

# Surveys of a small population of the Endangered Black-throated Finch *Poephila cincta cincta* in North Queensland

Anthony C. Grice<sup>1†</sup>, Tamara Large<sup>2, 3</sup>, Christopher P. Kahler<sup>4\*</sup> and Rodney Heading<sup>5</sup>

<sup>1</sup>6 Perrin Court, Annandale QLD 4814, Australia

<sup>2</sup>318 Western Avenue, Montville QLD 4560, Australia

<sup>3</sup>North Queensland Dry Tropics, P.O. Box 1466, Townsville QLD 4810, Australia

<sup>4</sup>Ecological Interpretation, 21 Humphrey Street, Townsville QLD 4810, Australia

<sup>5</sup>Toomba Station, Charters Towers QLD 4820, Australia

<sup>†</sup>Deceased

\*Corresponding author: ecointerp@mac.com

**Abstract.** The Endangered southern subspecies of the Black-throated Finch *Poephila cincta cincta* survives in two recognised ‘strongholds’: parts of the Galilee Basin and the Townsville Plains, in Queensland. Elsewhere, there are apparently smaller populations scattered north of the Tropic of Capricorn. Between November 2014 and April 2018, 15 field surveys for Black-throated Finches were conducted on Toomba Station, a cattle property west of Charters Towers, North Queensland. Black-throated Finches were detected during five of these surveys, indicating the presence of a small and possibly isolated population. They were detected on 16 of the 65 survey days over a 3.5-year period. All but two detections were within 400 m of one of two water sources, one a cattle trough and the other a small farm dam. The habitat consisted principally of open woodland dominated by Narrow-leaved Ironbark *Eucalyptus crebra* and other *Eucalyptus* and *Corymbia* species. Black-throated Finches were observed attending the two water sources, foraging and resting. The largest number seen was 13. Other observations detected 1–11 birds. These numbers, along with the limited number of sites at which the species was detected despite considerable search effort, suggest that the total population of the district is very small. Small and isolated populations are likely to be vulnerable to drought, local changes in land use and stochastic factors. Given the current threats to the Black-throated Finch in its ‘strongholds’, it is important to ascertain the status, ecology and conservation needs of any remaining small, isolated populations of this subspecies.

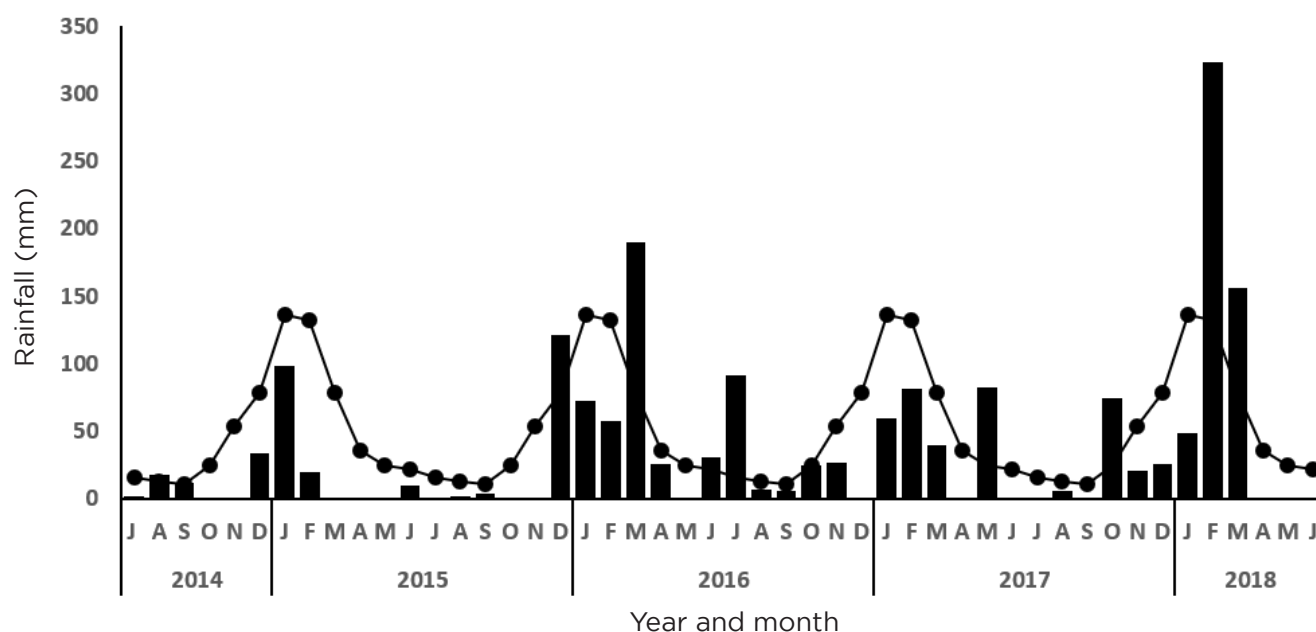
## Introduction

The Black-throated Finch *Poephila cincta* Gould 1837 is a grassfinch (Estrildidae) (Christidis & Boles 2008) endemic to eastern Australia. Although other taxonomic arrangements have been proposed (e.g. Forshaw & Shephard 2012), two subspecies are generally recognised (Higgins *et al.* 2006). The Northern Black-throated Finch *P. c. atropygialis* is restricted to Cape York Peninsula; the historical range of the Southern Black-throated Finch *P. c. cincta* was from inland north-eastern New South Wales to the upper Burdekin catchment in Queensland (e.g. Black-throated Finch Recovery Team *et al.* 2007; Rechetelo 2015; Menkhorst *et al.* 2017). Our paper relates to a population of the Southern Black-throated Finch (herein Black-throated Finch), a taxon listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and the Queensland *Nature Conservation Act 1992*, and as Presumed Extinct under the New South Wales *Biodiversity Conservation Act 2016*.

Over a period of decades, the range of *P. c. cincta* has contracted so that it is very sparse, if it occurs at all, south of the Tropic of Capricorn. Its remaining ‘strongholds’ are accepted as being in and around the Galilee Basin (*sensu* Queensland Government 2011) in central Queensland, and on the Townsville Plains (*sensu* Thackway & Cresswell 1995) in North Queensland (Black-throated Finch Recovery Team & BirdLife Australia 2021; Buosi *et al.* 2021). Research over the last 10 years has focused on these populations. In central Queensland, this work has consisted largely of surveys carried out as requirements associated with large-

scale mining developments, particularly in the Galilee Basin (Vanderduys *et al.* 2016). The relatively accessible population on the Townsville Plains has been the subject of a series of research projects concentrating on various aspects of Black-throated Finch ecology (Mitchell 1996; Isles 2007; Whatmough 2010; Rechetelo 2015; Rechetelo *et al.* 2016). Survey work on the Townsville Plains has occurred in response to the requirements associated with urban and infrastructure development around the city of Townsville and an ongoing monitoring program coordinated by the Black-throated Finch Recovery Team. The Galilee Basin probably supports several hundred Black-throated Finches and population estimates for the Townsville Plains are in the low hundreds, although estimates of population size are very imprecise (Buosi *et al.* 2021).

