that had been collected from the “Port Darwin District”. “The eggs were laid at the end of a hollow dead branch of a eucalyptus tree on the earthy substance” (Le Souëf 1902: 94). The single egg was “pure white, glossy, and rounded” (Le Souëf 1902: 94). McLennan described GSP eggs as “pure white, almost round, and with little gloss” (White 1922a: 99). Le Souëf's egg measured 21.8 mm by 18.3 mm, within the range of both GSP and Hooded Parrot eggs collected from the wild (Saunders 2009), although slightly larger than the 80 GSP eggs we measured from nests south of Musgrave between 1993 and 1995 ( $20.6 \pm 0.8$  mm by  $17.8 \pm 0.5$  mm). Le Souëf's egg collection was sold to H. L. White, who bequeathed his collection to NMV on his death in May 1927 (Museums Victoria 2022a). A footnote to White (1922a: 98) dismissed this egg as belonging to GSPs because the species “is not found west of the Gulf of Carpentaria”<sup>iii</sup>.

As GSPs and Hooded Parrots in the wild have only been recorded as nesting in antbeds (e.g. Fig. 6A)

(Higgins 1999), a nest in a tree hollow is highly unlikely to be that of either species. Of the hollow-nesting parrots found in the Top End of the NT, the Varied Lorikeet has a nest and eggs that most closely match Le Souëf's description. Varied Lorikeet eggs collected by McLennan at “Coen” (Fig. 6B) were  $21.8 \pm 1.0$  mm by  $18.0 \pm 0.5$  mm, and two of these eggs have the exact same dimensions as those of Le Souëf's egg (Saunders 2009). We therefore conclude this nest and egg was most likely to have been that of a Varied Lorikeet, and not of either *Psephotellus* spp.

#### *First captive birds*

In 1897, a small number of GSPs arrived on the market. Six were sent to England as immature Paradise Parrots in the spring of 1897 (March to May; Phillips 1898). Of these, the London Zoological Gardens purchased a pair on 10 March 1897 (North 1898). The remaining birds were females. Two were purchased by Reginald Phillips (1898). C. T. Maxwell obtained two and exhibited them at the Crystal Palace as a pair of immature Paradise Parrots (Cresswell 1898), and – in later exhibitions – as GSPs (Seth-Smith 1899). Another female was exhibited by Mr. L. W. Hawkins in the following two years (Phillips 1900; Seth-Smith 1901).



**Figure 6. Nests of A. Golden-shouldered Parrot, and B. Varied Lorikeet, cut open to expose eggs.**  
Photos: W.R. McLennan: A. White (1922a) and B. White (1922b).

Phillips (1898) commissioned Pierre Jacques Smit (illustrator at BMNH) to paint a portrait of the pair held at the London Zoo. The painting is clearly of GSPs (Fig. 7). It does not appear that the pair at London Zoo produced progeny, but – by 1901 – the zoo had produced hybrids from GSPs and Mulga Parrots (Seth-Smith 1901). The female died on 1 October 1904 suffering from cystic ovaries, and the male died on 19 September 1909 suffering from haemorrhagic enteritis (Zoological Society of London Library, personal communication 7 Feb. 2022). Both were listed as “useless”, so it is unlikely their skins were preserved.

Although Phillips (1898) claimed another two GSPs arrived in London in June 1897 or 1898, Seth-Smith (1910) believed this not to be the case; and Mathews (1916–1917: 429) stated that “all the later consignments [to the U.K.] were from Pine Creek or thereabouts, and these have been just as certainly *dissimilis*”. This included a pair of birds obtained by Mrs. Johnstone, of Bury St. Edmunds, in 1902 (Lendon 1950a), which turned out to be Hooded Parrots (Seth-Smith 1910).

One of the captive female GSPs ended up in Mathews’ collection. It was marked as coming from North Queensland, and had lived in captivity from 5 April 1897 to 4 January 1898, but had no other details of its origin. The skin of this bird is held in AMNH (SKIN-623439). Its details fit with those of one of Phillips’ birds, which had died of a chill in the winter of 1897/98 and was skinned to make a specimen (Phillips 1898). Mathews must have received the skin after 1917, when he wrote “Since Eelsey’s time no specimens of the particular form procured by him have been preserved” (Mathews 1916–1917: 427).

Of the bird trappers who were known to be active in the 1890s, Albert Meek can be ruled out as the collector of these birds because he was in New Guinea from late 1896 to early 1897 (Australian Joint Copying Project 1894–1931) and he did not arrive on CYP until June 1898 (Hartert 1899), after the birds had arrived in London. Nor were the parrots collected by Henry Greensill Barnard, as he wrote in 1914 “*P. chrysopterygius* was obtained somewhere in the Normanton district, and does not appear to have been found since it was described by Gould” (Barnard 1914: 46). However, by 1897, most of the parrot’s range had been opened up for either gold mining or cattle grazing, and the track servicing the telegraph line running through the centre of the peninsula had long been completed (Lack 1962), so much GSP habitat would have been accessible to bird trappers; and the parrots might easily have been collected by an enthusiastic naturalist, as were so many of the early pastoralists.

On 14 December 1897, Alfred J. North, Curator at AM, enthusiastically purchased a live male GSP for the museum from Emma Young (O.9754; Australian Museum 1897; North 1898). It had reportedly been caught in a net by a bird trapper near Port Darwin NT, but this appears unlikely, as inspection of photographs of this specimen indicates it is definitely a GSP. Although North confirmed that this bird was a GSP, he noted that its plumage differed somewhat from that in Gould’s description.

In the living example now before me ... a narrow line of turquoise blue separates the pale-yellow feathers of the forehead from the crown of the head, and the black feathers of the





**Figure 7. Pierre Jacques Smit's portrait of Golden-shouldered Parrots held in the London Zoological Gardens, painted in 1898.** Source: Phillips (1898).

latter extend in a central stripe on to the nape (North 1898: 89).

North kept his GSP alive for nearly two years, after which he transferred it to the reference collection of AM (North 1900). It was the first GSP specimen to be retained in an Australian museum. At the time of writing, the bird did not appear in ALA; and

as its origins remain a mystery, we unfortunately cannot include it in our dataset.

#### *Watson River*

McLennan first recorded seeing a pair of GSPs [10], and collecting a male [11] on 14 April 1915, at Watson River on the west coast of CYP.

On reaching the river a pair of strange Parrakeets was flushed from the thin fringe of mangroves; they flew off up the river, and disappeared in a big patch of mangrove. I followed, and searched for about an hour, but did not see them. Returning along the edge of the mangrove, I saw one of the Parrakeets flying in from the plain. It alighted in the mangroves, and I managed to secure it (Macgillivray 1918: 189).

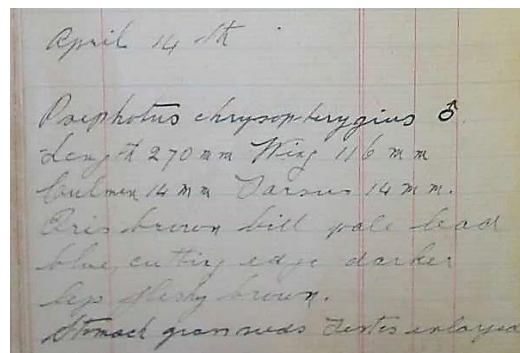
Returning along the edge of the mangroves, I saw one of the Parrakeets flying in from the plain, it lit in the mangroves and I shot it. It proved to be *P. chrysopterygius* (McLennan 1922b: lmg\_1672.jpg).

At that stage, the species' nest and eggs had not been described, so McLennan did not realise that GSPs nested in antbeds. McLennan recorded the details of this bird in his field notebook (Fig. 8A),

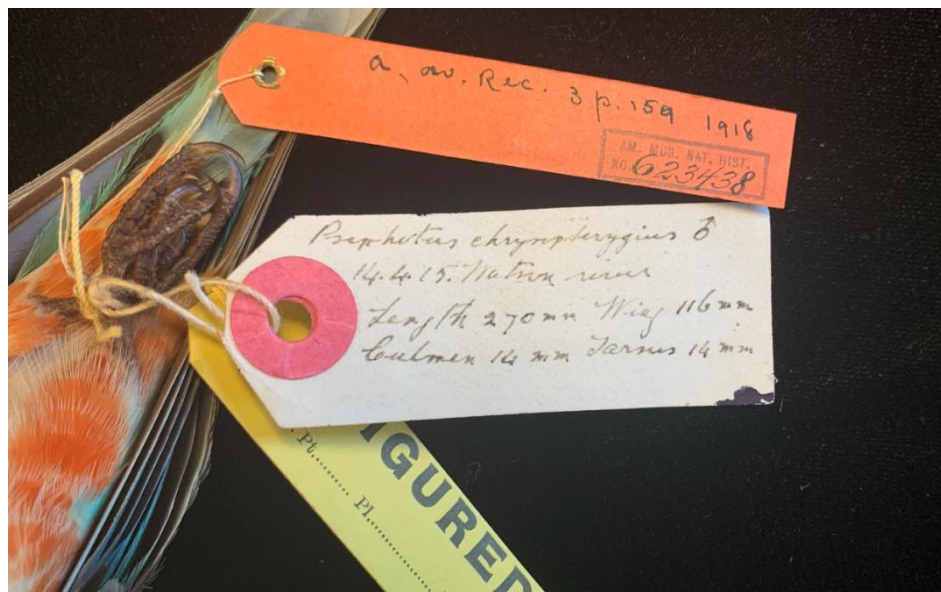
and sent the bird to Mathews (White 1922a). Mathews (1918) later nominated it as the holotype for *P. chrysopterygius nova*. In the 1920s, Mathews sold it with the rest of his collection to Lord Walter Rothschild (McCarthy 2019), who on sold his collection in the 1930s to AMNH (O'Dowd 2018), where the specimen is currently listed in the catalogue as SKIN-623438 (American Museum of Natural History 2021). Based on the handwriting on the label, Greenway (1978) thought the collector was F. B. Lawson Whitlock, but comparison with McLennan's field notes confirm it was his Watson River bird (Fig. 8B).

Based on this specimen, we allocate a high level of confidence to this record. We consider it to be a breeding record because of the bird's enlarged testes (Young & Nelson 2001). McLennan's description allows us to allocate a positional uncertainty of 250 m to this record. He had taken his boat up Watson River on 13 April to revisit a

A



B



**Figure 8. A. McLennan's description of the Golden-shouldered Parrot he secured at Watson River in 1915. B. McLennan's label on the same bird, now held in the American Museum of Natural History.** Photos: A. Queensland Museum from McLennan (1922a); B. American Museum of Natural History.

Great-billed Heron *Ardea sumatrana* Raffles, 1822 nest, and anchored within half a mile of the place, unable to go any further as the tide was running out (McLennan 1922b), so he was still in the tidal reaches of the river. The next day, he followed a creek on the right side of the river into forest country. Returning to Watson River, he flushed the parrots from the mangroves. This description places the birds at the junction of Watson River and Kokialah Creek. Multiple citations of this bird in secondary sources have resulted in four ALA records, two from BA (one of which is listed as a Hooded Parrot), and two from WildNet (one of which is listed as being collected in 1910), all within 11 km of our designated collection site.

According to White (1922a: 98), up until this collection, “a considerable amount of mystery was attached to this beautiful little Parrot, it being confused with the Hooded Parrot, *Psephotus dissimilis*, until W. McLennan set all doubts at rest by securing a pair on the Archer River, and sending them to Mathews, who confirmed Gould’s identification made in 1857”. This erroneous mention of Archer River, which enters the Gulf of Carpentaria about 3 km to the southwest of the mouth of the Watson River, may have led to further confusion about the distribution of the species (see below).

#### Coen district

We define the Coen district as the land around Coen, extending to Port Stewart in the southeast and the Archer River in the north, and encompassing the eastern section of Oyala Thumotang NP (Cape York Peninsula Aboriginal Land). The long presence of GSPs in the Port Stewart area is indicated by the Lama Lama name of Thaku for the parrot (meaning left-handed; Golden-shouldered Parrot Recovery Team 2022). McLennan arrived at Port Stewart on 27 August 1921 to explore the Coen district, which – for our purposes – extends between the Stewart River and Archer River roadhouse. Although he had handled GSPs at Watson River, it is clear that he did not link them to the anthill parrot that was being reported from the Coen district. Nor did he realise that he had found his first GSP nest, when he noted “an old Finch’s nest found in a hole drilled in an anthill” along the Port Stewart Road in September 1921 (McLennan 1922b: 4). He would later return to this area and find parrot nests in abundance.

