

AUDIOWINGS

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Spotted pardalotes:

Row 1: Olympus LS10 recorder and habitat; FEL Clippy mic with lichen cover; lichen-covered mic at nest.

Row 2: male singing territorial song; male at nest (note yellow throat); female near nest (note pale throat).

Row 3: first two images are young just out of the nest; third image is a juvenile five weeks since fledging.

Images by Vicki Powys.

Spotted pardalote (*Pardalotus punctatus*) nesting vocalisations in Capertee Valley, NSW.

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Summary

Two successive spotted pardalote broods produced eight fledglings from a single nest burrow in the spring and summer of 2021-22. The nest was situated 70 metres from my home in Capertee Valley NSW. I documented nesting behaviour with audio recordings, video footage and photographs.

Introduction

Whilst exploring bushland near my home in September 2021, a sudden whirr of wings at my feet revealed a pair of spotted pardalotes busily digging a nest burrow. Thus began my journey into the contradictory world of these tiny, colourful birds that nest underground but forage in the very tops of the tallest eucalypts. The pardalotes' short bell-like notes seem to match their beautiful spotted markings.

One of four species of pardalote endemic to Australia, spotted pardalotes feed mainly on lerp (the sugary housing of psyllid insects found on gum leaves), and also small spiders and insects. Their song and calls are relatively simple, described in HANZAB Volume 6 (Higgins & Peter 2002) as 'well-known' but referencing only a few older studies where descriptions and call names are confusing and lack supplementary audio. Calls of nestlings and fledglings are poorly described.

Anecdotal references describe the adult song as being ventriloquial, and one early account wrongly considered the *sleep bab-ee* song was a duet between male and female (Chandler 1961; Brunt 1962). These fast-moving little birds are difficult to see in the canopy, hence the confusion. There were encouraging references (Richards 1971; Hubregtse 2016) to spotted pardalotes being tolerant of a human observer near the nest.

I wondered how the wet, cool and windy La Niña spring weather might affect the pardalotes and if their underground nest might get flooded. I noted that spotted pardalotes did well even on Bruny Island in Tasmania (Woinarski 1985), so perhaps a wet spring in NSW could be tolerated. Could I pick male from female by the pitch of their calls as Richards had done in 1971? Was it possible to record the nestlings being fed, deep in their burrow? And would I be alerted to imminent fledging by increased calling by the parents at the nest (Mollison 1960)?

I videoed many aspects of the nesting attempts to better study the behaviour that went with the calls and songs, and often recorded simultaneously with a small audio recorder (Powys 2021, 2022). No playback was used. I experimented with microphone placement at the nest, with mixed results.

For this article, calls and songs for male, female and young were verified by video footage and are described with sonograms (Figures 1 & 2). Recordings can be heard on the accompanying *AudioWings* CD. See Box 1 for recording equipment.

Habitat, nest site and plumage

The study took place in dry woodland habitat on my property in Capertee Valley NSW, for four months from September 2021 to January 2022. Vegetation included ironbark, red gum, native pine and acacia. Nest 1 in an upturned tree root was soon abandoned, with Nest 2 then occupied 35 metres away presumably by the same pair. Both nests were within 100 metres of my house. Nest 2 was later re-used to become Nest 3. I visited Nests 2 and 3 almost daily for four months – from 10 September to 8 November when three young fledged, then from 16 November to 8-9 January when five more young fledged from the same burrow.

Nesting adults were easily identified by their plumage, the male having a yellow throat and the female a pale throat. Also, the male had a red rump and the female an orange rump, seen as they entered the nest. Nesting duties were shared equally, from burrowing, bringing nest material, incubation, feeding nestlings and tending fledglings.

The nest entrance was east facing, situated in a shallow depression that may have originally been dug by an echidna or wombat. I was unable to measure the burrow length without damaging it, but estimated about half a metre (can be up to 1.5 metres).

The pardalote family occupied a foraging area of about 5 hectares covering a 125 metre radius around the nest. Boundaries were judged by calls heard in the distance from other males. Potential nest predators included goannas and foxes, both able to dig out the burrow.