There are populations of Black-throated Finches away from these perceived strongholds but records are sporadic and they have not been subject to longitudinal research. Records suggest that individual populations are small and fragmentation may be an issue. However, populations are threatened by livestock grazing and weed invasion throughout their range (Black-throated Finch Recovery Team & BirdLife Australia 2021). Additionally, localised threats include changes in land use associated with urban expansion on the Townsville Plains. Thus, the populations elsewhere are important. Better knowledge of these apparently small and possibly isolated populations would help ascertain their conservation significance and determine their conservation needs.



**Figure 1.** Monthly rainfall totals (bars) and average monthly rainfalls (line) at Toomba Station for the period July 2014 to June 2018.

Our paper provides a case study that attempted to locate Black-throated Finches on a single grazing property outside their perceived strongholds and to provide some basic ecological information on the population.

## Material and methods

### Study location

Our study was carried out at Toomba Station (−19.96895, 145.5852), a cattle-grazing property of 47,800 ha, ~100 km west of Charters Towers in North Queensland. This area is well within the historic range of the Black-throated Finch and there are previous reliable records of the subspecies in the district (Vanderduys *et al.* 2016). Toomba supports 26 Regional Ecosystems (Sattler & Williams 1999) including grassy woodlands broadly typical of the habitat of the Black-throated Finch (Table 1). Much of the northern section of Toomba Station is covered by the lava flows of the Great Basalt Wall, with vegetation quite different from that of the southern portion, although it does include pockets of grassy eucalypt woodlands (Fensham & Skull 1999). We concentrated efforts to document the occurrence of the Black-throated Finch in the southern portion of Toomba Station, away from the Great Basalt Wall. The parts of the property supporting the most suitable Black-throated Finch habitat, including places where Black-throated Finches were sighted, consist of Tertiary and Quaternary colluvium of clay, silt, sand and gravel (Department of Natural Resources, Mines & Energy 2014). In addition to natural waterholes, ranging from nearly permanent to highly ephemeral, there are artificial open water sources available to Black-throated Finches on Toomba.

### Climatic conditions

Average annual rainfall at Toomba over the period for which records are available (1960–2019) was 635 mm

(Bureau of Meteorology 2020). On average, 75% of rain fell between November and March. In all but 7 months of the period from July 2014 to June 2018, when our surveys were carried out, monthly rainfall was below average (Figure 1). The 2014–2015 and 2016–2017 wet seasons were particularly dry. Only March 2016, March and October 2017, and February and March 2018 had rainfall well above average.

### Detection of Black-throated Finches

We made 15 visits to Toomba Station between November 2014 and April 2018 (Table 2). Our initial surveys were designed to maximise the chance of detecting Black-throated Finches by searching likely habitat, mainly the large areas of open grassy woodlands in the southern half of the property (Figure 2).

Away from water, in December 2014, we surveyed 14 1-ha sites in suitable habitat (Figure 2). Each site was surveyed for 10 minutes at various times throughout the day, and all bird species seen or heard were recorded and counts were made of all granivorous species.

Because Black-throated Finches, like other grassfinches, need to drink water daily, we focused on observing likely water sources for periods of 1–3 hours. We visited 20 temporary or persistent water sources in total. Most sites were visited 2–3 times but a few 1–8 times. All bird species seen or heard during these observation periods were recorded. Counts were made of granivorous species drinking at water sources in line with a standardised methodology used by the Black-throated Finch Recovery Team (McCullough & Payet 2009).

We made opportunistic records of all other bird species away from these specific sites, including the locations and numbers of any granivorous birds.

A database maintained by the Black-throated Finch Recovery Team (Queensland Wildnet and Black-throated

**Table 1.** Regional Ecosystems of Toomba Station. \* denotes Regional Ecosystems in which Black-throated Finches have been recorded generally by the Black-throated Finch Recovery Team (Queensland Wildnet and Black-throated Finch Recovery Team 2020). Bold print denotes Regional Ecosystems in which Black-throated Finches were recorded on Toomba Station during the present study.

Regional Ecosystem	Description	% of Toomba Station
9.3.1	River Red Gum <i>Eucalyptus camaldulensis</i> and/or Forest Red Gum <i>E. tereticornis</i> ± <i>Melaleuca</i> spp. ± River Sheoak <i>Casuarina cunninghamiana</i> fringing woodland on channels and levees.	0.2
9.3.3b	<i>Corymbia</i> spp. and <i>Eucalyptus</i> spp. dominate mixed woodland on alluvial plains and terraces.	3.2
9.3.5	Reid River Box <i>Eucalyptus brownii</i> ± <i>Eucalyptus</i> spp. ± <i>Corymbia</i> spp. open woodland on alluvial plains.	0.3
9.3.6a	Poplar Gum <i>Eucalyptus platyphylla</i> ± <i>Eucalyptus</i> spp. ± <i>Corymbia</i> spp. woodland on alluvial plains with palustrine wetlands.	0.9
9.3.7	Wetlands and seasonally inundated grasslands with a fringing open woodland of mixed <i>Eucalyptus</i> spp. on Tertiary surfaces.	0.4
9.3.11a	Wetlands (sometimes ephemeral) with aquatic species and fringed with <i>Eucalyptus</i> spp. communities within basalt plains and flows.	0.01
9.3.11b	Permanent or ephemeral wetlands on dark basaltic clay with or without loose basalt rocks, surrounded by Quaternary basalt.	4.3
9.3.12a	Riverbeds and associated waterholes on major rivers and channels.	0.1
9.3.17	River Sheoak and/or River Red Gum or Forest Red Gum fringing open forest on channels and levees on basalt flows.	0.4
9.3.27a	Grassland of <i>Dichanthium</i> spp. or Blady Grass <i>Imperata cylindrica</i> or Flinders grass <i>Iseilema</i> spp. or Black Speargrass <i>Heteropogon contortus</i> with patches of sedgeland. Isolated low clumps of Black Teatree <i>Melaleuca bracteata</i> and a range of other species may occur as emergents. Occurs on alluvial deposits overlying basalt geologies. Floodplain.	0.08
9.5.3	Narrow-leaved Ironbark or Grey Ironbark <i>Eucalyptus drepanophylla</i> and Clarkson's Bloodwood <i>Corymbia clarksoniana</i> woodland on sand plains.	0.5
9.8.5a	Mitchell grass <i>Astrebla</i> spp. ± Red Flinders Grass <i>Iseilema vaginiflorum</i> grassland on basalt plains. Occurs on gently undulating to undulating basalt plains with numerous surface basalt boulders and grey to black soil.	0.04
9.8.7	Semi-evergreen vine thicket on cones, craters and rocky basalt flows with little soil development.	40
9.8.9	Mountain Coolibah <i>Eucalyptus orgadophila</i> ± <i>Corymbia</i> spp. open woodland on basalt plains and rocky basalt hills.	0.4
9.8.13	<i>Iseilema</i> spp. and/or <i>Dichanthium</i> spp. tussock grassland on basalt plains.	1.4
*10.3.6a	Reid River Box woodland on alluvial plains.	2.6
10.3.7b	Curly Bluegrass <i>Dichanthium fecundum</i> and Mitchell grass <i>Astrebla</i> spp. dominate the very sparse to sparse ground layer/grassland.	0.02
*10.3.13a	River Red Gum woodland along watercourses.	0.5
10.3.16d	Open herbland of mixed tussock grasses, copperburrs <i>Sclerolaena</i> spp. and diverse forbs.	0.06
<b>10.5.4a</b>	<b>Narrow-leaved Ironbark <i>Eucalyptus crebra</i> usually dominates, often with Dallachy's Ghost Gum <i>Corymbia dallachiana</i> in the very sparse canopy on sandplain.</b>	<b>7.05</b>
10.5.4b	Narrow-leaved Ironbark dominates the very sparse canopy, with Box Thorn <i>Bursaria incana</i> and Silver Grevillea <i>Grevillea parallela</i> as small trees and sparse shrub layer. Sparse to mid-dense ground layer of Black Speargrass and Kangaroo Grass <i>Themeda triandra</i> . Occurs on sandplain.	1.9
<b>*10.5.5a</b>	<b>Silver-leaved Ironbark <i>Eucalyptus melanophloia</i> dominant with Soft Spinifex <i>Triodia pungens</i> on sandplains.</b>	<b>15.7</b>
<b>*10.5.5x2</b>	<b>Reid River Box woodland with grassy ground layer. Occurs on loamy red and yellow earths.</b>	<b>2.1</b>
*10.7.2a	Inland Yellow Jacket <i>Eucalyptus persistens</i> sparse open woodland with sparse Soft Spinifex understorey on ferricrete above scarps.	0.2
10.7.4	Inland Yellow Jacket low open woodland on pediments below scarps.	0.07