Fred Keppel, manager of Rokeby, had been on the lookout for anthill parrots for McLennan, and on 12 December 1921 told him that he had seen some on the track to Rokeby: six birds about six miles from Coen in April 1921 [13], and a pair 18–20 miles from Coen on 10 December 1921 [14] (McLennan 1922a, b). The same day, McLennan searched the area between Six Mile ridge and Eight Mile water-hole with Jack Bassani, but did not find the parrots. At that stage, McLennan did not know which species of parrot they were looking for, and wondered if it might be a “*Neophotus*” (McLennan 1922c: 92), a genus that does not exist, so is possibly either a transcription error or a corruption of *Neopsephotus* Mathews, 1912, which – even then – only applied to Bourke’s Parrot *N. bourkii* Gould, 1841.

McLennan again sought the parrots on 2 January 1922, when one of the station-hands mustering on Rokeby told him he had seen a pair around the Eight Mile waterhole [15]. The following day, he searched the area with Cecil Wilson, but without success. Not knowing which species of parrot had been seen, he left a blank space in his diary for inserting its name once the birds were identified. In March, he heard news of the parrots at Port Stewart [12, 16, 17], and resolved to return there. Before he did so, he was told of a sighting north of Coen. Herb Thompson, owner of Rokeby and Silver Plains stations, told McLennan that a Chinese-Aboriginal station-hand called Willie Massey had “found a nest of the Anthill Parrot within a mile of the camp a couple of days previous” [18] (McLennan 1922c: 184) and offered to take him out to the site the following day.

#### Lagoon Creek flat

McLennan finally saw the parrots on 23 April 1922. At 2:30 am, McLennan headed off with Thompson to Lagoon Creek flat,<sup>iv</sup> 14 miles (22.4 km) by road from Coen, where – after some searching – Massey found the nest for him. It was in a conical antbed. McLennan collected the eggs, but did not know which species had laid them until he managed to shoot the parents.

In a few yards I heard a strange parrot call, and saw both birds flying from tree to tree along the edge of the flat too far away to note the colours. In a short time, both flew to the termitarium, the male on top and the female to the nest entrance. I could see they were not

*pulcherrimus*, and thought I had found a new species. With the first barrel I secured the male, and brought the female down with the second barrel as she flew off. On picking them up I saw they were *P. chrysopterygius*, a rare bird, the eggs of which are undescribed (McLennan 1922c: 185).

I really expected to see *P. pulcherrimus* the Paradise Parrot, but they proved to be the very rare Golden-winged Parrot (White 1922b: 109).

McLennan made three GSP collections at this nest, which are now in NMV: a clutch of five eggs [19], an immature male [20] and an adult female [21] (Fig. 9). Only three of the eggs made it to the collection, as the fully-developed chicks had been difficult to extract, and two eggs were “failures” (McLennan 1922c: 187). Massey and McLennan found another three nests, all of which McLennan thought were still being built [22-24].

McLennan returned to Lagoon Creek alone on 12–13 May 1922, and recorded: “The anthill flats extend for some miles here. Put in a few hours searching thru them” (McLennan 1922b: lmg\_0883.jpg). He revisited the three nests found earlier, two of which were deserted [76, 77]. The third contained young [78], “so must have

contained eggs” when he first found it (McLennan 1922c: 200). He recorded finding several old or last season’s nests [79, 81], and another two current-year nests: one from which the young had recently fledged [80], and another with four eggs, and four moths, all of which he collected [82]. He recorded the details of this last nest twice in his notebook, but only once in his diary. All six nests at Lagoon Creek flat appeared to be in conical antbeds, although he mentioned the mound type of only three of them (Appendix 4).

All specimens from this site are labelled as being collected at 13.95°S, 143.2°E, and either from Coen, or 14 miles from Coen. Although Lagoon Creek is indeed 14 miles from Coen by road, it is approximately 10.6 miles (17 km) to the NNW of Coen. As McLennan provided no directions or distances to nests once he reached Lagoon Creek, we locate all nests noted or sampled as being within 5 km of the centre of the flat. Apart from verified specimens, we rate the species’ identification of all GSP observations by McLennan and his two Indigenous guides as having a high confidence, and allocate a medium level of confidence to the records that McLennan was unable to substantiate.



Figure 9. Golden-shouldered Parrot specimens collected by W. R. McLennan at Lagoon Creek on 23 April 1922 and held by Museums Victoria: A. clutch of eggs (BE 1418); B. immature male (HLW 527); and C. female (HLW 529). Photos: Museums Victoria.

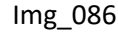
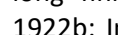
## Archer River

There is a 1922 GSP record in WildNet and ALA that is attributed to Alexander (Alec) Hugh Chisholm (1922b). In response to a request by Chisholm (1918) in his newspaper column for information on Paradise Parrots, a former police constable from Coen had written that Paradise Parrots were “still to be found in the far north” (Chisholm 1922b: 7; Olsen 2007). White had disputed that Paradise Parrots could be “found on Cape York, when two such close observers as H. G. Barnard and Wm. McLennan have searched the locality diligently” (Chisholm 1919: 12).<sup>v</sup> When pressed on the matter, the constable had not described the birds’ plumage, but instead that the parrots were more plentiful than GSPs and “moved about on the ground in numbers... but... never... more than two or three close together at any time” (Chisholm 1922b: 8), a description that could equally apply to Pale-headed Rosellas. He also mentioned finding nests in antbeds, but did not appear to know that such nests were made by GSPs.<sup>vi</sup> When Chisholm (1922b: 7) approached the police patrol at Cape York, he was told that the Paradise Parrot “was not at Cape York<sup>vii</sup> itself, but was moderately plentiful at a certain point in the neighbourhood of the Archer River”. As Lagoon Creek flat drains into Bourne Creek, a tributary of the Archer River, these reports may pertain to this area. We therefore conclude that the nests the constable described were indeed those of GSPs. However, because of the vague nature of the report, we do not assign them specific record numbers.

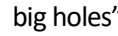
## Port Stewart area

McLennan returned to Port Stewart with Tommy Tucker, an Indigenous tracker, between 1 and 7 May 1922, and spent most of his time in pursuit of the parrots. On 1 May, McLennan (1922b) recorded eight GSP observations at five locations along the Port Stewart Road, between the foot of the range and 20 km west of Port Stewart. Identifying the location of these nests was aided by his practice of recording distances along the road. They found a female bird [25] and a fresh nesting attempt “a couple of miles from the foot of the range” [26]; a nest with young [27]; a female flushed from a nest with five eggs and one young [28]; a nest with five well-feathered young [29]; old nests and others that had been started but abandoned [30]; a pair of birds [31]; and a nest with four finch eggs and four abandoned GSP eggs

[32]. The finch’s eggs were of the Black-throated Finch (then called *Poephila neglecta* North, 1904, currently *P. cincta atropygialis* Diggles, 1876). All eight eggs are in NMV (BE 1419), and are labelled as being collected from Port Stewart, several kilometres to the east of their actual collection point. On 6 May McLennan returned to nest 29, from which he collected six of seven young [54]; and, on 21 May, to nest 27 and 28, where he collected the two best-feathered birds from each nest [83 & 84, respectively].

On 2 May, they failed to find nests seen by Mick Bassani near Port Stewart. Instead, Tucker took McLennan “a couple of miles ... through heavily timbered wattle and swamp paperbark country at back of the saltpans and mangroves ...[to] reach the first anthill flat” (McLennan 1922c: 192). There, they made four GSP observations at two locations, but no collections until 4 May. Near the edge of the mangroves, they found a recent nest in a magnetic antbed, which had been occupied by finches [33]; and later flushed a bird from a nest in a conical antbed that had “4 eggs and one small young just hatched” [35] (McLennan 1922b: ) and another parrot from a nest in a magnetic antbed that had four eggs, which they left to see if others would be laid [36] (McLennan 1922c, b). In the next flat over, they found nests in both conical magnetic antbeds, including “one not long finished, but ... deserted” [34] (McLennan 1922b: ). Many of the old nests had been occupied by Black-throated Finches.

The following day, they headed south from Port Stewart towards Balclutha Creek. Although they reached the place where Mick Bassani had told McLennan that parrots had been seen – and Tucker was familiar with the location – no sign of parrots could be found.

On 4 May, they returned to the sites visited on 2 May, and made 12 observations at three locations. At nest 36, McLennan collected the eggs [37], which he remarked appeared “hard set”, and shot the female [38] and its immature mate [39] (McLennan 1922c: 194). When McLennan blew the eggs the next day, he wrote that they were “almost hatching. Managed to blow them but had to make big holes” (McLennan 1922b: ). AM holds four eggs with particularly large holes collected by McLennan on this date (O.63934), which are labelled as coming from Port Stewart (14.05°S,

143.683°E), approximately 9 km from the actual collection location.

Further along, they found “Several old nests and 3 that the birds had started within the last few days” [40-42], and a nest from which a Black-throated Finch emerged [43] (McLennan 1922b: *Img\_0870.jpg*). They then passed through “a belt of heavily timbered country” (McLennan 1922c: 194), where McLennan shot a mature male [44] and his mate [45]. On skinning these birds the next day, he remarked that “this pair would not have started nesting for some time” (McLennan 1922b: *Img\_0873.jpg*). The remainder of the flat had only “old nests and places where birds had started nests” in magnetic antbeds [46], as well as one old nest that was occupied by a Black-throated Finch [47] (McLennan 1922b). Following “a big stretch of anthill flat” to the southeast to the Port Stewart Road, they found “numerous old nests and fairly recent traces of *Psephotus* noted” [48], but saw no birds (McLennan 1922c: 194). They struck the Port Stewart Road three miles from the camp and returned along it.

NMV holds the following specimens collected that day: two male parrots (HLW 4940 & HLW 4941) and two female parrots (HLW 4942 & HLW 528). HLW 4941 is immature, so was collected from the first location [39], which means HLW 4940 was collected from the second [44]. As we cannot determine which of the females [38, 45] was collected at each site, we allocate them a location midway between the two, and have adjusted the geolocational accuracy appropriately (14.017°S, 143.629°E ± 3,860 m). Each of these collections is labelled as coming from Port Stewart or the Port Stewart area (14.08°S, 143.68°E), about 9 km to the southeast of our estimates of their collection locations.

Heading for Coen the next day, McLennan and Tucker stopped at the Old Silver Plains homestead (Mojeeba; 14.081°S, 143.642°E), which at that time was on the Port Stewart Road about 5 km west of Port Stewart, and did not encounter GSPs until they reached Seven Mile Lagoon on the left of the track, where they saw eight parrots and only two old nests [49], but collected nothing.

On 6 May, they made 15 observations at eight locations. They revisited the site where they had seen the eight parrots, but only found old nests and a single male [51] near an abandoned nest

[50]. On a big flat “a couple of miles” further along the track on the right, they found several old nests and a pair of GSPs that had recently started a nest in a conical antbed [52] (McLennan 1922b: *Img\_0875.jpg*). “A mile further on another pair of *P. chrysops* seen. Old nests only noted” [53] (McLennan 1922b: *Img\_0875.jpg*). They reached nest 29, from which McLennan took six of the seven young parrots “for the purpose of rearing them and noting their plumage changes”, leaving the smallest [54] (McLennan 1922c: 197).

It was in this nest that McLennan first noticed the caterpillars of the Antbed Parrot Moth. He cut the nest open and spent considerable time observing the caterpillars. He was quick to appreciate their role in maintaining nest hygiene. “Remarkable nest of caterpillars in bottom of Parrots’ nest, which feed on excreta of young birds. Secure several also part of their nest” (McLennan 1922b: *Img\_0876.jpg*). After this, he examined nearly every nest that he opened to look for the caterpillars and their moths, and collected enough specimens for their taxonomic description. Alfred Jefferis “Gentle Annie” Turner<sup>viii</sup> originally assigned the moths to *Neossiosynoeca scatophaga* White, 1922 (White 1922a). However, as a result of White’s announcement of the intended taxonomic name before it could be formally published by Turner (1923); taxonomic priority rules required that the species’ authorship be attributed to White (Common 2000). The species was later reassigned to the genus *Trisyntopa* Lower, 1918, but the species’ name “*T. scatophaga*” remains ascribed to White (Common 2000).

Only a single specimen of Antbed Parrot Moth collected by McLennan is included in ALA (K.191092 in AM; Fig. 10), and is described as being collected at Coen. It emerged on 17 August 1922, about three months after collection, and was used by Turner (1923) as the holotype for the species. This specimen likely came from one of the cocoons McLennan collected from three nests within site GSP-027. McLennan also recorded collecting larvae at four nests, both as specimens and for cleaning up the excreta of his captive nestlings (McLennan 1922c: 201-202). As he concurrently recorded GSP nests at each moth collection location, the moth collections do not provide unique evidence of GSP occurrence.