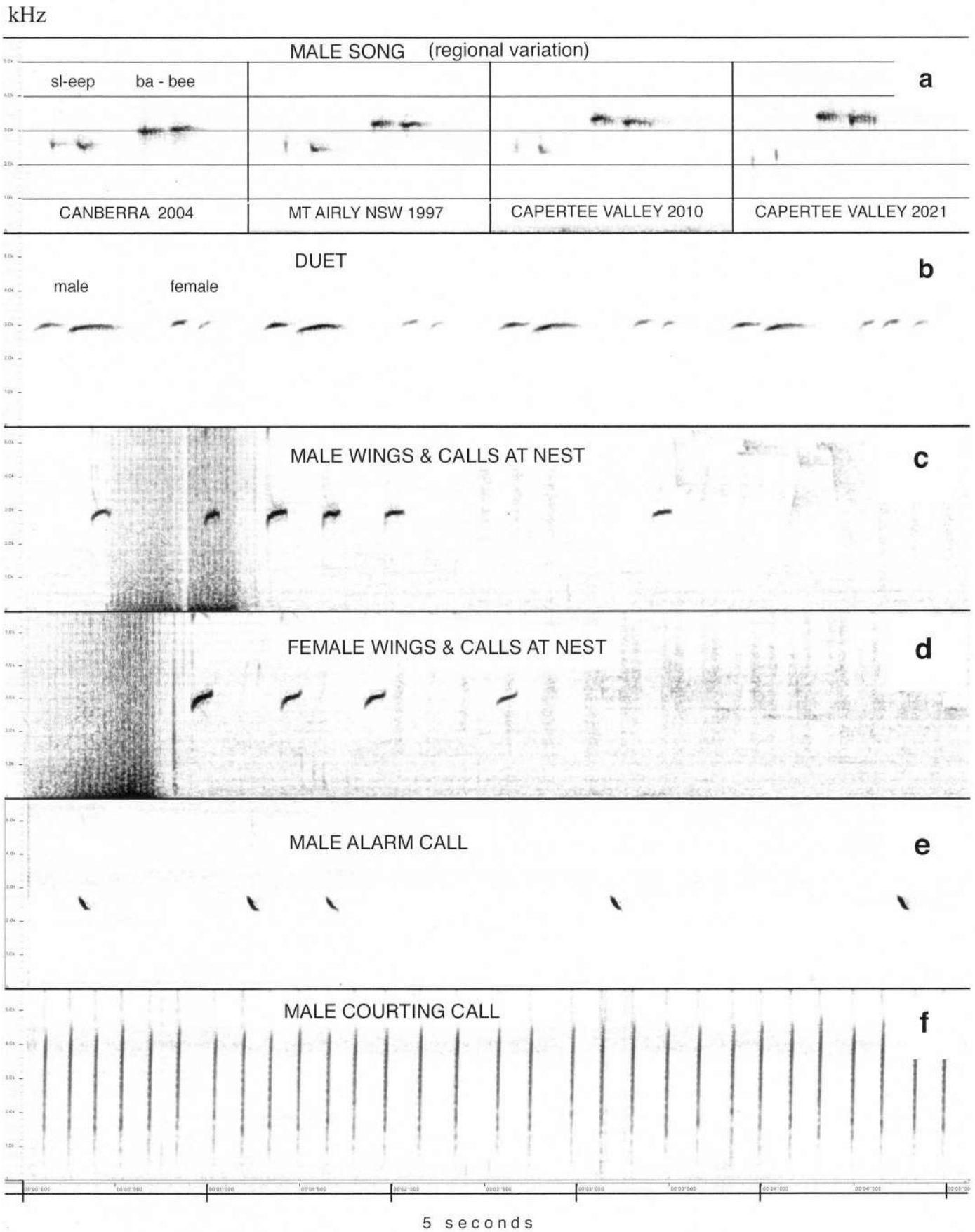
Fieldcraft

I learned over many days that the birds would NOT tolerate any equipment set up remotely (e.g. camera on a tripod or a small recorder wrapped in cammo cloth left near the nest entrance). However if I was close to the nest and holding the camera or recorder, the pardalotes were OK with that. The birds were accustomed to me, but not to my gear! Eventually I was able to set up a folding stool less than 2 metres from the nest entrance from where I could quietly observe for hours at a time without affecting the birds' behaviour.