**Table 2.** Timing, survey activities and general findings of field visits to Toomba Station to search for and observe Black-throated Finches (BTF).

Time	Activities	General findings
3–7 Nov. 2014	General reconnaissance	98 spp.; no BTF detected
8–13 Dec. 2014	Established 25 permanent sites	111 spp.; no BTF detected
20–24 Apr. 2015	Resurveyed 25 sites; established 3 additional sites (13 sites with water sources)	108 spp.; no BTF detected
21–22 Jun. 2015	Searched 'new' area in apparent habitat with several artificial water sources	29 spp.; few granivores; no BTF detected
21–26 Sep. 2015	Searched at and around water sources in area of favourable habitat searched in June 2015; observations of BTF	73 spp.; BTF detected at single site (Site 30)
16–19 Nov. 2015	Searched at and around water sources in area of favourable habitat searched in June and September 2015; observations of BTF	57 spp.; BTF detected at single site (Site 30)
17–22 Apr. 2016	Searched at and around water sources in area of favourable habitat observed in June, September and November 2015	69 spp.; no BTF detected
28–30 Sep. 2016	Searched at and around water sources observed during 3 previous visits plus 'new' dam in favourable habitat in east of property	62 spp.; no BTF detected
13–18 Nov. 2016	Searched at and around previously observed water sources in east of property; observations of BTF	70 spp.; BTF detected away from water source and at a water source (Site 36) last surveyed in April 2015
27 Mar. 2017	Brief visits to multiple water sources	40 spp.; no BTF detected
2–7 Apr. 2017	Watched multiple water sources and surveyed on foot in intervening areas	90 spp.; BTF detected at single site (Site 36)
15–16 May 2017	Watched multiple water sources; general observations	57 spp.; no BTF detected
6–7 Aug. 2017	Brief visits to sites where BTF previously sighted; general observations	54 spp.; no BTF detected
22–27 Oct. 2017	Watched multiple water sources	104 spp.; no BTF detected
16–20 Apr. 2018	Watched multiple water sources and surveyed on foot in intervening areas	88 spp.; BTF detected at single site (Site 36) on 4 consecutive days

**Table 3.** The specialist, principally ground-feeding, granivorous bird species recorded on Toomba Station between November 2014 and April 2018.