**Figure 10. Holotype of *Trisyntopa scatophaga* (White, 1922), collected by William McLennan in May 1922. Photo: Australian Museum.**

After this diversion, McLennan and Tucker went on a mile, then set up camp. After lunch, they searched a long flat with numerous conical antbeds on the right of the track, where they flushed a female GSP from a nest with small young in a conical antbed [55]. “A couple of hundred yards away” they found another nest in a conical antbed with two fresh eggs [56] (McLennan 1922b: *Img\_0877.jpg*). A mile beyond the camp on the left of the track, McLennan (1922b) recorded a few old nests in conical antbeds [57]; a new nest in a magnetic antbed [58]; a nest in a magnetic antbed with “half fledged young” [59]; “An old nest from which young had flown some time ago” [62] (McLennan 1922b: *Img\_0877.jpg*); a last-season’s nest [63]; and a nest in a magnetic antbed [60], from which one fully-fledged young [61] and Antbed Parrot Moth pupae were collected. Back closer to the camp, they found a nest in a conical antbed with “small young just starting to get their feathers with colony of scavenger caterpillars in bottom of nest” [64] (McLennan 1922c: 198). On 21 May, nests 52, 56 and 58 had been abandoned [96, 94 & 91, respectively]; the chicks from nest 59 had flown [92]; and McLennan collected the two best-feathered [95] and all the chicks and some caterpillars [93] from nests 55 and 64, respectively (McLennan 1922c). We could find no GSP specimen dated 6 May 1922 in any museum collection. However, ten of the young collected by McLennan

and Tucker were sent to Taronga Zoo (Le Souëf & Kinghorn 1924), and some may have been sent further afield.

McLennan (1922b,c) recorded 11 GSP observations at seven locations on the last leg of their journey between Port Stewart and Coen on 7 May. These were three newly started nests in unknown mound types [65-67]; two nests in conical antbeds that were each being attended by a pair of GSPs [68, 69]; a finch flushed from a recent parrot nest [70]; a nest in a magnetic antbed with small young and caterpillars [71] with a female [72] and male nearby [73]; and a nest from which the young had recently fledged, and the caterpillars were beginning to cluster in the nest wall [75]. Throughout this stretch, McLennan noted numerous old nests, until they reached a place towards the base of the range where they only found old nests [74]. McLennan did not record making any collections from nests on 7 May. By 21 May, nests 65 to 67 and 69 were abandoned [88 to 90 and 87, respectively]; nest 68 had been adopted by Black-throated Finches [86]; and the young in nest 71 were just starting to get feathers [85].

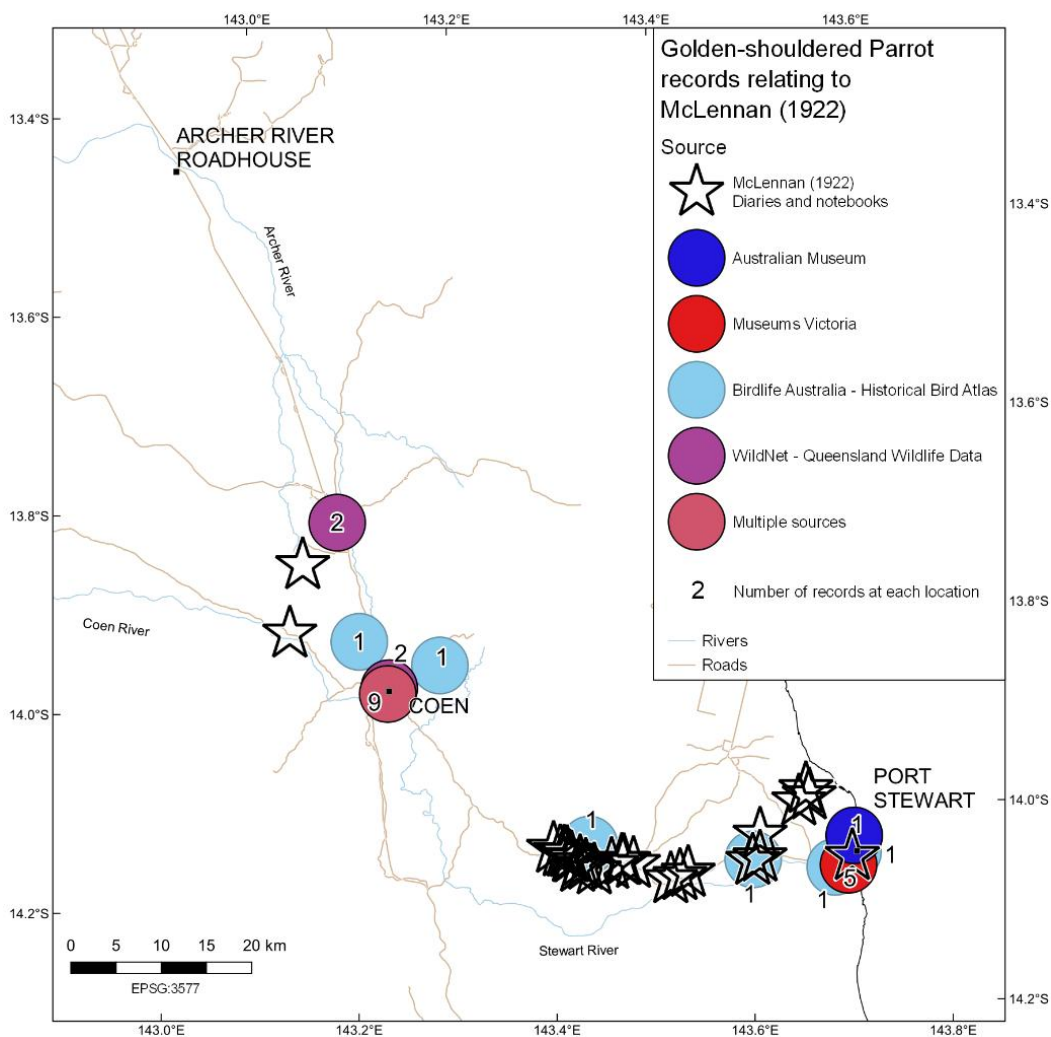
On 21 May, McLennan again left Coen for Port Stewart, revisiting some of the nests found earlier, from which he took eleven chicks from five nests (as noted above). The next day, he wrote: “One of the young Parrots got away. Took me about 2 hours to get him again” (McLennan 1922b: *Img\_0897.jpg*). According to Le Souëf and Kinghorn (1924: 1), “In June 1922, Taronga Park [Zoo] received through the courtesy of Mr. H. L. White ten young specimens of Golden-shouldered Parrot (*Psephotus chrysopterygius*) collected by Mr. W. McLennan at Coen, North Queensland”. These parrots, which may also have included those collected on 6 May, were grown to maturity, from which it was concluded that the species was “smaller, more slender ... and much more perky and active” than the Hooded Parrot (Le Souëf & Kinghorn 1924: 1).

Two of these chicks appear to have ended up in museums. A juvenile male parrot held in NMV (HLW 8546) is dated as being collected on 21 May 1922 at Coen (13.95°S, 143.2°E). As we cannot tell from which of the four collections [83, 84, 93, 95] the bird was taken, we have allocated it a position that is central to them, with a positional uncertainty to cover all points, as well as their own positional uncertainties (14.098°S, 143.422°E ± 3,500 m). We allocate a slightly different position

(14.102°S, 143.428°E ± 4,440 m) to a male parrot in AM (O.27895), where it is attributed to “McLennan, W. R. – Taronga Zoological Park”, to also encompass collections of live birds on 6 May [54 & 61]. This specimen has a collection date of 11 July 1924, which is presumably the date that it died and was added to the collection. Although it was presumably collected along the Port Stewart Road, its listed location is about 30 km to the northwest (west of Coen; 13.933°S, 143.183°E). These estimated locations should not be included in any modelling, as they are less accurate than the known collection locations from which they were derived.

BA includes a record from Port Stewart in May 1920 (SourcePK 119657). Although McLennan referred to several reports of GSPs extending back as far as March 1921, we could find no evidence of a record from 1920, so reject this record. In 1921 and 1922, McLennan recorded GSPs 85 times at

29 unique locations. ALA contained no 1921 records, and 22 records at 11 locations that corresponded to McLennan’s 1922 records: seven skins, four clutches, nine records from BA, and two from WildNet. A further WildNet-sourced record has been deleted from ALA since 2019. Locations of these ALA records span from southeast of Port Stewart to north of Coen (Fig. 11). Inconsistencies in the locations and dates of some ALA records made it hard to match many of the remaining ALA records to either of McLennan’s collecting areas. Each of McLennan’s 1922 records could have been replicated between seven and 14 times in ALA. Conversely, each ALA record could correspond to between one and 72 McLennan records. Only the ALA specimen records could be matched exactly to a single McLennan record, and even this was not possible where birds of the same sex and maturity were collected on the same day.



**Figure 11. Golden-shouldered Parrot locations reported by William McLennan, extracted from his own accounts (McLennan 1922a,b,c), and from secondary sources (as listed).**



Among the many specimens that McLennan collected in 1923, after his return to CYP to take up gold mining, were a clutch of six GSP eggs labelled as being collected on the Port Stewart Road on 4 May 1923 [97]; and a clutch of five GSP eggs collected on 18 May 1923 labelled as being collected at Coen, with a note that says the nest was being built on 4 May 1923 [98]. The second clutch, now in NMV, came from the Macgillivray Collection, and has been erroneously attributed in ALA to the photographer of one of the eggs. We conclude that both clutches were collected on the Port Stewart Road, as it would have been difficult for McLennan to visit both the Port Stewart Road and Lagoon Creek flat on the same day. Had both specimens been collected on 4 May, it would have been reasonable to conclude that the year had been inaccurately transcribed as 1923 instead of 1922. However, on 18 May 1922, McLennan was in Coen being treated for hookworms (McLennan 1922b), not nest-robbing, so the year 1923 stands for these specimens even though we found no corresponding diary entries. We calculated the location of both as being midway along the nests collected along the Port Stewart Road in the previous year, encompassing the relevant positional uncertainties.

Don Anderson collected one, or possibly two, GSP clutches 40 km from Coen on 30 July 1923 [99] (Ian Mason, personal communication 17 Jan. 2022). These are in a private collection. No other information is available on their collection location. However, a 40 km ride from Coen would find Anderson on the stretch of the Port Stewart Road along which McLennan collected most GSP clutches. We therefore allocated this record to the same location as McLennan's collections from the same year.

In 1928, Donald Thomson initially had difficulty finding GSPs on CYP. He undertook "a journey of about 1000 miles on the peninsula, [on which] we noted only one pair of these birds, and one old nest on the Edward River" (Thomson 1935: 44). This foray resulted in two GSP records in the Historical Bird Atlas, and possibly four ALA records, each with positional uncertainties too large (70 km) to meet our criteria.

In the following year, Thomson had better luck, leading him to conclude:

The Golden-shouldered Parrot is local but by no means rare in suitable country on Cape York Peninsula, at about 14th parallel of latitude ... Inhabits open forest country in variety of extensive flats where large antbeds are numerous. To the south and west of Port Stewart by no means uncommon (Thomson 1935: 44).

However, he did not collect any GSP specimens, or record any GSP locations, from the Coen to Port Stewart area (but see Violet Vale).

Irene Taylor, from the guesthouse in Coen, remembered seeing GSPs on Silver Plains as "she went through the area to catch the boat to boarding school" (Garnett & Crowley 1993: 2). As she was born in 1917, her school years would have spanned McLennan and Thomson's visits to Port Stewart. Unfortunately, lack of a specific date or location makes it impossible to include this record in our dataset.

The last reliable GSP sighting on Silver Plains was in the late 1950s [111], when the parrots were seen and photographed by A. C. (Sandy) Hunt, co-author of "The Parrots of Australia" (Eastman & Hunt 1966). In a letter to STG, he wrote:

I did find the Golden-shouldered Parrot on Cape [Silver] Plains when staying with the Wassell family in the late 1950s ... This day I was walking alone in the Bullock Paddock which ran from the homestead to the coast, one of only two fenced paddocks at the time on the property. My sighting was on a flat of typically poor soil with low trees consisting mainly of Melaleucas. The day before I had found a conical antbed nest with a hole about 2' 6" from the ground. This I considered had been tunnelled by the birds.

The following day I was privileged to find, in that exact area, a family party of Golden-shouldered Parrots ... This party consisted of 3 obviously immature birds (I was well prepared for recognition of this species and their young having bred Hooded Parrots in captivity for a number of years). The whole party was on the ground and from time to time the mature birds would feed the young who were following in the foraging party (A. C. Hunt, personal communication 21 Jan. 1994).

There are no fenced paddocks around the Old Silver Plains homestead. The new homestead,

further north (13.977°S, 143.550°E), appears to have been built before Hunt's visit, and there is an 8.4 square mile paddock to its east. We therefore record this sighting as being in the middle of this paddock, with a positional uncertainty sufficient to cover the whole paddock. Unfortunately, we have not been able to access Hunt's photographs, but – because of his familiarity with Hooded Parrots – we allocate a high identification confidence to his record.