The female in particular was sensitive to any micro-landscape changes within 40 cm of the nest entrance. She baulked and fluttered at my tiny lavalier mic on a long lead. I tried various forms of camouflage – green mohair wool wrapped around the mic, then a small piece of green cloth – both of these were pecked at by the female but tolerated by the male. I moved the mic further back and investigated natural materials.

The most successful camouflage was a piece of coral lichen tied to the mic with a strand of grey thread. I painted the audio lead 'army green' and covered it with a piece of bark. Eventually the mic was successfully positioned 20 cm from the nest entrance. When I was not recording, I swapped the real microphone for a same-sized piece of coral lichen. The birds soon got used to the lichen being there, and did not react to it.

Figure 1

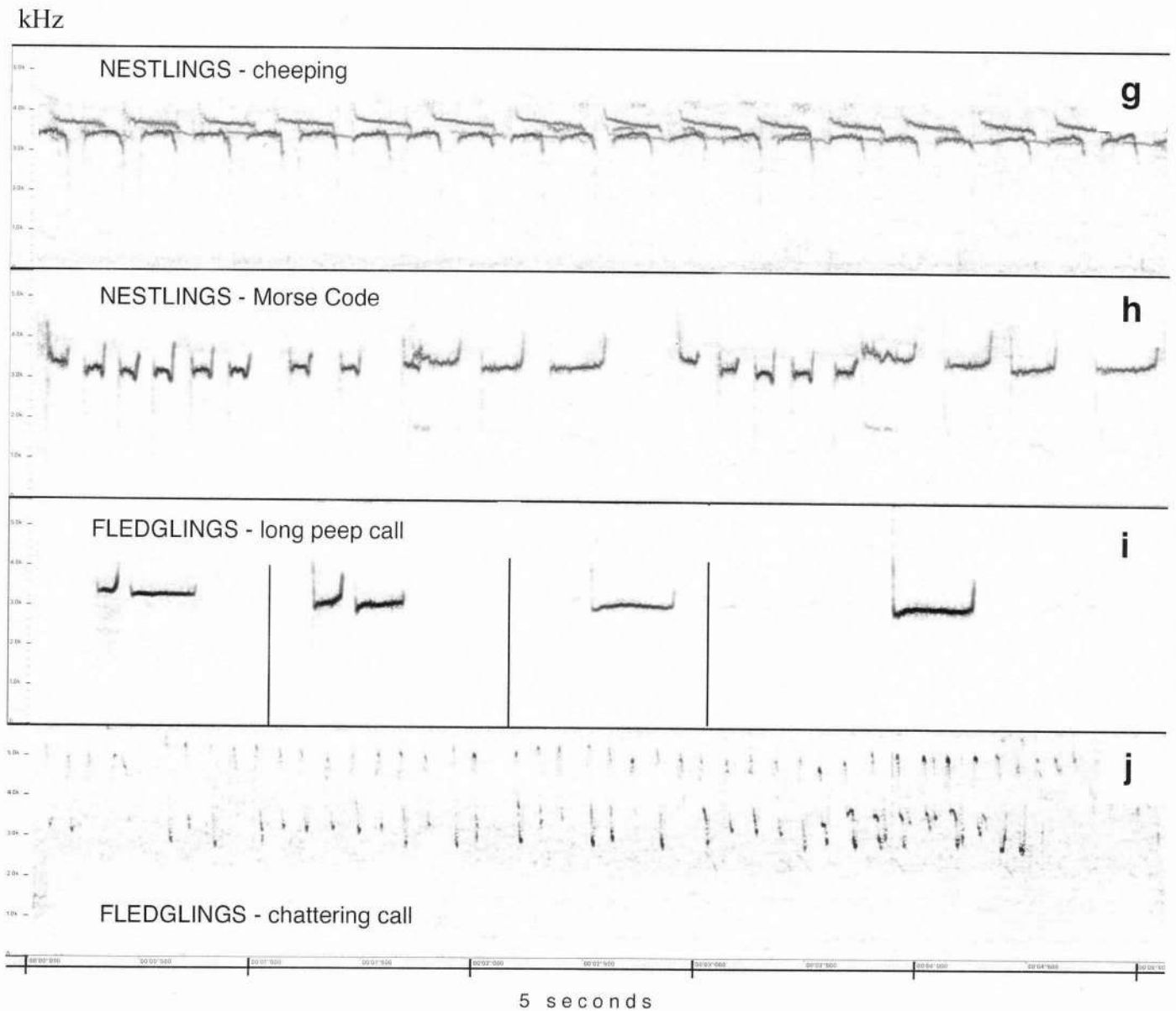


Whenever possible, I waited until the adults were away from the nest before doing the swap. I used a 12 metre audio lead so that I could monitor with headphones at a distance.

I checked if my own proximity to the nest affected

nesting behaviour, by comparing the number of nest-feeding visits per hour (and behaviour generally) from 1.5 metres and from 10-20 metres away. I was satisfied that my close presence was not affecting the birds' behaviour, at all stages of nesting.

Figure 2



Nest results

Nest dates and details

Table 1—Nest dates

NEST I.D.	DIGGING BURROW	LINING NEST CHAMBER	LAYING EGGS	HATCHING OF YOUNG	FLEDGING	HANZAB estimated fledging
1	31 AUG	abandoned				
2	about 3 SEP	10 SEP	17 SEP	16 OCT	8 NOV (23 days) from 9.48 am total 3 young	18-25 days/ at least 23 days
3	N.A.	16 NOV	27 NOV	14 DEC	8-9 JAN (25 -26 days) 2.30 pm (1) & from 7.45 am (4) total 5 young	as above

Nest results

NEST 1: excavation was abandoned after two days because of burrow obstacles.

NEST 2: Burrow excavation (not seen) was estimated to have begun 3 September. From 10-17 September adults brought bark fibres to the burrow. Egg laying and incubation occurred during four weeks of cool, rainy weather, estimated from 17 September when the adults stopped bringing nest material and began spending long periods in the nest. Incubation sittings averaged 39 minutes (n=6), with parents doing alternate shifts. Eggs hatched four weeks later, on about 16 October when I first observed the male with food in his beak, entering the burrow. Young were then fed on average every 6 minutes (n=13), again with parents alternating their visits but sometimes arriving together. Faecal sacs were removed by parents and dropped some distance away. Three young fledged 23 days later on 8 November between 9.42 and 10.07 am, with much calling from the adults. This event was captured on video (Powys 2021).