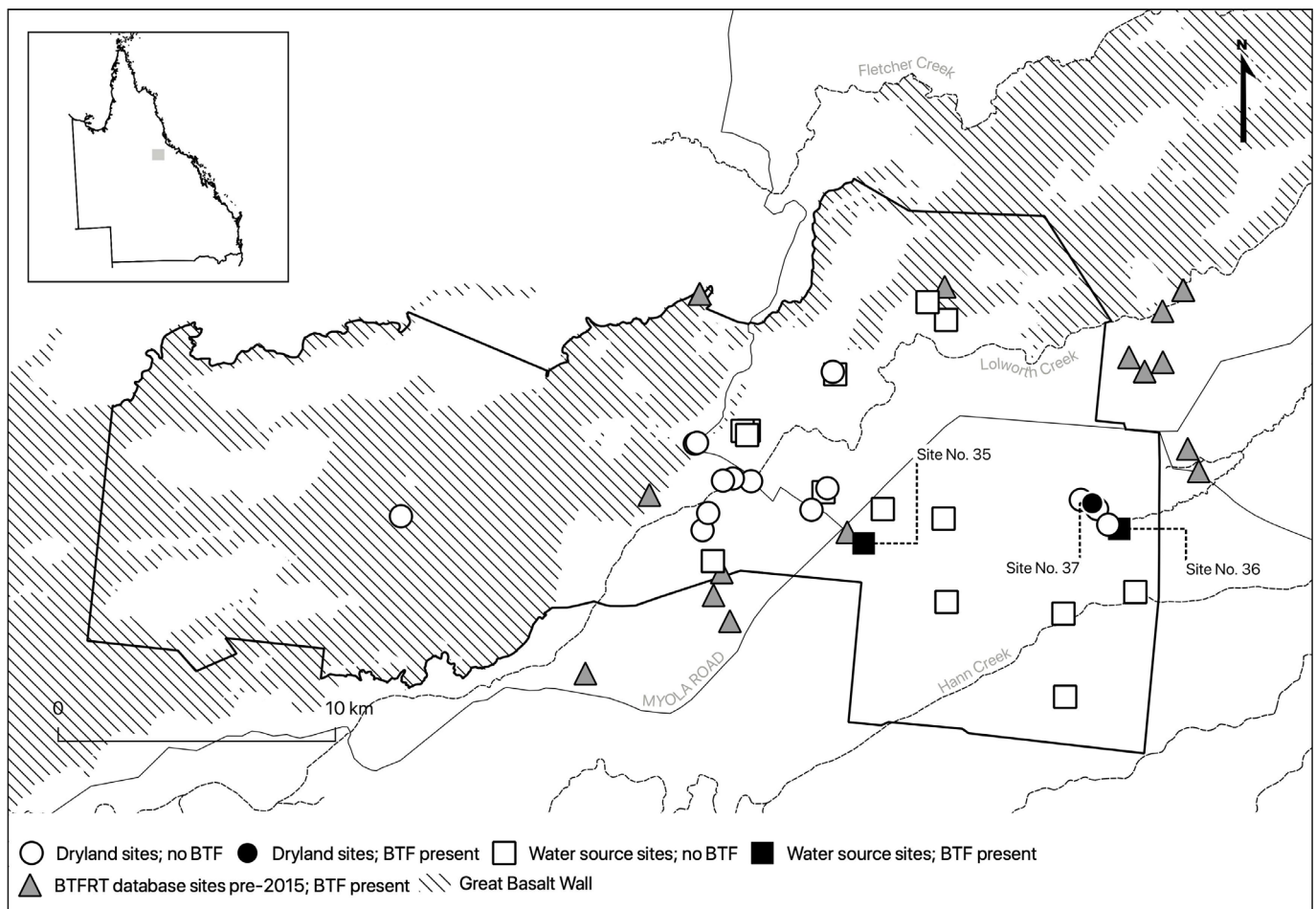
Common name	Scientific name
Brown Quail	<i>Synoicus ypsilophora</i>
Squatter Pigeon	<i>Geophaps scripta</i>
Common Bronzewing	<i>Phaps chalcoptera</i>
Crested Pigeon	<i>Ocyphaps lophotes</i>
Diamond Dove	<i>Geopelia cuneata</i>
Peaceful Dove	<i>Geopelia striata</i>
Bar-shouldered Dove	<i>Geopelia humeralis</i>
Little Button-quail	<i>Turnix velox</i>
Cockatiel	<i>Nymphicus hollandicus</i>
Galah	<i>Eolophus roseicapilla</i>
Budgerigar	<i>Melopsittacus undulatus</i>
Chestnut-breasted Mannikin	<i>Lonchura castaneothorax</i>
Plum-headed Finch	<i>Neochmia modesta</i>
Black-throated Finch	<i>Poephila cincta cincta</i>
Zebra Finch	<i>Taeniopygia guttata</i>
Double-barred Finch	<i>Taeniopygia bichenovii</i>

Finch Recovery Team unpublished database: <http://www.blackthroatedfinch.com>, accessed 6 April 2020) was searched for records of Black-throated Finches within 20 km of the Toomba homestead (–19.96895, 145.5852). The database includes all accessible records from across the species' distribution. In addition, we collected records from previous owners of Toomba who had compiled a bird species list for the property over a period of 23 years up to and including 2008 (R. Bassingthwaite pers. comm.). This list did not include information on where birds were sighted.

### *Observations of Black-throated Finches and other granivores*

Greater effort was concentrated in locations where Black-throated Finches were detected. During 3-hour observation periods, our data collection on this species and other granivorous birds included the direction of approach, the number of birds, behaviour, and direction of departure from the water. By following Black-throated Finches departing from water sources, and general searches in the vicinity of the water source, it was possible to observe other behaviours, including foraging and resting.





**Figure 2.** Locations of sites surveyed for Black-throated Finches on Toomba Station. ○ Fixed dryland sites surveyed at least once but where no Black-throated Finches (BTF) were sighted; □ water sources surveyed at least once but where no BTF were sighted; ■ the two water sources where BTF were recorded drinking (Sites 35 and 36); ● the site away from water where BTF were recorded foraging (Site 37); ▲ locations on Toomba from the Black-throated Finch Recovery Team database (BTFRT) where BTF were recorded before 2014. The hatched area indicates the lava flows of the Great Basalt Wall.

## Results and discussion

Toomba Station supports a diverse avifauna in line with the variety of habitats that occur on the property. Over the 15 survey periods, a total of 167 bird species was recorded (Appendix 1), comparable with the previous list of 200 species compiled for the property over a period of 23 years up to 2008 (Appendix 1; R. Bassingthwaite pers. comm.). Six species recorded during our study had not been detected before 2008.

Black-throated Finches were among 16 species of predominantly ground-feeding granivores (including parrots, pigeons, doves and grassfinches) recorded at Toomba (Table 3). They were detected during five of the 15 visits to the property (Table 2). An initial detection, with photographic evidence, was made by RH in July 2015 at a water source (a cattle trough = Site 35; Figure 3) first surveyed in June 2015. Two subsequent surveys (September and November 2015) concentrated on observing Black-throated Finches around this water source. The surveys in April and September 2016 failed to detect any at this site or other sites at Toomba Station. Black-throated Finches were next detected in November 2016 at a different location, a small dam created by the construction of an earthen wall across a

small water course (Site 36; Figure 4), and all subsequent observations were made in this vicinity. Observations of Black-throated Finches were thus made on 16 of the 65 days spent in the field over a 3.5-year period.

Before this project, the Black-throated Finch Recovery Team database contained 36 records of sightings of Black-throated Finches within 20 km of the Toomba homestead, the earliest in 1977. Of these, 22 were made in the period 1970–1979 and nine in 1980–1989. Excluding our observations, the database contained only three records post-2000, all in 2003. However, this pattern of sightings cannot be taken to indicate a trend in abundance as survey effort was very sporadic. Most of the database records of sightings in and around Toomba Station were made either on the adjacent property to the west of Site 35 or spread across an arc of country on Toomba Station east and north-east of Site 36 (Figure 2). The results of our surveys demonstrate that Black-throated Finches persisted on the property until April 2018 as a small, and possibly isolated, population away from the two regions perceived to be the subspecies' remaining strongholds.

The general vegetation of the two broad locations at which Black-throated Finches were observed differed markedly. The area around Site 35 was dominated by Narrow-leaved Ironbark *Eucalyptus crebra* with other tree



species present either as canopy or mid-storey species (e.g. Quinine Bush *Petalostigma pubescens*). The ground layer of the vegetation included a variety of species with *Aristida* spp. being common. The vegetation around Site 36 was dominated by Reid River Box *Eucalyptus brownii* with a mid-storey that was more open than that around Site 35. Silky Browntop *Eulalia fulva* was prominent in the ground layer around Site 36. One of the Regional Ecosystems where Black-throated Finches were recorded on Toomba Station (Regional Ecosystem 10.5.5a) is highlighted in the Black-throated Finch Recovery Plan (Black-throated Finch Recovery Team & BirdLife Australia 2021) as amongst those containing the greatest number of Black-throated Finch records nationally (Table 1).

Observations at Site 35 in September and November 2015 were made late in a dry season that followed the poor wet season of 2014–2015. Although the area where the Black-throated Finches were observed had more ground cover than some other areas of the property and adjacent properties, herbage cover was low.