#### More recent records

In 1965, a Coen resident was reportedly fined for taking "Golden-winged Parrots" (Storr & Johnstone 1970–2019).<sup>ix</sup> It is not clear if the parrots were trapped in the Coen area, but they were released at Violet Vale. As we have been unable to verify the collection location, this report is not recorded in our dataset. The last reliable GSP record in the Coen area was in the 1970s when a fledgling was found on the side of the telegraph line track, 20 miles north of Coen [126] (Sue Shephard, personal communication 24 Mar. 2022). As it was taken into the Coen pub and shown around, and was widely seen by people familiar with the species, we have high confidence in its identification. Based on the collection being from adjacent to a well-recognised waterhole, we also give the record a location with a moderate error margin. In 1974, an expedition to photograph Australian birds visited the Coen-Port Stewart area, as well as Jabiru outstation on Rokeby and the Hann River. Bruce (1979) reported three male and two female GSPs at an unlisted location. Unfortunately, we have been unable to find further details of this report, or whether the birds were seen north or south of Musgrave.

In 1998, Kaantju Indigenous Elder, Anne Creek (personal communication 1998), recalled GSPs occurring on her Traditional Land on the way up to Birthday Mountain, about 40 km north of Coen, but without a specific location. We include this record in the historical dataset with a nominal date of 1990. The occurrence of GSPs in the area was corroborated by a sighting by Eric Vanderduys (personal communication 9 Feb. 2022) made from a helicopter on 7 May 2019 on Oyala Thumotang NP (CYP Aboriginal Land) near Birthday Mountain. This area contains extensive Broad-leaved Tea Tree *Melaleuca viridiflora* open woodland (Department of Environment and Science 2021b), which is

potential GSP habitat. We therefore apply Vanderduys' location retrospectively to Anne Creek's record [201].

#### Edward River

As noted above, Thomson found an old GSP nest on the Edward River in 1928 (Thomson 1935). Exactly where on the river is unclear, for although most of his collecting was undertaken near the coast, he also crossed the river approximately 70 km upstream on Southwell on his way back to Coen. Woodland dominated by Broad-leaved Tea Tree lines the river for most of the intervening distance (Department of Environment and Science 2021a). Although its positional uncertainty means that we cannot include this record in our dataset, it is supported by two further GSP sightings made near the Edward River, close to Pormpuraaw, in the 1970s and 1980s. Both were close to mangroves and accurately located (Garnett & Bredl 1985). Robbie Bredl, manager of the Edward River Crocodile Farm, saw 20 birds in the 1974 wet season near the Chapman River mouth [133]. STG saw a single bird on 1 April 1981 in the Munkun River-Maliman Creek area [167]. The date of this last sighting suggests that the species was still nesting locally at that time. Both records are allocated a low level of confidence, for – at the time of observation – neither observer was familiar with the parrots.

#### Morehead district

We define the Morehead district as the upper reaches of the Morehead River and Saltwater Creek catchments, and – across the Great Dividing Range at one of its lowest points – the Alice River. Violet Vale is at its northern limit, and it includes Artemis, Mary Valley, Dixie and Killarney stations. While this area is currently known as GSP heartland, the species was not well known in the 1950s, even among birdwatchers. Donald Veivers noted a flock of magnificent predominantly green parrots with a dense black crown in the Morehead district, some miles above the Hann, which he attributed to the genus *Barnardius* Bonaparte, 1854 (Veivers 1951). We presume these were GSPs on Artemis station, which lies between the Hann River and Musgrave, but consider this reference too vague to include in our database.

#### Violet Vale

On 18 June 1929, Thomson sought GSPs at Violet Vale homestead. He recorded:

Arrived at Gostellow's on afternoon of 18<sup>th</sup> June. Gladys and I, with Tommy, walked over the nearer flats in search of nests of *P. chrysopterygius* this afternoon. Located several old nests, most of which had been opened and the young apparently taken, this season [100] (Thomson 1929: 5).

The Gostelow family, owners of the station, had numerous captive birds, which "swarmed over one's boots and all over one to be fed. They greedily took bread and milk from a spoon" (Thomson 1929: 4). Two days later, Thomson wrote:

Went out on horseback with Tommy in search of *P. chrysopterygius* nests. Presence of big young at the station and the old nests, did not make me very sanguine about the finding of them however. Discovered a number of nests, all old except one. They were placed at varying heights from the ground, not as I had thought, in spire type termitaria only, but in meridian ant hills as well and appeared to be chiefly in flats where there was little timber and where ant hills were very numerous and often very large. In these flats where suitable anthills were numerous, the birds were evidently quite numerous and we must have examined 20 or 30 nests old and deserted chiefly, during our few days here. Locally the birds are known as 'Antbed Parrots' and are quite well known, being easily got and easily reared. Located one nest in a meridian ant hill which had been opened and apparently deserted and containing 6 eggs [101] (Thomson 1929: 5).

He also referred to these nests in his article on the birds of CYP.

Examined between 20 and 30 nests, some of which in use that year. Frequently two broods are reared in one season. The first clutch of eggs is usually laid in May and the young hatched towards end of May or early in the following month, the second brood being reared in July or August (Thomson 1935: 44-45).<sup>x</sup>

Thomson recorded a further three nests [102-104]: two had eggs, and the other was not inspected. We later learned from Ann Colman (personal communication 1992) that these nests were on Dairy Flat. Curiously, in 1930, Thomson wrote that he discovered only one nest, from which the birds had already fledged. We do not include this

contrary observation in our dataset. Because of Thomson's familiarity with the species, we have high confidence in the identification of these records.

On 22 June, Thomson shot four parrots, and dissected them to find they had been feeding on grass seed and *Grevillea* flowers. These four specimens, one female bird [105] and three males [106-108] are in NMV. Although Thomson does not provide a specific location in his notes, it is likely that they were taken within 2 km of the house. In his notes, Thomson records their collection locality as "Violet Vale Station, near Musgrave" (Thomson 1929: 2). However, the specimens are labelled as being collected from "Port Stewart, c.60 miles south-south-west, Cape York Peninsula" with a georeference of 14.78°S, 143.5°E, which is the location of Musgrave Roadhouse, approximately 11 km WSW of Violet Vale homestead. ALA includes all four Thomson specimens (as well as a tissue sample from skin B15770) as separate, but associated, records – and two records from secondary sources (WildNet and BA).

In 1930, Thomson (1930) wrote to McLennan:

I don't know if I told you that we got some pictures of the breeding holes, nests and eggs of the Golden-shouldered – but not equal to your fine original gems. I also collected the larvae of that moth, but no adults have yet emerged from the silken cocoons.

We found no moth collections that could be attributed to Thomson.

In correspondence with Chisholm in 1957–8, the owners of Violet Vale (probably the Gostelow family) reported that GSPs were still at the station [115] (Olsen 2007). In May 1963, a clutch of eggs was reputedly collected by I. Curtis from the southern part of Violet Vale [119], and there are unverified birdwatcher records from east of the homestead in the Historical Bird Atlas the following month [120] and in eBird for 14 November 1990 [212]. The clutch is in the Len Harvey Collection in NMV. It is interesting to note that this collection also contains a Varied Lorikeet clutch collected by Curtis, which is visually indistinguishable from his GSP clutch, or from the two other GSP clutches in this collection.

Up until the mid-1970s, GSPs were still numerous around Violet Vale homestead (Sue Shephard, personal communication 1992). However, there

has been no sign of the parrots nesting there since at least 1977 (Weaver 1982; Mark Weaver, personal communication 1992).

#### Musgrave (Artemis and Mary Valley)

Bird-trapper Joseph S. Mattinson based himself at Musgrave homestead (now Musgrave Roadhouse) when he began collecting and studying GSPs in 1960 (Mattinson 1975). KOS contains a clutch of four GSP eggs procured by E. R. McKechnie one mile south of Musgrave Roadhouse in 1962 [118] (Anon. 2019). We allocate this record coordinates that are consistent with the distance being measured along the telegraph line, with an error term that takes in the nearest suitable habitat. We believe that Neill's 1966 report of GSPs at "Newgrave" (Olsen 2007) was actually from Musgrave, with the error possibly being attributed to difficulty reading Neill's handwriting. Allocating a position to this record would be difficult because of the size of this property (which, at the time, included both Artemis and Mary Valley), and would anyway be redundant given the many more-precise records from this area.

Mattinson claimed that GSPs had disappeared from Musgrave by 1975. He provided no locational data for nests or birds, but most birds he collected were from the north-eastern section of the current Artemis station (Tom and Sue Shephard, personal communication 1992).

In 1969, Len Robinson saw GSPs at the trough at Thirteen Mile Creek [124] (H. B. Gill manuscript cited in Storr & Johnstone 1970–2019), a location where they still occur today. Weaver (1970–1982) recorded 32 observations of GSPs made by himself and other birdwatchers at 21 locations on Artemis between 1973 and 1982 [130–132, 136, 138, 140–144, 148–150, 156–157, 159–161, 168–169, 175–178, 181, 187–193], including nine nests and 24 records of free-flying GSPs. The most northerly of these sightings was 9 km south of Musgrave Roadhouse, and the most northerly nest was 8 km further south.

During the First Australian Bird Atlas (1977–1981; BirdLife Australia undated), GSPs were recorded on Artemis three times [140, 152, 163]. On 11 July 1984, D. H. Seton collected GSP eggs on Artemis station [194]. These eggs are held in CSIRO's National Wildlife Collection (E12485). Birdwatching expeditions to record GSPs on Artemis occurred in the last three years of our study period, mostly

revisiting areas at which the birds had already been recorded. We have extracted four such records from WildNet [197–199, 211], and two from eBird via ALA [196, 200], but have not seen the original sources. We assume that a record in WildNet attributed to I. Ross, describing seeing the parrots in the Musgrave area in June 1990, was also on Artemis. We reject the allocated coordinates of this sighting (which correspond to Musgrave Roadhouse, with a positional uncertainty of only 3.6 m), as it was likely from much further south on Artemis.

Mary Valley is within the traditional lands of the Thaypan People, who call the parrots Arrmorral in their *Awu Alaya* language (Golden-shouldered Parrot Recovery Team 2022). GSPs were recorded once on Mary Valley during the First Australian Bird Atlas [182] (1977–1981; BirdLife Australia undated). Weaver (1970–1982) possibly saw GSPs at Mary Valley on 4 June 1979 [154]. Except for this record, to which we allocated a low level of identification confidence, all records on Artemis and Mary Valley seen by experienced GSP observers were allocated a high level of confidence. As these properties are within the current breeding range of the parrots, all records by other observers or egg collectors are allocated a medium level of confidence.

#### Olkola land (Dixie and Killarney)

Olkola land is the home of the creation story of the GSP, which is known as Alwal in the *Uw Olkola* language, indicating its significance and long presence in the area (Golden-shouldered Parrot Recovery Team 2022).

According to the Historical Bird Atlas (BirdLife Australia undated), Hans and Judy Beste recorded GSPs on Dixie (now on Olkola land) in July 1972 [128]. Weaver (1970–1982) also recorded 18 GSP observations on Dixie from between 1973 and 1982 [129, 137, 139, 151, 153, 155, 158, 170–174, 179–180, 183–186], including at least nine nests at six locations, and five records of free-flying birds; while WildNet records a report by D. I. Redhead of GSPs on Dixie on 7 July 1986 [195]. As with nearby Artemis and Mary Valley, we allocate all these records a high level of identification certainty if they were by experienced GSP observers, otherwise they receive a medium rating as they are within the known nesting distribution of the species.

After hearing reports of GSPs on Killarney in 1993, we were alerted to dry-season flocks regularly drinking at Maryanne Bore by Peter O'Shea, who co-owned the station at the time [202]. Their presence was apparently well known by the surrounding landholders, and we soon confirmed it first-hand. GSPs continue to be seen there to the present day, and nest nearby. As we have no date for the first observation at this location, we allocate the record to 1990, but with a high level of identification confidence and a low positional uncertainty.

#### *Laura district*

The Laura district includes the upper reaches of the Laura and Palmer rivers. Nine GSP records indicate that a breeding population of GSPs probably occurred in the Laura River district until the late 1970s. As the species' identification has not been verified for any of them, and the positions of some are a little vague, we allocate them all a low level of confidence.