NEST 3: The existing burrow of Nest 2 was renewed from 16-26 November, with fresh bark fibres being added and some older material removed. The male often gave the territorial song during this time. While the adults refurbished the nest they also tended and fed the young that had fledged on 8 November. Eggs hatched on 14 December when the male was seen bringing food and the female removed a faecal sac from the nest. Five young fledged over two days 8-9 January, and this was captured on video. The first one exited the nest at 2.30 pm on 8 January in hot sunshine with no adults present, and after pausing and calling for several minutes, it flew upwards into a native pine tree. No more young left the nest that day, despite urging from the parents. 30 mm rain then fell overnight, and showers continued next morning with thunder rumbling in the distance. The rain had quietened the cicadas, and I witnessed three more young leave the nest in light rain between 7.45 am and 8.11 am. Another young one (unseen by me) had fledged prior to 7.45 am while I was sheltering from the rain. On the evening of 9 January, I videoed the five new fledglings snuggled together in a row on a high eucalypt branch, about 70 metres from the nest (Powys 2022). For Nest 3, incubation sittings averaged 40 minutes (n=10 sittings 3-13 December), and nestlings were fed on average every 6.9 minutes (n=228 visits 30 December to 8 January).

The male and female had different nest approach and departure routes. The female invariably flew direct to the nest from a perch 3 metres above the nest, while the male descended via a series of perches to 1.4 metres above the nest, pausing there to listen for calls from the young before entering the burrow.

HANZAB (pp 43-44) provided these possible dates for nesting activities: excavating burrow 2-20 days; lining the nest chamber 5-10 days; incubation of eggs 16-22 days; nestling stage 'at least 23 days' and '18-25 days'; independence 'probably independent after 8 days' and 'once, incubation of subsequent clutch began while parents were still feeding fledged young from previous brood'.