We cannot estimate the population size from our observations. However, it is likely to be low; the maximum number of Black-throated Finches observed at any one time was 13, providing a minimum possible population size at that point in time. Observations at the two water source locations spanned a period of 3 years and 5 months. Black-throated Finches were seen at the first location (Site 35) in July, September and November 2015, and most other observations were made at Site 36, 9.4 km from Site 35. Additionally, we made two observations of foraging birds at Site 37, within 1.39 km of Site 36. As Black-throated Finches were not subsequently seen at Site 35 through until April 2018, despite multiple surveys and other visits, it is likely that some or all the individuals originally seen at Site 35 were the same as those seen at Site 36. A possible explanation of the timing and location of sightings is that a flock of Black-throated Finches was using the area around Site 35 at least from July until November 2015, and subsequently at least some of them relocated to the area around Site 36. Such a pattern would conform to those described by Rechetelo *et al.* (2016): Black-throated Finches had fixed and relatively small home ranges (up to ~50 ha) on short time scales but occasionally moved



**Figure 3.** Site 35 (in 15 May 2017) where Black-throated Finches were observed on several occasions between July and November 2015. Photo: Anthony C. Grice

longer distances. The distance of 9.4 km between the two locations at which the species was recorded at Toomba Station is well below the maximum distances over which movements have been documented on the Townsville Plains (16 km: Rechetelo *et al.* 2016).

#### *Observations of Black-throated Finches drinking*

Black-throated Finches must drink daily, and often drink early in the morning (Zann 1976). Most (all but two) of the sightings on Toomba Station during our 15 field visits over almost 3.5 years were within 400 m of a water source. However, a large proportion of our survey effort was directed at water sources to detect birds as they came to drink, and this concentration of effort at water sources was intended to maximise the probability of detecting Black-throated Finches. Many hours were also spent traversing likely habitat either cross-country, along tracks on foot, or by motor vehicle along tracks, but survey effort away from water yielded very few sightings of the species. Visits by Black-throated Finches to water sources were usually



**Figure 4.** (a) Water source at Site 36 (on 15 November 2016) where Black-throated Finches were observed in November 2016 and April 2017; (b) foraging location and surrounding woodland at Site 37, 1390 m from Site 36. Photos: Anthony C. Grice



very brief, sometimes <30 seconds, perhaps partially because time spent at the water's edge exposes them to an increased risk of predation. The Finches lingered longer in the nearby vegetation before and after drinking. It is not possible to say from these observations how often individual birds drank during the day, although many of these 'occasions' consisted of multiple observations of what was almost certainly the same group of birds on the same day.

Black-throated Finches were first observed drinking at the cattle trough at Site 35 in July 2015. They were subsequently observed drinking there usually several times on each day of observation in September and November 2015 (Table 4). Their directions of approach and departure from the water source varied, and they drank at different times through the day. The earliest observed drinking time was 0615 h (26 September 2015, c. 11 min. after sunrise) and the latest was 1529 h (22 September 2015, c. 2 h 45 min. before sunset). Most visits to water were before 1200 h but this may simply reflect that we spent more time observing water sources then. The number of Black-throated Finches seen coming to water at any one time varied from 1 to 13 (Table 4).

At both sites (Sites 35 and 36) at which Black-throated Finches were observed drinking, they approached the water source by first landing in nearby trees or shrubs. At Site 35, they landed in nearby eucalypts; at Site 36, they almost invariably landed in a few Mimosa Bush *Vachellia farnesiana* shrubs that were growing on the walls of the earthen dam. They also often landed in trees or shrubs upon leaving the water's edge and before moving away from the water sources.

Generally, we did not observe Black-throated Finches drinking when other birds were using a water source. The only other bird species seen at the same time, or visiting a water source just before or just after Black-throated Finches drank, were small passerines such as White-throated Honeyeaters *Melithreptus albogularis* or Double-barred Finches *Taeniopygia bichenovii*. The body of water at Site 36 had a perimeter of ~200 m (varying with the water level) and Black-throated Finches mostly drank in roughly the same location each time: the section of the water's edge closest to three Mimosa Bushes that they used as they transitioned from the canopy of nearby trees to the water's edge.

### Behaviour of Black-throated Finches

We encountered Black-throated Finches foraging on 24 of the 76 occasions on which the species was observed (see Table 4). Approximately 50% of these observations occurred in the vicinity of the two water sources used by the birds (Sites 35 and 36). All foraging locations associated with Site 35 were within 400 m of that water source. One foraging location (Site 37) was 1.39 km from the dam (Site 36) at which the birds were subsequently observed drinking. In that instance, there was another water source (two cattle troughs) slightly closer to the foraging location (1.28 km away), but Black-throated Finches were never observed drinking at those cattle troughs.

When foraging observations were made in September and November 2015 near Site 35, conditions were very

dry and biomass of grasses was low. There was a large amount of tree leaf-litter on the soil surface and a high proportion of bare ground. Particularly in the heat of the day, birds appeared to selectively feed in the shade, for example that created by the trunks of larger trees. On several occasions, we observed Black-throated Finches foraging in mixed flocks, consistent with previous reports (Vanderduys *et al.* 2012). Many of the foraging locations near Site 36 were either on a track or in the immediate vicinity of the dam where cover of herbaceous species was very low. There was considerable eucalypt leaf-litter on the soil surface and sometimes birds moved individual leaves to forage under them but it was not possible to identify what they were consuming.

Behaviour that might have been associated with breeding was observed only in April 2018: Black-throated Finches were noted collecting and carrying feathers into a hollow limb of a large, dead Narrow-leaved Ironbark. At least three birds were active in the vicinity of this location at the time.

### Other species

Four other species of grassfinch were observed on the property: Chestnut-breasted Mannikin *Lonchura castaneothorax*, Plum-headed Finch *Neochmia modesta*, Zebra Finch *Taeniopygia castanotis* and Double-barred Finch (Table 3). Black-throated Finches and Double-barred Finches were the only grassfinches observed drinking at Site 35 in September 2015. Black-throated Finches were the only finch species observed drinking at Site 35 in November 2015, although Double-barred Finches were recorded drinking at a nearby dam (Site 26). In November 2016, Zebra and Double-barred Finches, in addition to Black-throated Finches, were using Site 36, and Plum-headed, Zebra and Double-barred Finches were observed using several water sources even though Black-throated Finches were using only Site 36.

The mixed flocks with which Black-throated Finches sometimes associated included the following species: Brown Treecreeper *Climacteris picumnus*, Yellow-rumped Thornbill *Acanthiza chrysorrhoa*, Varied Sittella *Daphoenositta chrysoptera*, Rufous Whistler *Pachycephala rufiventris*, White-winged Triller *Lalage tricolor*, Willie Wagtail *Rhipidura leucophrys* and Rufous Songlark *Cincloramphus mathewsi*. All are small passerines that differ widely from Black-throated Finches in their basic ecology; for example, all are insectivores whereas Black-throated Finches are primarily granivores.

