

A population of the rare Northern Shrike-tit that forages and breeds in a seasonally inundated paperbark woodland in Arnhem Land, Northern Territory

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Abstract

The vast majority of records of the Northern Shrike-tit (*Falcunculus whitei*) in the Top End of the Northern Territory are from eucalypt woodlands in inland localities, mostly in the Katherine-Maranboy region, approx. 250 km from the nearest coastline. This report summarises observations of a small resident population of these rare birds which is largely confined to a paperbark woodland on the seasonally inundated floodplain of the Tomkinson River, a tributary of the Liverpool River, only 17–35 km from the coast of western Arnhem Land. The population is apparently isolated and small (8–50 pairs) with a relatively low density (est. 0.01 birds ha⁻¹), and given its existence since at least 2000, appears sustainable. These birds forage mainly on Broad-leaved Paperbark (*Melaleuca viridiflora*), in which they obtain arthropod prey from both leaves and bark. Nest-building was observed in September and October, and dependent juveniles were present in two territories in early March. One nest was built in a paperbark tree, the lowest nest height (6.5 m) reported for the species to date and the first in a non-eucalypt. Vocalisations of birds in this population differed from those described and recorded in the literature for the species. Although it has been argued that the scarcity of this species in northern Australia is due to the paucity of eucalypt species that shed their bark annually, both the Tomkinson River population and some populations of the species' two congeners forage partly, or even largely, on foliage.

Introduction

Patchily distributed within the Top End of the Northern Territory and the Kimberley region of Western Australia, the rare Northern Shrike-tit (*Falcunculus whitei*) (Figure 1) differs slightly in appearance from the commoner Eastern Shrike-tit (*F. frontatus*) in being smaller with a relatively larger bill, and in having more white on its face and yellowish (instead of grey) edges to its wing feathers (Franklin *et al.* 1997; Higgins & Peter 2002; Menkhurst *et al.* 2017), as well as in its song (Rix 1970). Formerly listed as Endangered (Garnett & Crowley 2000; Higgins & Peter 2002), based on the paucity of records and

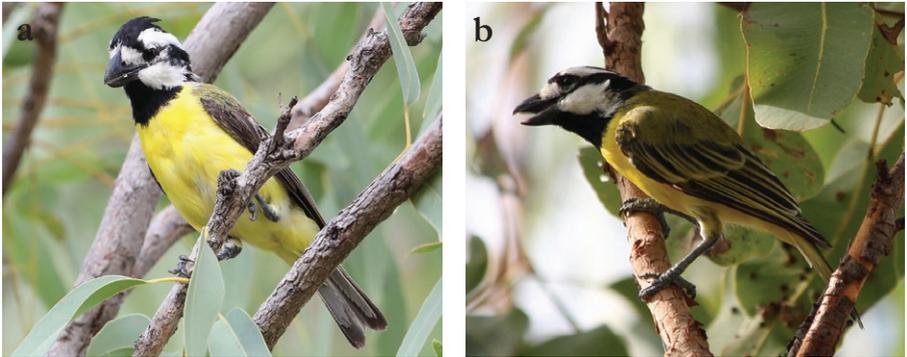


Figure 1 (a, b). Northern Shrike-tit, male, Central Arnhem Road, 9 February 2020. (Marc Gardner)

information on its ecological requirements, this bird is now classified as Near-threatened in the Northern Territory (Woinarski & Ward 2012), though it is not listed as Threatened in Western Australia. Nevertheless, it is arguably one of the rarest and most patchily-distributed resident bird species in the Top End. In this paper I follow BirdLife Australia (2020) in treating the taxon as a full species.

The first specimens of the Northern Shrike-tit were collected in the northwestern Kimberley in 1910 by Gerald Hill (Hill 1911), while obtaining specimens for the eminent grazier and natural historian H.L. White, in whose honour the bird had been named *Falcunculus whitei* a year earlier by Campbell (1910). Only three years later it was discovered in the Northern Territory at Borrooloola Station on the McArthur River in the southeastern corner of the Top End. Somewhat ironically, although Hill had been stationed there for six months during 1911–1912, it was Henry (Harry) Barnard who found the species at Borrooloola and collected a specimen in June 1913, and its nest and eggs in January 2014 (Barnard 1914; White 1914; LeCroy 2010). Remarkably however, the species has not been seen since in the region or anywhere nearby, despite numerous surveys in the McArthur River area (Robinson & Woinarski 1992). It was not until 1944 that the species was recorded in the Top End again; this time by English-born Eric Sedgwick (Sedgwick 1947) while serving with the Royal Australian Air Force during WW II, and its location was Larrimah, approx. 335 km WNW of Borrooloola and approx. 250 km SSW of the nearest coast of the Gulf of Carpentaria. Since then, most sightings of this species have been concentrated in the region between Pine Creek, Maranboy and Mataranka (Rix 1970; Holmes & Noske 1990; Robinson & Woinarski 1992; Franklin *et al.* 1997; McCrie & Watson 2003).

The habitat and foraging behaviour of the Northern Shrike-tit were reviewed by Robinson & Woinarski (1992), who showed that the vast majority of records known at the time were from eucalypt woodlands, especially those dominated by Darwin Stringybark (*Eucalyptus tetradonta*), Darwin Woollybutt (*E. miniata*) and Shiny-leaved Bloodwood (*Corymbia bleeseri*). The scant information on its foraging behaviour and diet

suggests that, like its southeastern counterpart, it prises or tears bark from living or dead eucalypts (Sedgwick 1947; Robinson *et al.* 1992; Robinson & Woinarski 1992) and hunts among dead leaves (Barnard 1914) in search of insects and spiders. All nests found to date have been in eucalypts (Barnard 1914; Ward *et al.* 2009). In this paper, I provide details of the habitat, foraging behaviour, breeding season and vocalisations of a population of Northern Shrike-tits that live on a seasonally inundated floodplain in sub-coastal western Arnhem Land.