Vocalisations

Terminology

Sonograms are read from left to right, with a 5.6 kHz (kilohertz) scale on the y-axis showing pitch, and a 5-second scale on the x-axis showing time. More precise kHz measurements were made using the spectrum function of Amadeus Pro, which measures the strongest point of a single note.

Territorial song

Described in the literature as a bell-like *sleep bab-ee*, the song has four notes and is relatively loud compared to other calls, and was the highest pitch of all calls at 3.4 kHz. I have only seen the male giving this call (Fig 1a). My video footage showed the male (perched just below the canopy of a tall ironbark), turning from side to side, neck stretched upwards, giving a series of open-beaked *sleep bab-ee* phrases (Powys 2021). This song varies regionally but has remained stable locally for many years, indicating a sedentary local population. A lower-pitched (2.9 kHz) 2-note call may also be territorial song, again given by the male with wide-open beak and neck stretching. It was often answered by the female (with a higher pitched 2-note call of 3.0 kHz) in a duet (Fig 1b).

Contact calls

Both parents gave 1-2 note calls when perched above the nest and when entering the burrow. The throat swelled slightly but the beak was almost closed. I was able to tell the sexes apart from sonograms of these calls, and less reliably by ear. The female (at 3.0 kHz) sang a semitone higher than the male (at 2.9 kHz) and her note had an upwards inflection (Figs 1c, 1d). Three and four-note variations were also recorded. When nestlings were less than one week old, the parents gave many calls when approaching and entering the burrow. In the nestlings' third week, there were almost no calls from the parents at the nest.

Alarm call

A downwards 'squeak' call (2.5 kHz) was occasionally heard from the male, apparently given as a warning of perceived danger, e.g., once when I was too closely photographing the male, another time when magpies, and a grey butcherbird, came close to the nest (Fig 1e).

Courting calls

A series of rapidly repeated *pit-pit-pit* notes were given by both male and female, sometimes continuing for a minute or more by the male, during nest building and incubation changeovers when both adults were in the burrow together. I also recorded this call when male was in the burrow with five young ones, two days before they fledged (Fig 1f). Each *pit* note slopes upwards from 1-5 kHz.

Encouragement calls

For several days before the young fledged, both adults sporadically gave encouragement calls to the young, urging them to leave the nest. On the day of fledging, a parent would enter the nest with food then not feed the young, instead backing out of the nest while calling, then flying off still calling. These call notes were

the same as for Figs 1c and 1d.

Nestlings

With the benefit of a close mic and headphones, I could hear the nestlings give progressively louder cheeping calls (Fig 2g). Without this hearing aid, their calls were almost inaudible even when I was sitting close to the nest. In the week before fledging, the young also gave long and short piping notes that sounded like Morse code! (Fig 2h). When 16 days old, young in the nest began to answer the calls of the male parent perched outside. Occasionally wing-exercising sounds were heard in the nest in the days before fledging. When the young emerged from the nest for the first time, they gave longer peep calls, each individual having their own pitch (Fig 2i). Measurements of these ranged from 3.4 kHz down to 2.9 kHz. Upon take-off from the nest, they each uttered a triple-note.

Fledglings

In the treetops the new fledglings gave 1-5 piping notes and also a constant tremulous chattering (Fig 2j), presumably a combined begging and contact call. The

chattering was faint, only properly heard using a gun mic and headphones. The birds' tails quivered as they gave this call.

Vocalisations in the literature

Table 2 summarises spotted pardalote call descriptions from the literature, as quoted in HANZAB (pp 40-41). Richards (1972) described three distinct calls and was able to identify male and female as they approached the nest, but unlike my own findings, Richards found the pitch of the male was higher. Richards heard the 'series of rapid zits' only during nest excavation, whereas I (with the aid of a close microphone) heard it during all stages of nesting. Short *et al.* (1983) described with sonograms six calls for race *punctatus* that I have included in the table, plus a brief description of the fledgling begging calls for race *xanthopygus*. I did not hear the high pitched *whee* call that Short mentioned. I found Short's call names confusing e.g. *weep*, *weet*, *whee*. Short made no attempt to differentiate between male and female calls, apart from the *sleep ba-bee* call which he observed was only sung by the male.