Predatory birds, some of which are likely to present a threat to small birds such as Black-throated Finches, were frequently observed around water sources but particularly the more persistent water sources. At Toomba Station, these species included Brown Goshawk *Accipiter fasciatus*, Whistling Kite *Haliastur sphenurus*, Black Kite *Milvus migrans*, Laughing Kookaburra *Dacelo novaeguineae*, Blue-winged Kookaburra *D. leachii*, Nankeen Kestrel *Falco cenchroides*, Brown Falcon *F. berigora*, Australian Magpie *Gymnorhina tibicen*, Pied Butcherbird *Cracticus nigrogularis*, Grey Butcherbird *C. torquatus*, Torresian Crow *Corvus orru* and Australian Raven *C. coronoides*.

**Table 4.** Observations of Black-throated Finches drinking, foraging and resting at or near Site 35, in September and November 2015, and Site 36, in November 2016 and April 2017 and 2018. Dates are given as day/month/year.

<i>Date</i>	<i>Time (h)</i>	<i>No. birds</i>	<i>Notes</i>
<b>At or near Site 35</b>			
22/9/15	0722–0726	13	First heard near water source, then seen drinking
22/9/15	1142–1145	9	Drinking; near water source for 3 min.
22/9/15	c. 1225	8?	Foraging at Site 35 – shrubby understorey, eucalypt litter
22/9/15	c. 1245	9	Foraging at Site 35
22/9/15	1228	8?	Resting in trees
22/9/15	1529	4	Drinking; at water source for <30 sec.
23/9/15	0720	6	Drinking
23/9/15	0725	9	Drinking, bathing
24/9/15	1210–1216	10	Drinking with Double-barred Finches though arrived separately
25/9/15	0702	13	Passed water source without drinking
25/9/15	0730–0745	11	Drinking with Double-barred Finches
25/9/15	0830–0900	8–11	Foraging with mixed flock, resting within 50 m of Site 35
25/9/15	1009–1032	9	Foraging in mixed flock near Site 35; periods of rest in trees
25/9/15	1051–1100	9	Resting in eucalypt 319 m from Site 35
25/9/15	1114–1122	9	Foraging 270 m from Site 35
25/9/15	1150–1352	11	Drinking with White-throated Honeyeaters
25/9/15	1640–1719	10	Foraging with mixed flock near Site 35; short periods of rest
26/9/15	0615–0617	6	Drinking
26/9/15	0805–0807	8	Drinking with White-throated Honeyeaters
26/9/15	0820–0835	2	Inspecting nest sites
26/9/15	0850	10+	Resting near mixed flock
16/11/15	1306–1308	10	Drinking
16/11/15	1420	8	Resting in tree near mixed flock
16/11/15	1522	9	Drinking
16/11/15	1550–1642	10	Foraging in mixed flock near Site 35
16/11/15	1705	11	Resting near Site 35
16/11/15	1706–1715	10	Foraging near Site 35
17/11/15	0647–0649	3	Drinking
17/11/15	0742–0746	11	Drinking (for c. 30 sec.)
17/11/15	0946–1027	9	Foraging in mixed flock
17/11/15	1027–1030	?	Foraging near Site 35
17/11/15	1103–1107	9	Drinking
17/11/15	1107–1111	9	Resting in trees
17/11/15	1350–1447	9	Foraging near Site 35 with periodic rests
17/11/15	1609–1632	8	Resting near Site 35
17/11/15	1632–1649	11	Resting near Site 35
17/11/15	1650–1702	11	Foraging with mixed flock near Site 35
17/11/15	1707–1716	11	Foraging near Site 35
18/11/15	0730–0759	8	Drinking (for <30 sec.)
18/11/15	0817	9	Foraging 120 m from Site 35
<b>At or near Site 36</b>			
16/11/16	1115–1125	2	Foraging at Site 37 with mixed flock
16/11/16	1215–1244	2	Alternately resting and foraging at Site 37
16/11/16	1412	1	Drinking
17/11/16	0654	3	Drinking
17/11/16	0656	1	Drinking
17/11/16	0658	1	Drinking



Table 4 continued

Date	Time (h)	No. birds	Notes
<b>At or near Site 36</b>			
17/11/16	0701	3	Drinking
17/11/16	0718	2	Drinking/bathing
17/11/16	0730	2	Drinking
17/11/16	0942–0944	2	Drinking
17/11/16	1340	1	Drinking
18/11/16	0631–0633	5	Drinking
18/11/16	0820	2	Drinking
18/11/16	0821	2	Drinking
18/11/16	1005–1008	1	Drinking
6/4/17	0630–1145	2	Drinking
17/4/18	0734	1	At water source but not observed to drink
17/4/18	0840	1	Foraging beside dam
17/4/18	c. 0900	3	Collecting nesting material
17/4/18	0933–0940	3	Active around dead standing trees
17/4/18	1006–1009	1	Entering hollow tree limb
17/4/18	1020–1021	2	Active on ground
17/4/18	1207–1227	3	Foraging on track in mixed flock
18/4/18	1405	1	Foraging (Sabi Grass <i>Urochloa mosambicensis</i> ) near dam
19/4/18	1015–1030	2	Foraging, perching, preening
19/4/18	1045	2	Foraging (Sabi Grass)
19/4/18	1512	2	Entering and emerging from hollow tree limb
19/4/18	1518	1	Perched on dead tree
19/4/18	1559	1	Perched on dead tree
19/4/18	1618	2	Perching and flying between trees
20/4/18	0748–0750	2	Birds exchanging positions in nest hollow
20/4/18	0843–0846	1	Foraging
20/4/18	0920–0948	3	Foraging, perching on dead tree and entering hollow limb with nesting material
20/4/18	1004	1	Perched in tree, departed north-east
20/4/18	1011–1023	2	Taking feathers into nest hollow; active around nest tree
20/4/18	1356	1	Foraging on track

Given the threats to Black-throated Finches in their recognised strongholds, it is important to understand the significance of small and possibly relatively isolated populations elsewhere in their range. Management of Toomba Station is such that the vegetation there has retained structure and function, enabling the persistence of at least a small population of Black-throated Finches. The challenge of conserving such populations is likely to be exacerbated by their small size and apparent isolation. Land managers in Queensland should focus on management regimes that retain native vegetation, including both the tree and herbaceous strata, and water sources in a state and over an area that provide for Black-throated Finches.

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**Appendix 1.** Bird species recorded at Toomba Station during this study (November 2014–April 2018) and/or by Bassingthwaite et al. (pers. comm.) (1985–2008). Bird names according to BirdLife Australia Working List v3 (<https://birddata.birdlife.org.au/whats-in-a-name>). \* = species recorded only during this project, † = species recorded only by Bassingthwaite et al.