- [1] On 17 May 1949, Glenn Milton Storr (1984: 76) saw GSPs at "the Normanby, near Battlecamp ... after crossing the river on the Laura Railway, a small party flushed from the ground beside rails in low open woodland savanna" [110]. We easily located this sighting as the route of the railway is shown on old topographic maps, and its easements are still reflected in the cadastre.
- [2] KOS contains three clutches, each of four GSP eggs labelled "J. & B. Young" (Anon. 2019), one collected at Laura [112] and two 40 km to the north [114, 116]. We assume that the latter were collected along the road north to New Laura, and not along the Peninsula Development Road to the northwest, but we treat all three with caution until they are verified using genetic testing. According to Ron Johnstone (personal communications 9 Feb. 2022, 25 Oct. 2022) this clutch was collected by Clary Young, father to John and Bruce Young. However, the date and location are problematic, as there is no other evidence that Clary visited CYP (his first collection from Queensland was in 1959), and John and Bruce were infants at the stated time of collection (Ian Mason, personal communication 28 Nov. 2022).
- [3] When Charles Robert Roff (1967: 274)<sup>xi</sup> was undertaking fauna surveys on CYP between 4 and 9 July 1964, he listed seeing one GSP at Byerstown [121]. There is also a clutch of four eggs that was reported as being collected by G. Cameron and P. Hodgers at Byerstown on 9 May 1976 [135] in KOS (Anon. 2019).
- [4] George Watkins, the publican at Laura, reported seeing GSPs at the Laura Railway Station, opposite the hotel on 14 July 1970 [127] (Weaver 1970–1982).
- [5] Watkins also reported seeing birds eight miles south of Laura (Weaver 1970–1982), which we locate midway between eight miles due south of Laura and eight miles along the road to Jowalbinna, with an appropriate level of positional uncertainty to cover both extremes [125]. We cannot be sure of the date, so merely list it as being in the 1970s.
- [6] On 27 August 1979, Mick Godwin (QNPWS ecologist) saw an adult GSP pair feeding on the flowers of *Grevillea pteridifolia*, 45 km along the Peninsula Development Road north of Laura [162] (Mick Godwin, personal communication to L. Little 26 Oct. 2022; Weaver 1970–1982).

Although none of these records can be verified, there are persistent reports of GSP sightings in the Palmerville area, south of Laura (Stephanie Todd, personal communication 28 Nov. 2022).

#### *Staaten and Mitchell river catchments*

Indigenous knowledge of the presence of GSPs in the upper reaches of the Staaten River catchment is indicated by the Wakaman name of Minpin for the species (Golden-shouldered Parrot Recovery Team 2022).

In 1990, 145 years after Leichhardt's party encountered "a new parrot" on the Lynd River [1], Lana Little and Danny Chew, rangers with QNPWS, discovered a significant breeding population of GSPs on Staaten River NP. In September, they drove through Bulimba to the far southeast corner of the Park, and set up camp near Waterfall Hole on Cockburn Creek. Little recalled the occasion with the aid of the notes that she made at the time (Lana Little, personal communication 7 Feb. 2022):

We carried backpacks, and did day walks away from that camp. On Wednesday, 19th September, we had walked downstream

(further into the Park) and in the late afternoon as we were returning, according to my diary notes I “saw two small turquoise parrots at water near camp... Distinctive parrot flight” [204]. On the following morning ... Danny reported seeing 3 parrots and gave an excellent description of GSPs [205]. On the back of these 2 sightings, we “pulled out air photos, located a nearby swamp and walked to it. Located four conical termite mounds with shallow holes, and one with a completed excavated tunnel and chamber” [206]. In the afternoon we “walked through swamps S of Cockburn and noted more tunnels in antbeds [207]. On return to camp, along N bank of Cockburn, two parrots flew overhead and landed in tree behind us, then took off and flew parallel to our track. Golden shoulders plainly visible” [208].

So that was when we were completely convinced.

We were due to head back to Chillagoe the next morning but before leaving, around 0630 – 0700, we were thrilled to watch a flock of 12-18 GSPs drink at the waterhole below the camp [209]. We recorded the group as being mostly females and immatures, and they were in the water up to their bellies, but with adult males ‘on watch’ higher up, where they incidentally looked spectacular in the early light. I also noted that we “saw another group of 3 birds on the way out (outside Park)” [210].

We place all these sightings at a single location within 3 km of Waterfall Hole on Cockburn Creek.

On 28 August 1978, Hans Beste recorded holes in one magnetic and two conical antbeds on Dunbar station [145-147] (Weaver 1970–1982). While other species are also known to nest in these antbeds, and the record is far away from any other contemporary GSP report, Beste was familiar with GSP nests from his visits to Artemis earlier that year. We therefore accept these records, but with a low level of confidence as no birds were seen. We rejected a GSP report from the Gilbert River on Dunbar on 21 December 1973 by a Mr Thurgood (Weaver 1970–1982), because of insufficient and inaccurate details (the Gilbert River does not flow across Dunbar, but ~80 km to the south).

#### *Kalpowar and Lakefield*

The Len Harvey Collection in NMV contains two clutches labelled as being GSP eggs collected from

Kalpowar. The first [109] is labelled as having been collected in 1948 by John Patrick Dwyer, who lived at Kalpowar for a short period around this time (Mason & Pfitzner 2021), but whose labelling of specimens may not be reliable (Patrick Webster, personal communication 2022). Before moving to Kalpowar, Dwyer had been the policeman at Laura, so it is also possible that the eggs were collected from further west. There is a second anonymously-collected clutch listed as coming from Kalpowar in 1955 [113], after Dwyer had moved on. The coordinates of both clutches indicate they were collected at the homestead, and there are two patches of Broad-leaved Tea Tree open woodland within 5 km (Department of Environment and Science 2021b). In support of the clutches coming from Kalpowar, a later manager, Jack Scott, reported to Weaver that he had also seen GSPs in the Bullock Paddock in 1977 [117]. We therefore accept these records with a low identification confidence rating, and give the location a 5 km margin of error.

In correspondence with Chisholm in 1966, A. J. Neill reported seeing Paradise Parrots at “Matrina Plains” [123] (Olsen 2007). Neill had originally considered the parrots might be Paradise Parrots, but on revisiting them, confirmed they had golden wings. We believe that the actual location was Marina Plains, and that a potential GSP sighting at Marina Plains in the north of current-day Rinyirru (Lakefield) NP (CYP Aboriginal Land) shown on maps of GSP distributions by Weaver (1979, 1982) relates to this record. However, as Weaver failed to confirm the sighting, he did not include it in his dataset. Nevertheless, given Neill’s description of the parrots and the presence of habitat similar to that found in the vicinity of Port Stewart, Neill’s record at Marina Plains is reasonable. Without more detail, we allocate it low levels of identification confidence and positional accuracy. We similarly include a single record from the lower reaches of the Hann River on Rinyirru (Lakefield) NP (CYP Aboriginal Land) about 5 km south of Marina Plains, listed in the Historical Bird Atlas [134] (BirdLife Australia undated).

#### *Incidental records*

We include the following incidental records that are outside the GSP’s current nesting distribution, all with low levels of confidence:

- [1] While living on Artemis station, we heard persistent rumours of GSPs at Koolburra, where there is ample suitable habitat. They were recorded there by a contributor to the First Atlas of Australian Birds in October 1980 [123] (BirdLife Australia undated).
- [2] The First Atlas of Australian Birds also included a report of GSPs on Batavia between the Wenlock River and Schramm Creek in October 1980 [165] (BirdLife Australia undated).
- [3] A clutch of GSP eggs was reportedly collected from near the Pascoe River in the Kaanju Ngaachi Indigenous Protected Area by G. Churchill on 19 February 1990 [203]. If so, then its most likely origin was the single patch of Broad-leaved Tea Tree open woodland (Department of Environment and Science 2021b) that is traversed by the road in this area. As with all clutches of eggs that lack a documented provenance trail and have not been genetically tested, this record is of low confidence.
- [4] A report by Michael Sharland to Keith Hindwood of Paradise Parrots at Temple Bay [122] (Olsen 2007), which has very similar habitat to that found at Port Stewart, may have been of GSPs.
- [5] An pair of adult GSPs was seen roosting in a dead tree about 10 km along old Karen Valley track northwest of Tozer's Gap by Peter Reeders on 14 December 1980 [166] (Weaver 1970–1982).

We reject the WildNet record from Shelburne Bay that appeared in “Garnett and Crowley (1992)”, as we have insufficient information on the source of this record, and because of the lack of suitable habitat in the area, which is predominantly heath (Department of Environment and Science 2021a).

#### *Other overseas specimens*

As well as McLennan’s Watson River bird, AMNH<sup>xii</sup> holds the captive GSP from Mathews’ collection (SKIN-623439), which we think he obtained from Phillips, as well as a bird in alcohol (FLUID-7189), dated 13 September 1929, that could be either a GSP or a Hooded Parrot, and for which neither origin nor collector is recorded, and which is not listed in Global Biodiversity Information Facility (2021). If it is a GSP, this bird may have been the

progeny of live birds collected by McLennan and transferred to Taronga Zoo, as none of the birds that arrived in London in 1897 had pure-bred GSP progeny.

The only other historical GSP specimen listed by GBIF as being in overseas collections is in MVZ, where it is labelled as being collected by Russell C. Ward in 1818, well before the first GSP was collected for scientific purposes. Ward was employed by the MVZ, University of California. He collected between 1928 and 1969, and there is no indication that he visited Australia (Online Archive of California 2021). Reference to the Museum of Vertebrate Zoology (2021) catalogue provides a date range for this specimen of 20 June 1818 to 16 March 2006, so the details of this bird are in fact too sketchy for it to be included in our definitive list, and in any case, the specimen is highly likely to be from a captive bird.

#### *Other Psephotellus records*

BA’s Historical Bird Atlas includes two records of Paradise Parrot made within the GSP’s known breeding range in 1918, which were more likely to be of GSP. However, both have such low positional accuracy (54 and 108 km, respectively), such that it is not possible to say anything other than that the species was found on CYP. Both relate to Chisholm’s efforts to establish the persistence of the Paradise Parrot (Chisholm 1922a, b; Julian 1989; Olsen 2007). The Historical Atlas also includes one Hooded Parrot record from Kwokkunum. Two Paradise Parrot collections reputed to have come from Far North Queensland are also excluded from the dataset. The first is a male bird housed in AM (O.28621). It is labelled as being collected in Cairns, Qld, in 1894, and while its identification is not in doubt, its collection location has been disputed (Olsen 2007). NMV holds two eggs labelled as being Paradise Parrots collected in Cooktown, Qld (BE 13182), which may also be GSPs or Varied Lorikeets, as none of these species’ eggs can be distinguished on size alone (Saunders 2009). In any case, the collection locality of Cooktown is highly unlikely. Each of these dubious records is currently listed in ALA.

#### *More recent records*

Since 1992, GSP nesting has also been recorded on Alice River (Imooya), Alwal NP (CYP Aboriginal Land) and other parts of Olkola lands (Garnett & Crowley 2002). As these are currently-active nesting areas – and so vulnerable to nest robbing –

and largely under Indigenous ownership, GSP occurrence records for these areas remain confidential. Free-flying birds have also been reported from Oriners (Eric Vanderduys, personal communication 9 Feb. 2022). We assume that the parrots also occurred in all these areas in the period covered by our study, although we could find no GSP records to support this contention.

#### *Final data set*

The final historical GSP dataset contains 212 records at 103 locations at which the parrots have been collected or observed (Table S1, Appendix 5). Twenty-two records at 10 locations were supported by verified skins or high-quality clutches, and seven related to capture of live birds. Including the records of experienced antbed parrot observers resulted in 156 high-quality records from 62 locations. Inclusion of medium quality records increased the dataset to 185 records from 83 locations. These records demonstrate the contraction of the species' distribution (Fig. 12), and indicate a 95% decline in the GSP's extent of occurrence from 171,000 km<sup>2</sup> in 1845 to 8,420 km<sup>2</sup> in 2020 (Golden-shouldered Parrot Recovery Team 2020).

We rejected 42% of BA records, 62% of WildNet records and 37% of ALA records, because they were from outside CYP; had a positional uncertainty greater than 15 km; or their listed details could not be supported (Fig. 13A). Between 36% and 49% of records in these databases could be matched with confidence to a single GSP record location in our dataset. The remaining records could possibly correspond to between two and 29 of our record locations. For example, the 29 locations at which McLennan and his helpers observed or collected GSPs in 1922 are encapsulated in a single WildNet record centred on Coen. Restricting the ALA dataset to those marked "spatially valid" only slightly increased the accuracy of record matches. This option removed a total of 59 ALA records, including 27 of the GSP records that we had rejected, and 18 records that we could confidently match to a single record event.

Conversely, we found 89 GSP records from 56 locations that were not recorded in ALA, including 81 records from 49 locations that were not recorded in the other two databases (Fig. 13B). Eleven per cent of our record locations can be confidently matched to a single ALA record, but the

remaining 47% of locations could correspond to between two and 17 ALA records. The majority of our records (67.3%) had a positional uncertainty of  $\leq 1$  km, and a further 30.8% of records  $\leq 5$  km. Records that were verified or were identified as GSPs with high confidence also tended to have better positional certainty than records with a medium or low level of identification confidence (Kruskal-Wallis  $H = 27.9$ , d.f. = 3,  $n = 117$ ,  $p = 0.0000$ ; Fig. 13C).