Table 2— comparison of call descriptions from the literature.

RICHARDS 1972	SHORT 1983	POWYS 2022
sleep bab-ee	sweet bab-ee	sleep bab-ee territorial song
-	-	duet territorial song
pe-he call	long weep call	1-3 note contact calls
-	weet call	1-3 note contact calls
-	whee call (high pitched)	(not heard)
-	-	1-note contact calls male & female at nest
-	short weep call	alarm call
rapid zits	fast chip call	courting call
-	-	cheeping (nestlings)
-	-	long peep call (fledglings)
-	-	Morse code (nestlings)
-	begging calls (race <i>xanthopygus</i> only)	chattering (fledglings)

Conclusion

The cool and rainy La Niña weather during spring and summer suited the pardalotes, who successfully raised two broods totalling eight young ones. One brood had fledged, undeterred, in light rain. The underground burrow did not flood even during the torrential rain that had caused local road closures and raging rivers and creeks.

The adults were remarkably tolerant of me as an observer, but four months of observations for the

two broods, required some stamina! I was keen to witness any fledging events, but the '18-25 days' fledging period given in HANZAB was rather open ended and gave no indication of time of day. As it turned out, one brood took 26 days! Observational lessons I learned from the first nest were put into practice for the second nest, e.g., the use of a small, well-camouflaged microphone placed close to the nest.

All the young pardalotes survived for at least the first month after leaving the nest. They soon

learnt how to find lerp, and on hot days, where to find the water dishes in my garden. In January, within a 2-kilometre radius of my home, I noted a number of other successful spotted pardalote families, with small flocks numbering up to 17 individuals. In February as I write this article, the treetops are filled with soft chiming calls from juveniles and adults alike, with some young ones attempting the higher pitched territorial song, albeit a little wobbly.

Predators had failed to materialise, although there were some anxious moments e.g., nearby were black snake, goanna, butcherbirds, ravens, sparrowhawk and fox. In the spring I had seen many arboreal nests of small birds predated by larger birds, but the pardalote burrow remained secure. The closed canopy of my woodland acreage excluded noisy miners, which also eat lerp and are known to attack pardalotes.

In December and January, the deafening roar of cicadas, especially razor grinders, made aural observations difficult for me but may have helped protect the nestlings by masking their cheeping calls. The cicadas also provided an easy meal for the larger birds (rather than nestlings).

I felt fortunate to have observed five new fledglings roosting high up in a eucalypt on the evening of their first day out of the burrow. This was only possible because I had learned what calls to listen for. I was also able to obtain some video footage of them (Powys 2022).

As for the vocalisations, I have extended current knowledge by describing distinctive calls of male and female at the nest, also a duet, and verified these calls with video footage. HANZAB had no information on calls for nestlings and fledglings, so I have filled that gap too.

If I am lucky enough to find another pardalote nest in the future, I will be interested to know if adult female calls are consistently higher than male calls, as I found

in this study. And I wonder if those calls are regionally, and individually, variable? Also, I would love to obtain more video footage of that intriguing duet!

Acknowledgments

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Box 1 Recording equipment

Olympus LS10 recorder (WAV files, 24 bit/ 44.1 kHz); Sennheiser ME66 gun mic in Rode pistol-grip with slip-on windshield; Telinga 1-point stereo mic; FEL 'Clippy' PIP electret mic on long lead placed close to the nest entrance; handheld Lumix DMC-TZ80 pocket camera with x30 optical zoom. Observations were made pre-dawn to dusk, almost daily. Audio was edited using Sound Studio 4 (v 4.8.14) and iZotope RX7. Spectrograms were made using Amadeus Pro (v 2.7.5) on an iMac desktop computer (OS v 10.15.3 and 11.6.2). Adobe Photoshop Elements was used to edit the sonograms. iMovie & Quicktime were used to produce the video/s. Other useful fieldwork items included Swarovski 8 x 20B binoculars, folding stool and insect repellent.