Common Name	Scientific name	Common Name	Scientific name
Emu	<i>Dromaius novaehollandiae</i>	Royal Spoonbill	<i>Platalea regia</i>
†Australian Brush-turkey	<i>Alectura lathamii</i>	Straw-necked Ibis	<i>Threskiornis spinicollis</i>
Brown Quail	<i>Synoicus ypsilophorus</i>	Australian White Ibis	<i>Threskiornis moluccus</i>
†King Quail	<i>Synoicus chinensis</i>	Glossy Ibis	<i>Plegadis falcinellus</i>
Magpie Goose	<i>Anseranas semipalmata</i>	Black Bittern	<i>Ixobrychus flavicollis</i>
Plumed Whistling-Duck	<i>Dendrocygna eytoni</i>	Nankeen Night-Heron	<i>Nycticorax caledonicus</i>
Wandering Whistling-Duck	<i>Dendrocygna arcuata</i>	Cattle Egret	<i>Bubulcus ibis</i>
Pink-eared Duck	<i>Malacorhynchus membranaceus</i>	White-necked Heron	<i>Ardea pacifica</i>
†Freckled Duck	<i>Stictonetta naevosa</i>	Great Egret	<i>Ardea alba</i>
Black Swan	<i>Cygnus atratus</i>	Intermediate Egret	<i>Ardea intermedia</i>
Cotton Pygmy-goose	<i>Nettapus coromandelianus</i>	White-faced Heron	<i>Egretta novaehollandiae</i>
Green Pygmy-goose	<i>Nettapus pulchellus</i>	Little Egret	<i>Egretta garzetta</i>
Australian Wood Duck	<i>Chenonetta jubata</i>	Australian Pelican	<i>Pelecanus conspicillatus</i>
Hardhead	<i>Aythya australis</i>	Little Pied Cormorant	<i>Microcarbo melanoleucos</i>
†Australasian Shoveler	<i>Spatula rhynchotis</i>	Great Cormorant	<i>Phalacrocorax carbo</i>
Pacific Black Duck	<i>Anas superciliosa</i>	Little Black Cormorant	<i>Phalacrocorax sulcirostris</i>
Grey Teal	<i>Anas gracilis</i>	Great Pied Cormorant	<i>Phalacrocorax varius</i>
Australasian Grebe	<i>Tachybaptus novaehollandiae</i>	Australasian Darter	<i>Anhinga novaehollandiae</i>
†Hoary-headed Grebe	<i>Poliocephalus poliocephalus</i>	Bush Stone-curlew	<i>Burhinus grallarius</i>
Great Crested Grebe	<i>Podiceps cristatus</i>	Pied Stilt	<i>Himantopus leucocephalus</i>
Squatter Pigeon	<i>Geophaps scripta</i>	†Pacific Golden Plover	<i>Pluvialis fulva</i>
Common Bronzewing	<i>Phaps chalcoptera</i>	†Red-capped Plover	<i>Charadrius ruficapillus</i>
Crested Pigeon	<i>Ocyphaps lophotes</i>	†Lesser Sand Plover	<i>Charadrius mongolus</i>
Diamond Dove	<i>Geopelia cuneata</i>	Black-fronted Dotterel	<i>Elsayornis melanops</i>
Peaceful Dove	<i>Geopelia placida</i>	†Banded Lapwing	<i>Vanellus tricolor</i>
Bar-shouldered Dove	<i>Geopelia humeralis</i>	Masked Lapwing	<i>Vanellus miles</i>
Tawny Frogmouth	<i>Podargus strigoides</i>	†Red-kneed Dotterel	<i>Erythronyx cinctus</i>
Pheasant Coucal	<i>Centropus phasianinus</i>	†Australian Painted-snipe	<i>Rostratula australis</i>
Eastern Koel	<i>Eudynamis orientalis</i>	Comb-crested Jacana	<i>Irediparra gallinacea</i>
Channel-billed Cuckoo	<i>Scythrops novaehollandiae</i>	†Little Curlew	<i>Numenius minutus</i>
Horsfield's Bronze-Cuckoo	<i>Chalcites basalís</i>	†Black-tailed Godwit	<i>Limosa limosa</i>
*Little Bronze-Cuckoo	<i>Chalcites minutillus</i>	†Red Knot	<i>Calidris canutus</i>
Brush Cuckoo	<i>Cacomantis variolosus</i>	†Sharp-tailed Sandpiper	<i>Calidris acuminata</i>
Pallid Cuckoo	<i>Heteroscenes pallidus</i>	†Curlew Sandpiper	<i>Calidris ferruginea</i>
Oriental Cuckoo	<i>Cuculus saturatus</i>	Red-necked Stint	<i>Calidris ruficollis</i>
†Buff-banded Rail	<i>Hypotaenidia philippensis</i>	†Latham's Snipe	<i>Gallinago hardwickii</i>
Purple Swampphen	<i>Porphyrio porphyrio</i>	†Terek Sandpiper	<i>Xenus cinereus</i>
Dusky Moorhen	<i>Gallinula tenebrosa</i>	†Common Sandpiper	<i>Actitis hypoleucos</i>
Eurasian Coot	<i>Fulica atra</i>	†Common Greenshank	<i>Tringa nebularia</i>
Brolga	<i>Antigone rubicunda</i>	†Marsh Sandpiper	<i>Tringa stagnatilis</i>
Australian Bustard	<i>Ardeotis australis</i>	†Red-backed Button-quail	<i>Turnix maculosus</i>
Black-necked Stork	<i>Ephippiorhynchus asiaticus</i>	†Red-chested Button-quail	<i>Turnix pyrrhothorax</i>
Yellow-billed Spoonbill	<i>Platalea flavipes</i>	Little Button-quail	<i>Turnix velox</i>