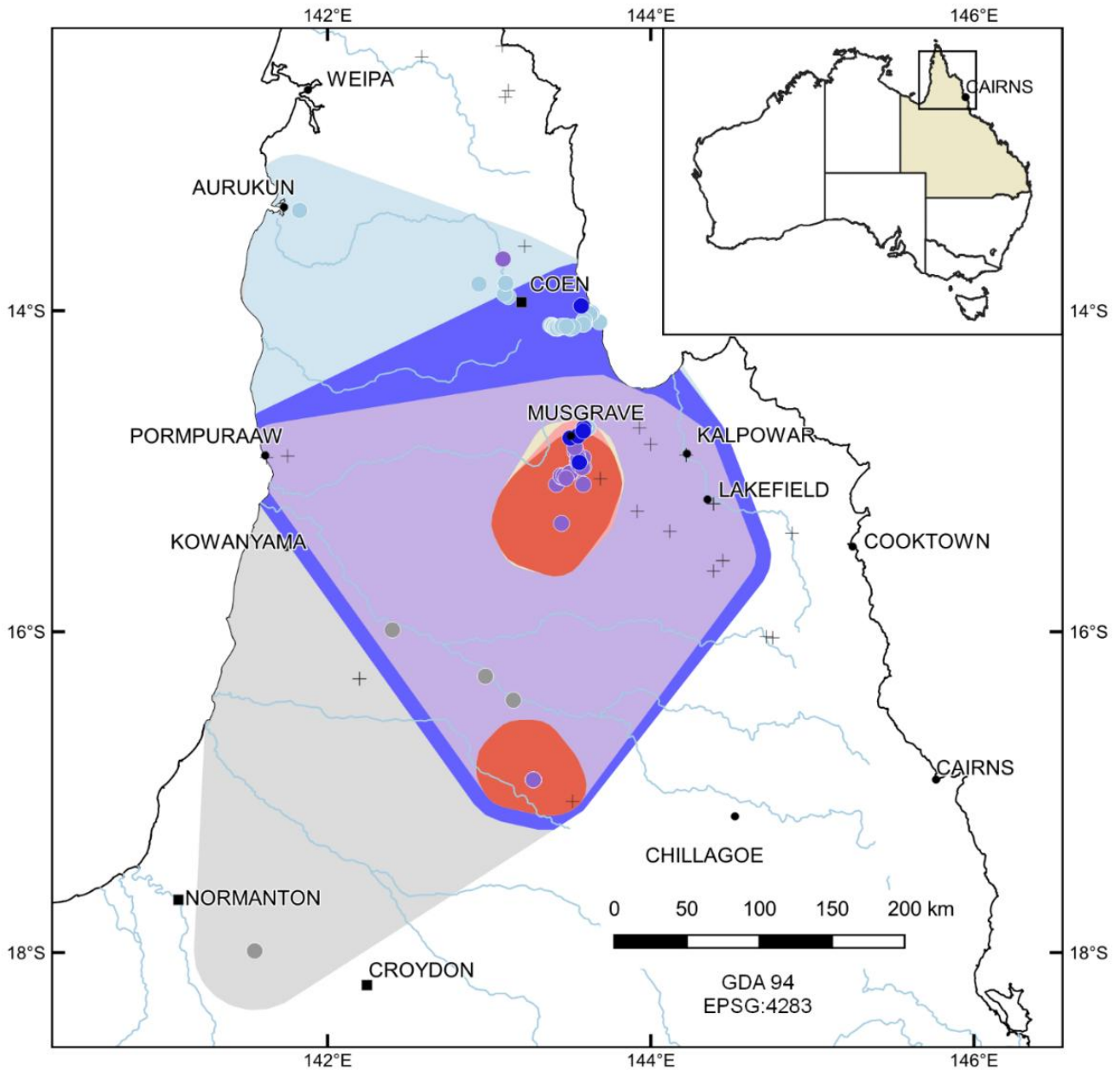
#### *Antbed preferences and nest outcomes*

Of the 35 current-year GSP nests that McLennan recorded in 1922 (Appendix 4), 46% were in conical antbeds (built by *Amitermes scopulus* (Mjöberg, 1920)), 23% in magnetic antbeds (*A. laurensis* (Mjöberg, 1920); Fig. 14), while the remainder were unrecorded. Of the 362 nests for which we recorded mound type in the Morehead district between 1992 and 1997, only 3% were in magnetic antbeds (STG and GMC unpublished data), indicating a significant difference in antbed use ( $\chi^2 = 140.1$ , d.f. = 1,  $n = 386$ ,  $p = 0.0000$ ).

Of the 33 nests for which activity was recorded, 16 were still active when McLennan last visited them (48.5%); four had successfully fledged (12.1%; including one nest in which one fully-feathered chick remained); and 13 had failed (39.4%), giving a maximum potential success rate of 60.6%. For the 107 nests for which we know the outcome from the 1990s, 57.9% produced at least one mature fledgling (STG and GMC unpublished data). McLennan collected live specimens from nine nests (25.7% of the nests that he visited, and 40.9% of the nests that were – or might have been – successful). He took 17 eggs from four nests, 17 live chicks from six nests, and both adults from three nests, thereby being responsible for the complete failure of four nests and the partial failure of a further five. Hence, he reduced the potential nest success from 57.1% to  $\leq 45.7\%$ .

McLennan observed Black-throated Finch occupation of four current-year nests (11.4%), and at least two older nests. One of the current-year nests contained an abandoned GSP clutch, another was abandoned either before or during the egg-laying stage, and the remaining two nests may have either fledged or been abandoned.





### Historical Golden-shouldered Parrot distribution

#### Observations & specimens

Medium & high confidence  
& verified records

- Before 1900
- 1900-1930
- 1930-1970
- 1970-1990

Low confidence records

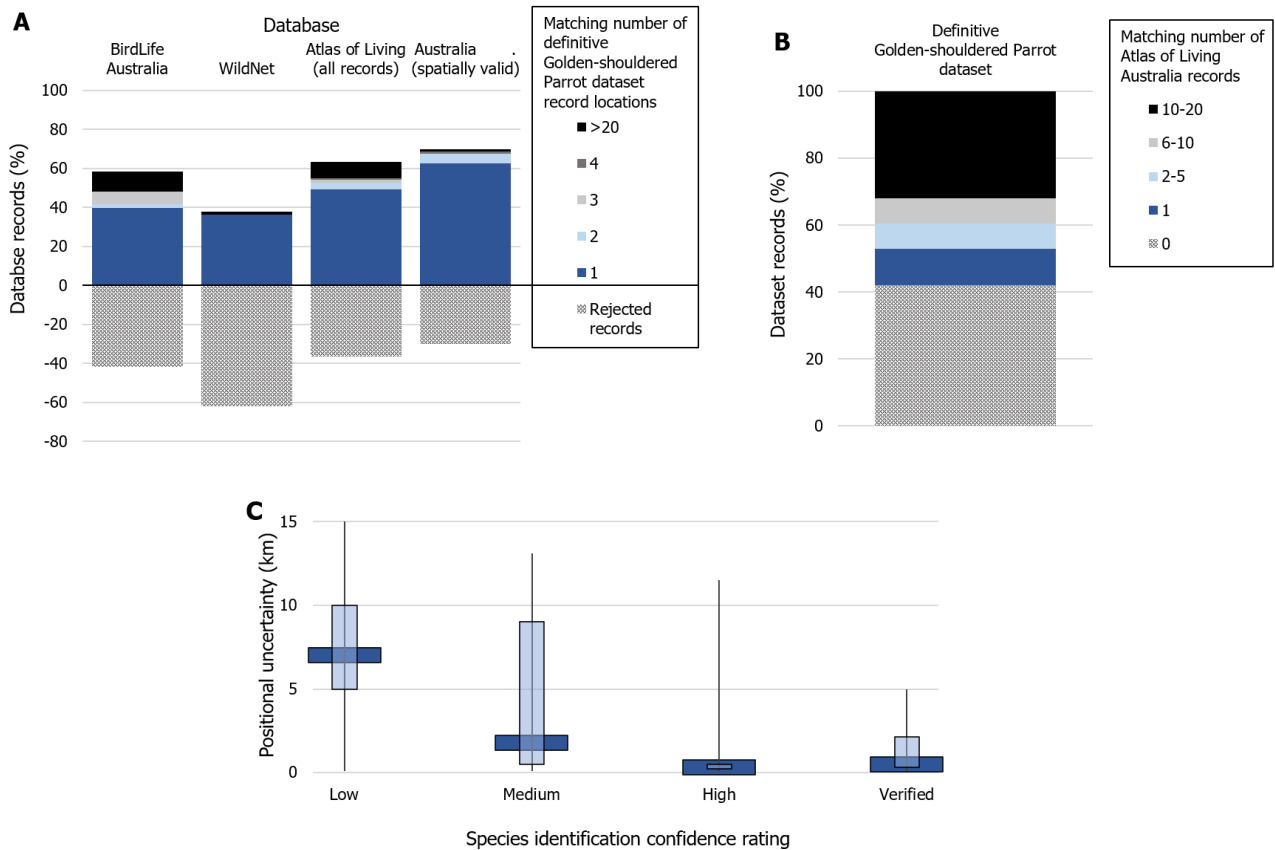
- + All periods

#### Estimated distribution

- Before 1900
- 1900-1930
- 1930-1970
- 1970-1990
- 1990s
- 2000s
- 2010s

— Major rivers

Figure 12. Historical Golden-shouldered Parrot distribution based on records compiled in this article.



**Figure 13. Veracity of Golden-shouldered Parrot records: A. correspondence of BirdLife Australia, WildNet and Atlas of Living Australia records to record locations in the definitive dataset produced for the current study; B. correspondence between records in the definitive dataset and those in Atlas of Living Australia; and C. box plots showing relationship between reliability of species' identification and positional uncertainty in the definitive dataset.**

### Pastoral expansion

The first cattle properties were established on CYP in 1874, following the discovery of gold on the Palmer River in 1872 (Denaro & Ewers 1995). These were Wrotham Park “a nice open piece of country, consisting of black soil flats and ridges” (Lack 1962: 964–965) between the Walsh and Mitchell rivers, and Boralga on the Laura River (Appendix 6). Over the next six years, pastoral development was concentrated around these two properties and on the rich volcanic soils of Butchers Hill (now Lakeland). By 1900, pastoralism had spread across most of the alluvial plains (Fig. 15). Most of the ranges and foothills were not developed until after the start of the 20<sup>th</sup> century. The 1970s brought renewed intensification of pastoral operations on the peninsula (Walker 1995). By the 1990s, reliable GSP records were confined to the hills and drainage flats close to the Great Dividing Range, in areas that had not been developed for grazing.

### Discussion

#### Identification

From the very start of European interest in the GSP, there was confusion over the species' identification, most of it perfectly explicable. All three antbed-nesting parrots were confused with each other to some extent. Gould's assumption that the GSPs collected by Elsey were the same species as Bauer's Hooded Parrots was based on a painting produced half-a-century earlier, and shown to him only occasionally. He is therefore more likely to have remembered the similarities than the differences. Paintings, early descriptions and museum specimens showed marked plumage variation in the male GSP – especially in the extent of yellow on the forehead. This encouraged Mathews (1916–1917: 428) to conclude that the Hooded Parrot was only an extreme expression of this variation, “or else Elsey's specimens were aberrations”. Hence, there was periodic lumping of



**Figure 14. A magnetic antbed containing a Golden-shouldered Parrot nest in 1922.**

Photo: W. R. McLennan (White 1922b).

the two species until 1994, even though it was clear that there were two separate species once it was realised that their distributions did not overlap (Barnard 1914). Genetics has now cemented the two species as distinct, and more distantly related to each other than the GSP is from the Paradise Parrot (Provost *et al.* 2018).

In the field, GSPs are difficult to differentiate from the two other antbed parrots. Immature birds would be particularly difficult to tell apart: young GSPs sent to London in 1897 were initially thought to be Paradise Parrots (Phillips 1898). Gilbert did not take a specimen, and without the benefit of binoculars, which were not invented until the 1890s (Greivenkamp & Steed 2011), his assumption that the birds were Paradise Parrots is understandable, although Leichhardt reportedly travelled with a collapsing telescope (Julian 2013). Even though McLennan used binoculars to identify unfamiliar birds (Macgillivray 1918: 185), he was unable to identify the GSP at Watson River until he shot the

male. He subsequently mistook GSPs at Lagoon Creek flat for Paradise Parrots until he had the dead birds in his hand. It therefore seems perfectly reasonable to conclude that Gilbert made the same mistake – especially given the proximity of his sightings to existing GSP breeding areas.

Confusion about the antbed parrots extended to their nesting habits. Both Paradise Parrots and GSPs were reported as nesting in antbeds in the NT (Le Souëf 1903: 153; Mathews 1916–1917: 428–429), and Le Souëf (1902: 94) reported GSPs nesting in a tree hollow in the NT. The two other *Psephotus* species recognised at that time (*P. haematonotus* and *P. varius*) were known to nest in tree hollows (Mathews 1916–1917). When White (1922a,b) published McLennan's description of GSPs nesting in antbeds, he presented it as new knowledge. Therefore, early reports of Paradise Parrots on CYP were probably based on the assumption that these were the only parrots that nested in antbeds.

Seventeen of the 37 specimens we used to identify our GSP locations were clutches of eggs. However, eggs are not always correctly identified (Webster *et al.* 2022), particularly when they are nondescript and devoid of markings (Grealy *et al.* 2021). The kudos of acquiring a clutch from a rare bird or completing a collection (Mason & Pfitzner 2021) might prove an incentive to substitute the eggs of a common species for those of a rare one. Similarity between GSP and Varied Lorikeet eggs may explain the reporting of GSPs nesting in a tree hollow in the NT. Other clutches of eggs may have been similarly mislabelled. Curtis' Varied Lorikeet clutch is visually indistinguishable from his putative GSP clutch, or from the other GSP clutches in the Len Harvey collection. Genetic analysis would be warranted for identification of all clutches labelled as GSPs, especially of those collected outside the known breeding range of the species.

Persistent rumours of a red-shouldered anthill parrot on CYP, particularly in the eastern ranges between Coen and Iron Range, have never been substantiated (Olsen 2007). Follow-up surveys near the recent sighting on Oyala Thumotang NP (Vanderduys, personal communications 9 Feb. 2022) and the potential nesting area south of the Pascoe River (along with genetic analysis) may help to resolve the issue at last.

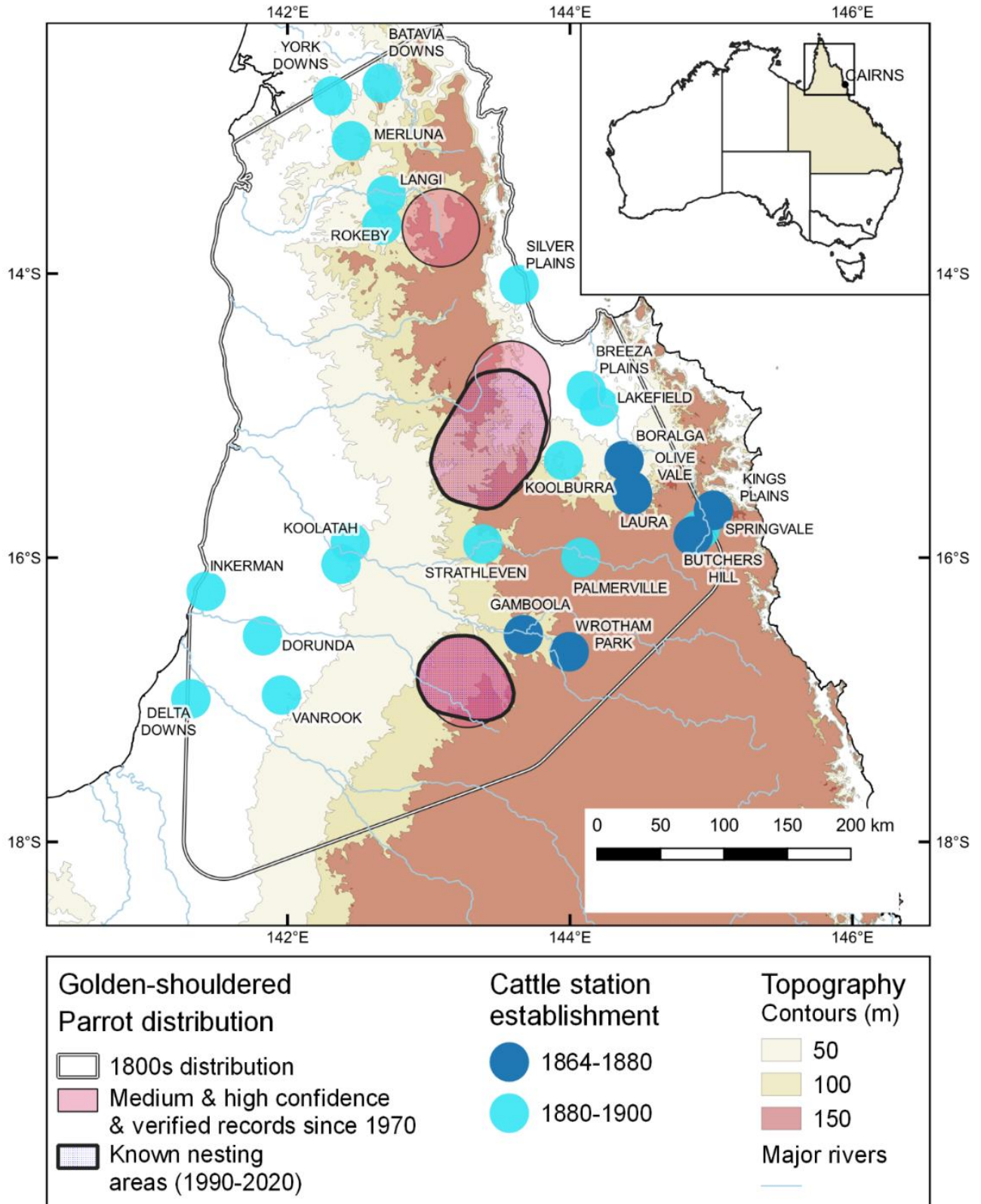


Figure 15. Contraction of the Golden-shouldered Parrot distribution in relation to topography and expansion of the cattle industry on Cape York Peninsula.

*Unacknowledged collectors*

During his Coen trip, McLennan generally employed someone to manage the horses and accompany him on his travels. The role often extended to helping find and collect birds. McLennan had been expecting to engage a Mr W. Fox in this role. However, Fox had gone collecting sandalwood. Instead, McLennan sought permission from Coen police to employ an Indigenous man. Bob Ross had this position at 5 shillings a day from 12–28 October 1921 (McLennan 1922c). Tommy Tucker was engaged between 31 December 1921 and 6 April 1922, and between 28 April 1922 and 22 May 1922. A man named Peter temporarily replaced him when Tucker was required for police duties. However, it was Willie Massey, a Chinese-Aboriginal station-hand (Anon. 1926–1962), who showed McLennan his first GSP nest (Appendix 3). Other people who assisted McLennan find GSPs and their nests included several boys from the Coen school, their teacher Don Anderson, Mick Bassani, young Jack Bassani (also paid 5 shillings a day), Cecil Wilson, Fred Keppel and an unnamed station-hand; though none was as productive as Tucker.

None of McLennan's collaborators was given the credit of being listed as a collector. The closest acknowledgement was contained in White's account of "McLennan's" discovery.

Mr. McLennan first received a definite report upon the existence of *P. chrysopterygius* in the Coen district, when a friend stated he had seen it in the vicinity of Port Stewart, and had noted old nests in anthills. Nothing further was done in the matter until 22<sup>nd</sup> April, 1922, when a station hand reported having found a bird supposed to be the Golden-shouldered Parrot breeding some 14 miles north of Coen. Mr. McLennan proceeded to the spot, which is a large flat, thickly dotted with magnetic and spire-shaped termitariums. The nesting site was soon located by the half-caste guide (White 1922a: 98).

While Gilbert had also engaged the services of local Indigenous guides on his initial collecting trips, it appears this was not the case on the Leichhardt expedition (Olsen & Russell 2019). Later, Thomson travelled with another Indigenous man known as Tommy Thompson because of his close association with Donald Thomson (Verstraete & Rigsby 2015).

Thompson's Language names were Tyamintinyu and Tapumpangu. He helped Thomson find and collect GSPs at Violet Vale, and – while his services were highly valued – he was also not credited with the collection of specimens that he helped to find.

This general lack of acknowledgement of the contribution of First Nations People to science reflects the hierarchy that existed in the sciences and society at the time (Olsen & Russell 2019). Not even McLennan was included as a co-author on any of the publications that arose from his work. His humility at not seeking recognition was lauded (D'Ombrain 1936), while others were only too happy to be immortalised in print on the basis of his efforts. Papers by White (1922a, b) were entirely regurgitations of McLennan's and his assistant's observations.

We know little of the contribution of Indigenous people to scientific discovery, or of the people that made this contribution (Olsen & Russell 2019). We believe that it is important that the contributions of these First Nations collaborators are properly recognised, but this is hard when most of them cannot be properly identified. Most of what we do know comes from records of employment or incarceration. There are records of a Tommy Tucker being removed from Coen to Palm Island in 1928 (Protector of Aborigines 1915–1942), and dying at Coen on 22 October 1931 (Chief Protector of Aborigines 1910–1928). The whereabouts of Willie Massey, formerly of Merluna and Rokeby, was unknown in January 1930 (Anon. 1926–1962), and he possibly died on Palm Island in 1944 (Anon. 1941–1975). At least two different men called Bob Ross were recorded in the Cooktown Aboriginal Employment Register (Protector of Aborigines 1925–1939), and we do not know which – if any – of them assisted McLennan, or anything else about them. We do at least know a little about Tyamintinyu (Chase & Rigsby 1994; Verstraete & Rigsby 2015). His heritage was Umpila through his father, and Yintyingka through his mother. He was born in about 1890, grew up on his mother's country at Port Stewart, worked as a cattleman at Nebo and Silver Plains, and died on his father's country at Lockhart River in about 1960. Thomson lauded Tyamintinyu for cultural knowledge, and Thomson's photograph of him can be seen in Verstraete and Rigsby (2015).

*Data reliability*

This study highlights the need to closely vet all biological records, particularly for species' identity and locational information, especially before using them in modelling. We found numerous cases where geographic position did not coincide with actual collection locations, but rather was allocated to the nearest town (Coen or Port Stewart) or homestead (Kalpowar). We also found errors of identification, with some Hooded Parrot specimens still being curated as GSPs 123 years after the two species were initially separated. Nor could the identity of many GSP clutches be assured. So strong is the desire to display clutches of rare birds that some could be from aviary-bred birds or Varied Lorikeets. Others appear to have been collected a different time and place – or even by a different collector – than is indicated on the label. A couple of specimen records were also attributed to the wrong collector on their transfer into ALA; and there were a few transcription errors. We also found many duplicate records in both WildNet and BA, multiplying further as they were entered into ALA, often with differing collection locations. Our dataset consolidates such records back into a single occurrence. It should not be used to add further duplicate records to ALA, but to amend existing records judiciously.

Our reasons for producing this list were to provide a basis for identifying the GSP's former distribution, and for modelling habitat and climate change responses. Different purposes might require different approaches from those we have used. For example, the Historical Bird Atlas aimed to map the presence of species within ten-minute and one-degree grids, rather than produce a definitive list of species' locations. This intent was lost on the transfer of records to ALA, resulting in record duplication and positional inaccuracies. Generalised location names found on many specimens – as was often the case before GPS units became available – may also be adequate for specimen curation, provided any transcription of locational information to spatial databases includes an appropriate measure of positional uncertainty. This was often not the case. Multiple records at a single location can also be useful for assessing species' abundance, as long as they do not simply repeat the same records through secondary sources. Replication of Elsey's single collection locality to

ten separate locations, up to 63 km from the source, should be instructive.

Positional uncertainty is particularly important when using species records for distribution mapping or modelling (Naimi *et al.* 2014). We found that positional errors of 20–63 km were not uncommon, and often did not correspond to the positional uncertainty value provided. This measure was frequently missing, especially from museum specimens. Hence, positional uncertainty cannot be reliably used for selecting the most accurate records from ALA. Those using “big data” to map or model species' distributions should be alert to such levels of inaccuracy, and should scrutinize each record individually before accepting it. Another alternative would be to restrict the resolution of models to account for the largest inaccuracies found. For unvetted GSP records in ALA, this would be a resolution of at least 120 km, or no more than 20 cells covering the whole of the species' historical distribution. Exclusion of records tagged in ALA as “spatially suspect” did not improve the situation.

Although we included 212 records in our definitive dataset, only 14 records at six locations were verified by skins, with seven verified by reference to the capture of live birds. Of the 17 clutches of eggs, only the six collected by McLennan can be considered highly reliable. Adding the records of experienced observers, produced 156 high quality records at 62 locations. Modelling based on these records alone is most defensible, but likely to give an incomplete representation of the GSP's distribution. Inclusion of medium quality records extends this set to 185 records at 83 locations, increasing the geographic spread (Fig. S1). However, only low-quality records are available for north-east CYP and south-east of Princess Charlotte Bay.

*Distribution and habitat use*

The records in our dataset confirm that GSPs occurred widely across CYP in the mid-19<sup>th</sup> century. The broad distribution of accurately geolocated-specimen collection sites makes many of the less well verified records appear plausible. While the species' current range is largely restricted to narrow drainage lines adjacent to foot-slopes of the Great Dividing Range and within 20 km of the rocky levees of the upper reaches of Staaten River and its associated tributaries, high-quality records show that the former distribution also included

alluvial and coastal plains. For example, from his observations in the late 1920s, Thomson (1935: 17) concluded of the GSP that “where there were stretches of open savannah, extensive grass flats, and numerous termitaria, it was numerous”; and when E. E. Gostelow painted the species in 1936, he depicted it alongside coastal mangroves, describing its distribution as “Normanton to Watson River” (Fig. 16).