## Appendix 1 continued

Common Name	Scientific name	Common Name	Scientific name
†Australian Pratincole	<i>Stiltia isabella</i>	Brown Treecreeper	<i>Climacteris picumnus</i>
Silver Gull	<i>Larus novaehollandiae</i>	Red-backed Fairy-wren	<i>Malurus melanocephalus</i>
Common Gull-billed Tern	<i>Gelochelidon nilotica</i>	Banded Honeyeater	<i>Cissomela pectoralis</i>
Caspian Tern	<i>Hydroprogne caspia</i>	Brown Honeyeater	<i>Lichmera indistincta</i>
Whiskered Tern	<i>Chlidonias hybrida</i>	Blue-faced Honeyeater	<i>Entomyzon cyanotis</i>
†Eastern Grass Owl	<i>Tyto longimembris</i>	White-throated Honeyeater	<i>Melithreptus albogularis</i>
†Barn Owl	<i>Tyto alba</i>	Black-chinned Honeyeater	<i>Melithreptus gularis</i>
Barking Owl	<i>Ninox connivens</i>	†Striped Honeyeater	<i>Plectorhyncha lanceolata</i>
Southern Boobook	<i>Ninox boobook</i>	Little Friarbird	<i>Philemon citreogularis</i>
†Osprey	<i>Pandion haliaetus</i>	Noisy Friarbird	<i>Philemon corniculatus</i>
†Black-shouldered Kite	<i>Elanus axillaris</i>	Rufous-throated Honeyeater	<i>Conopophila rufogularis</i>
Black-breasted Buzzard	<i>Hamirostra melanosternon</i>	Lewin's Honeyeater	<i>Meliphaga lewinii</i>
†Square-tailed Kite	<i>Lophoictinia isura</i>	Yellow Honeyeater	<i>Stomiopera flava</i>
Pacific Baza	<i>Aviceda subcristata</i>	Spiny-cheeked Honeyeater	<i>Acanthagenys rufogularis</i>
Wedge-tailed Eagle	<i>Aquila audax</i>	Singing Honeyeater	<i>Gavicalis virescens</i>
Little Eagle	<i>Hieraaetus morphnoides</i>	Yellow-tinted Honeyeater	<i>Ptilotula flavescens</i>
†Swamp Harrier	<i>Circus approximans</i>	†Fuscous Honeyeater	<i>Ptilotula fusca</i>
Spotted Harrier	<i>Circus assimilis</i>	Grey-fronted Honeyeater	<i>Ptilotula plumula</i>
Brown Goshawk	<i>Accipiter fasciatus</i>	Yellow-throated Miner	<i>Manorina flavigula</i>
Collared Sparrowhawk	<i>Accipiter cirrocephalus</i>	Striated Pardalote	<i>Pardalotus striatus</i>
White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>	Fairy Gerygone	<i>Gerygone palpebrosa</i>
Whistling Kite	<i>Haliastur sphenurus</i>	White-throated Gerygone	<i>Gerygone olivacea</i>
Black Kite	<i>Milvus migrans</i>	†Western Gerygone	<i>Gerygone fusca</i>
Rainbow Bee-eater	<i>Merops ornatus</i>	Weebill	<i>Smicromnis brevirostris</i>
Oriental Dollarbird	<i>Eurystomus orientalis</i>	*Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>
Azure Kingfisher	<i>Ceyx azureus</i>	Grey-crowned Babbler	<i>Pomatostomus temporalis</i>
Forest Kingfisher	<i>Todiramphus macleayii</i>	*Varied Sittella	<i>Daphoenositta chrysoptera</i>
Sacred Kingfisher	<i>Todiramphus sanctus</i>	Australasian Figbird	<i>Sphecotheres vieilloti</i>
Red-backed Kingfisher	<i>Todiramphus pyrrhopygius</i>	Olive-backed Oriole	<i>Oriolus sagittatus</i>
Laughing Kookaburra	<i>Dacelo novaeguineae</i>	Rufous Whistler	<i>Pachycephala rufiventris</i>
Blue-winged Kookaburra	<i>Dacelo leachii</i>	Grey Shrike-thrush	<i>Colluricincla harmonica</i>
Nankeen Kestrel	<i>Falco cenchroides</i>	Ground Cuckoo-shrike	<i>Coracina maxima</i>
*Australian Hobby	<i>Falco longipennis</i>	Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>
Brown Falcon	<i>Falco berigora</i>	White-bellied Cuckoo-shrike	<i>Coracina papuensis</i>
Peregrine Falcon	<i>Falco peregrinus</i>	*Common Cicadabird	<i>Edolisoma tenuirostre</i>
Cockatiel	<i>Nymphicus hollandicus</i>	White-winged Triller	<i>Lalage tricolor</i>
Red-tailed Black-Cockatoo	<i>Calyptorhynchus banksii</i>	Varied Triller	<i>Lalage leucomela</i>
Galah	<i>Eolophus roseicapilla</i>	Pied Currawong	<i>Strepera graculina</i>
Sulphur-crested Cockatoo	<i>Cacatua galerita</i>	Australian Magpie	<i>Gymnorhina tibicen</i>
Pale-headed Rosella	<i>Platycercus adscitus</i>	Pied Butcherbird	<i>Cracticus nigrogularis</i>
Rainbow Lorikeet	<i>Trichoglossus moluccanus</i>	Grey Butcherbird	<i>Cracticus torquatus</i>
Budgerigar	<i>Melopsittacus undulatus</i>	Masked Woodswallow	<i>Artamus personatus</i>
Red-winged Parrot	<i>Aprosmictus erythropterus</i>	White-browed Woodswallow	<i>Artamus superciliosus</i>
Spotted Bowerbird	<i>Chlamydera maculata</i>	Black-faced Woodswallow	<i>Artamus cinereus</i>
Great Bowerbird	<i>Chlamydera nuchalis</i>	Little Woodswallow	<i>Artamus minor</i>

## Appendix 1 continued

Common Name	Scientific name	Common Name	Scientific name
White-breasted Woodswallow	<i>Artamus leucorhynchus</i>	Australian Reed-Warbler	<i>Acrocephalus australis</i>
Willie Wagtail	<i>Rhipidura leucophrys</i>	†Brown Songlark	<i>Cincloramphus cruralis</i>
Grey Fantail	<i>Rhipidura albiscapa</i>	Rufous Songlark	<i>Cincloramphus mathewsi</i>
Spangled Drongo	<i>Dicrurus bracteatus</i>	†Tawny Grassbird	<i>Cincloramphus timoriensis</i>
Leaden Flycatcher	<i>Myiagra rubecula</i>	Fairy Martin	<i>Petrochelidon ariel</i>
Restless Flycatcher	<i>Myiagra inquieta</i>	†Tree Martin	<i>Petrochelidon nigricans</i>
Magpie-lark	<i>Grallina cyanoleuca</i>	†Welcome Swallow	<i>Hirundo neoxena</i>
Torresian Crow	<i>Corvus orru</i>	Mistletoebird	<i>Dicaeum hirundinaceum</i>
Australian Raven	<i>Corvus coronoides</i>	Chestnut-breasted Mannikin	<i>Lonchura castaneothorax</i>
White-winged Chough	<i>Corcorax melanorhamphos</i>	Plum-headed Finch	<i>Neochmia modesta</i>
Apostlebird	<i>Struthidea cinerea</i>	Black-throated Finch	<i>Poephila cincta</i>
Jacky Winter	<i>Microeca fascinans</i>	Zebra Finch	<i>Taeniopygia castanotis</i>
†Hooded Robin	<i>Melanodryas cucullata</i>	Double-barred Finch	<i>Taeniopygia bichenovii</i>
†Horsfield's Bushlark	<i>Mirafrja javanica</i>	*House Sparrow	<i>Passer domesticus</i>
Golden-headed Cisticola	<i>Cisticola exilis</i>	†Australasian Pipit	<i>Anthus novaeseelandiae</i>