Gilbert’s observation of abundant GSPs is hard to reconcile with the rare and secretive parrot we know today. However, we gained some appreciation of this phenomenon on our first visit to Staaten River NP, where in November 1993, we saw over 100 birds in a single tree. Such would have been the case across the Mitchell River floodplain when the birds from a far larger population dispersed through the non-breeding season.



**Figure 16. Ebenezer Edward Gostelow’s 1936 illustration of Golden-shouldered Parrots on the edge of mangroves.**

Source: National Library of Australia.

We estimate that McLennan recorded at least 24 current-year nests along an 18 km stretch of Port Stewart Road, and a further seven between Old Silver Plains and the coast. If such densities were repeated through the most favourable parts of the species’ range, the population could have been very large indeed. Non-breeding birds are known to disperse, with some birds being noted as flying at least 20 km in a single day (Garnett & Crowley 1995), so before their range had contracted, non-breeding birds could be expected to turn up almost anywhere on CYP. This may explain why Elsey saw the parrots as far south as Croydon in September 1856, outside the breeding season.

However, it was in the breeding season that multitudes of “new *Platyercus*” were recorded along the Mitchell River in June 1845. When breeding, GSPs stay within a few kilometres of their nests (Crowley *et al.* 2004); so were likely to have had nests nearby. This indicates that the parrots not only dispersed across the alluvial plains of CYP, but that they also bred on them. Similarly, it was in the breeding season that GSPs were found on subcoastal floodplains near the mouth of the Watson River (Apr. 1915) and near Pormpuraaw (Apr. 1981); the Watson River bird being in breeding condition. In May 1922, GSPs were found breeding behind the mangroves north of Port Stewart, and had recently been seen nesting in similar habitat further south. These records show that the GSP not only had a wider breeding distribution than it does today, but also bred in a wider range of habitats.

#### *Decline*

Kemp (in 1912–1914), McLennan and Tucker (in 1922), and Thomson and Tyamintyinyu (in 1928–1929) witnessed early signs of the GSP’s demise. Kemp failed to find GSPs inland from Normanton, despite actively collecting birds, mammals and invertebrates in the area over a two-year period from 1912 (Mathews 1916–1917). Although locals described places where the parrots nested around the Old Silver Plains homestead, the closest nests McLennan and Tucker found in 1922 were about 6.5 km to its west and 9 km to its north (McLennan 1922c). Instead, McLennan noted only old nests near the homestead, and found no sign of the birds along the coastal strip between the Stewart River and Balclutha Creek, despite local knowledge that they had been there. Even along the section of the

road where McLennan and Tucker found 35 fresh nests, 15 were abandoned or failed before the chicks could be collected. In their 1,000-mile journey traversing CYP in 1928, Thomson and Tyamintyinyu found only one pair of parrots and one old nest. Most of the 20 or 30 nests they examined on Violet Vale in 1929 were old and abandoned, even though the GSPs themselves – fed by the Gostelows – were numerous (Thomson 1929).

GSPs could not be found in the southwest of the parrot's distribution, where Elsey had collected the type specimen, 20 years after the first cattle stations were established in the area (Mathews 1916–1917; Appendix 6). On the eastern peninsula, they began declining forty years after Silver Plains was established, and had disappeared from Violet Vale 70 years after it became a cattle station. GSP nesting has now almost been eliminated from Artemis station, which – while taken up as part of Musgrave in 1907 – was not developed until the 1970s (Susan and Tom Shephard, personal communication 1992). The decline of nesting extends west from the homestead across Artemis and the northern part of Dixie station, both areas that were actively developed in the late 1990s and early 2000s. Since 1990, rumours of GSPs occurring beyond the Staaten and upper Morehead river catchments have largely remained unsubstantiated, although recent single bird sightings on Oriners and Oyala Thumotang (Eric Vanderduys, personal communication 9 Feb. 2022) and south of Laura (Stephanie Todd, personal communication 23 Nov. 2022) are encouraging.

It appears that the parrot's decline has been greatest in areas that support magnetic antbeds, and that this decline started soon after the arrival of cattle. When Thomson (1929: 5) visited Violet Vale in 1929, he was surprised to see nesting in magnetic antbeds, despite this being common at Port Stewart seven years earlier. He also commented on the open structure of the flats and the large size of the antbeds. The severe decline in the importance of magnetic antbeds suggests a deterioration of the magnetic antbeds to a point where they were no longer broad enough to support nesting. A preferential decline in nesting in magnetic antbeds may also be due to a change in the vegetation structure in the middle of flats and across the broad alluvial plains where these mounds predominate. There is evidence for both

drivers, with vegetation thickening being well documented from at least the 1960s (Crowley & Garnett 1998), and observations in the 1970s that few antbeds were large enough for the parrots to tunnel without emerging out the other side:

Golden-shouldered birds do not normally nest in magnetic termite mounds, usually because these mounds are not wide enough, and moreover have many small side branches coming off the main mound which is flat and aligned in a N-S direction. I have followed Golden-shouldered tunnels for up to two feet in magnetic mounds always to find them abandoned because they have struck light, and not found an area large enough to excavate a chamber (Mattinson 1975: 3).

Hence, the parrot's disappearance started close to the homesteads of cattle stations (where grazing pressure would have been most intense) and continued across alluvial plains (which are most easily compacted by cattle, and include most areas of the best quality soils). Nesting areas contracted to the flat edges and seepage area in hills, where conical antbeds predominate. This is consistent with the pattern of decline of other northern Australian granivores (Franklin 1999). Franklin *et al.* (2005) found that the greatest decline of seed-eating birds in northern Australia was in areas that had been subject to the most intense grazing for the longest time. Feral pigs may have also contributed to this decline. Although James Cook apparently did not release pigs at Cooktown in 1770 (Pullar 1953), they had become established on CYP by the mid-1800s (Balkanu 2011). Thomson described pigs as being “very much in evidence and spoiling good waterholes” in the country between Port Stewart and Violet Vale (Thomson 1929). CYP is now reputed to have the largest feral pig population in Australia (CSIRO 2018). The arrival and spread of pigs would have highly modified the alluvial plains, causing their erosion (Sloane *et al.* 2021), intensifying wet season seed shortages, and adversely affecting the abundance and health of antbeds used by nesting GSPs (Crowley *et al.* 2004).

GSPs have not been the only species to decline following the introduction of cattle. In his letters to Oldfield Thomas, Kemp reported (1913–1914) a dearth of small mammals on CYP and in the Queensland Gulf region. In his final letter to Thomas, he reported conversations with the local



inhabitants, who informed him that many of the species that had been abundant less than 25 years earlier had completely disappeared. He was convinced that this loss was due to changes in rainfall and water supply, dismissing the impact of cats (which were by then widespread) and not even considering the impact of either cattle or pigs (Kemp 1913-1914). The decline of the Paradise Parrot has also been attributed to grazing: “The parrot’s days were numbered by the time it was discovered. Its country, the richest grasslands in Australia, was seized and overused within a few decades” (Olsen 2007: vii).

Across northern Australia, seed-eating birds have persisted best in rocky areas (Franklin *et al.* 2005). This is also the case with GSPs, which now rely on rocky areas for finding food in the early wet season, and nest along nearby drainage lines (Crowley *et al.* 2004). Several threatening processes are less severe on rocky hills than they are across alluvial plains. This includes intense grazing pressure (Landsberg *et al.* 2003); erosion by pigs (Sloane *et al.* 2021); predation by cats (Radford *et al.* 2021); and vegetation thickening as a result of change in fire regimes (Crowley *et al.* 2009). The effects of these pressures in the parrot’s habitat have been reduced food availability in the early wet season, increased woody plant density, increased predation pressure and elimination of antbeds suitable for nesting (Crowley & Garnett 2001; Garnett & Crowley 2002; Crowley *et al.* 2004, 2009). These changes were brought about by the displacement of the First Nations Peoples from CYP by pastoralism, with the resultant loss of their environmental management strategies (Golden-shouldered Parrot Recovery Team 2022). Management is currently underway to restore GSP habitat, including through returning the land to its Traditional Owners, destocking, feral animal control and improved fire management to control woody invasion of open habitat (Department of National Parks, Recreation, Sport and Racing 2013; Bush Heritage Australia 2021; Murphy *et al.* 2021; Golden-shouldered Parrot Recovery Team 2022). The persistence of the species will depend on excluding cattle grazing from most areas where the species remains, and carefully managing grazing pressure where this cannot be achieved. It will also require ongoing management of pigs, cats and fire regime.

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### Supplementary files

All data used in this article are available in Appendix 5.

Two supplementary files accompany this paper on its web-page, a pdf and an Excel file. The pdf file contains Appendices 1–4 & 6, whilst the Excel file contains Appendix 5:

- Appendix 1. Timeline of taxonomic classification of Paradise, Golden-shouldered and Hooded Parrots;
- Appendix 2. Gilbert's and Leichhardt's observations of *Platycercus* spp.;
- Appendix 3. Excerpts from McLennan's writings relating to Golden-shouldered Parrots, September 1921 to May 1922;
- Appendix 4. Nest outcomes and specimen collections recorded by McLennan in 1922;
- Appendix 5. Definitive list of Golden-shouldered Parrots records (1845-1990); and
- Appendix 6. Date of establishment of the earliest cattle stations on Cape York Peninsula.

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## Endnotes

- i Naturhistorisk Museum, University of Oslo, Norway, retained two of the female Golden-shouldered Parrot syntypes (Naturhistorisk Museum 2022). Mathews obtained the male and the other female, which are now housed in AMNH (American Museum of Natural History 2021).
- ii Apparently discovered by William McLennan in 1909, *McLennan's Lode Mineral Occurrence* (13.146°S, 143.002°E) was on the Batavia Goldfield just south of the Wenlock River (Denaro & Ewers 1995).
- iii In his catalogue, White considered this egg to be part of the clutch of Hooded Parrots that was collected by J.H. Niemann at the Daly River, Northern Territory, on 16<sup>th</sup> Nov. 1901, purchased from the D. Le Souëf's collection (HLW 358A/NMV BE 1416) (Museums Victoria, personal communication, 3 Mar. 2023). However, the date of collection (16<sup>th</sup> Dec. 1901 vs 16<sup>th</sup> Nov. 1901), number of eggs (1 vs 2), and the size of the eggs (0.86 x 0.72 in vs 0.79 x 0.67 in and 0.79 x 0.70 in) argue against this being the case.
- iv A "flat" is a grassy area of impeded drainage along which termite mounds built by *Amitermes scopulus* (conical antbeds) and *A. laurensis* (magnetic antbeds) frequently occur, and may be used by GSP for nesting.
- v By 1919, Barnard and McLennan had only visited coastal areas of CYP, and not the Coen district or Archer River neighbourhood (Ian Mason, personal communication 24 Jan. 2022; Mason & Pfitzner 2021).
- vi Although Mathews (1916-1917) described GSPs nesting in termite mounds in the NT, the literature contained no records of them doing so in Qld until Chisholm (1922b: 7; published 1 July 1922) wrote that GSPs "also nest in termites' mounds". This knowledge was clearly based on McLennan's observations made on 23 Apr. 1922 (McLennan 1922c), which White (1922a, b) published in the subsequent issue of *Emu* (published 1 Oct. 1922). Chisholm was clearly in contact with White, who was frequently mentioned in Chisholm's newspaper column, and would have had advance warning of this observation.
- vii "Cape York" refers to the tip of Cape York Peninsula (10.689°S, 142.532°E).
- viii A. J. Turner was a remarkable doctor, responsible for improving infant and maternal health in Brisbane (A Special Correspondent 1947).
- ix Entry in Storr & Johnstone (1970-2019) annotated with "Ad. Bd Notes 1(4):2". However, the original source has not been seen by authors of the current article.
- x Although we found nesting may extend into August in our studies (Crowley *et al.* 2004), we found no evidence of parrots renesting after a successful nesting attempt in the same year (STG and GMC unpublished data).
- xi Before the Queensland National Parks and Wildlife Service was established in 1975, Charles Robert Roff was the Chief (and only) Fauna Officer in Queensland in the Department of Primary Industries (Thorsborne 2015).
- xii At the time the records from AMNH were transferred to GBIF in 2017, AMNH followed the taxonomy of Peters (1937), with Hooded Parrots being considered a subspecies of GSP (Paul Sweet, personal communication 19 Jan. 2022). AMNH has since adopted *Psephotellus* at the generic level, with *P. dissimilis* and *P. chrysopterygius* as two separate species (American Museum of Natural History 2021). Hence, two AMNH birds listed in GBIF as GSPs (SKIN-156470 & SKIN-156614) have since been identified as Hooded Parrots.