Study area and historical background

Much of the eastern half of the Top End lies within Arnhem Land, which is managed by the Indigenous traditional owners. Access to Arnhem Land requires permits from the Northern Land Council, and, as such, it is rarely visited by ornithologists or birdwatchers (Noske 2017). Until the present century, bird specimen collections and surveys had been restricted to Cobourg Peninsula, in the extreme northwest of Arnhem Land, during the 1840s and 1960s (Frith & Hitchcock 1974; Fisher & Calaby 2009), to King River in 1915–1916 (White 1917a,b), Gunbalanya (formerly Oenpelli) in 1948 and 1968 (Deignan 1964; Hall 1974), and to Gove Peninsula in the 1940s (Humphries 1947; Deignan 1964), in 1974 (Boekel 1976), and in 1998–2000 (Brady & Noske 2010). Significantly, Shrike-tits were not recorded in any of these localities.

The first record of Northern Shrike-tits in northern Arnhem Land was of a pair in eucalypt woodland 35 km south of Ramingining on 6 August 1990 (Robinson *et al.* 1992; ALA 2020: catalogue no. 1131353). Ten years later, while conducting bird surveys in Arnhem Land for the second national *Atlas of Australian Birds* (Barrett *et al.* 2003), I was attracted to an unfamiliar call at a site approx. 15 km east of Mumeka outstation and the Mann River crossing along the road from Gunbalanya to Maningrida, on 27 September 2000. This area was not revisited until October 2008 when I was leading a ‘Bird Week’ tour from the Arnhem Land Barramundi Nature Lodge, 17 km SSE of Maningrida. During the following two years, similar tours of 5–7 days were undertaken in June and September 2009, and June–July 2010. All the tours included a vehicular trip or walk to Nangak floodplain lying between the Tomkinson River and the rocky escarpment on which Arnhem Land Barramundi Nature Lodge and Djinkarr Ranger Station (1.7 km south of ABNL) are perched.

In addition to co-leading these bird tours with colleagues Johnny Estbergs and Dick Eussen, I conducted 20 min censuses of 17–19 x 2 ha plots within 20 km of the Arnhem Land Barramundi Nature Lodge in each of six months (October 2008, January, May, August and December 2009, and March 2010). This study compared the avifauna of two distinct local habitats: (1) open eucalypt forest dominated by Darwin Wollybutt and/or Darwin Stringybark, on the rocky plateau (60–80 m asl; n = 8 sites) situated 0.5–12 km from ABNL, and (2) open paperbark woodland dominated by Broad-leaved Paperbark (*Melaleuca viridiflora*) on the seasonally-inundated floodplain (4–40 m asl; n = 9 sites) on the abovementioned Gunbalanya-Maningrida Road, between Mumeka in the west and



Figure 2. Map of study area, showing location of sites mentioned in Tables 1 and 2 and the text. The inset indicates the area's location within Arnhem Land. (Niven McCrie)

the turnoff to Ramingining in the east. All but two of the nine paperbark woodland sites were located along a 10 km span of this road, stretching between 15 and 25 km from Mumeka to the Kolorbidahbidah turnoff, 6.5 km south of the Ramingining turnoff, and hereafter referred to as the Upper Tomkinson floodplain (Figure 2). Two additional lower elevation sites differed from the other sites in not being dominated by paperbarks or eucalypts of the abovementioned two species, and were classified as 'mixed woodland' (Figure 3). All the plots were normally sampled three times over 2–3 consecutive days except in January, when four of the paperbark plots could not be accessed due to flooding of the road, and December, when only



Figure 3. Paperbark woodland habitat in: **a.** January 2009 (Nangak), **b.** March 2010 (Site SD) (surface water present), **c.** May 2009 (Site FI) and **d.** mixed woodland habitat in May 2009 (Site CA). The sites are described in Table 1. (Richard Noske)

paperbark sites were sampled, and only once due to inclement weather. Detailed results of that study will be presented elsewhere. Shrike-tits were located by listening for their vocalisations, sometimes after playing recordings of their calls on an MP3 player.

Results

Shrike-tits were recorded during 25 censuses overall, involving eight sites, six of which were in paperbark woodland (n=124) and two in mixed woodland (n=27 censuses), all at elevations below 40 m asl (Table 1). They were not recorded at any of the eight sites in eucalypt forest on the plateau (n=98), where the trees were typically 17–20 m high, most with an understory of Sand Palms (*Livistona humilis*) and several *Acacia* species. The six paperbark woodland sites were dominated by Broad-leaved Paperbark, typically 5–9 m high, with scattered Round-leaved Bloodwood (*Corymbia latifolia*) and/or Hills Salmon Gum (*E. tintinnans*), 9–12 m high, small patches of Coastal Paperbark (*M. acacioides*), 3–5 m high and a ground cover of grasses including *Eriachne burkettii*, *Pseudopogonatherum contortum*, *P. irritans* and *Heterachne gulliveri*. Of the two mixed woodland sites, one was in a poorly-drained area of open woodland comprising a mixture of Long-fruited Bloodwood (*Corymbia polycarpa*) and Swamp Box (*Lophostemon lactifluus*), with scattered Broad-leaved Paperbark, and other species (e.g. *Grevillea pteridifolia*). The other mixed woodland site was in open eucalypt woodland on a well-drained, low, rocky hillside situated between two paperbark woodland sites, and was dominated by scattered Round-leaved Bloodwood and Darwin Stringybark, with groves of Quinine Tree (*Petalostigma pubescens*) and scattered Cooktown Ironwood (*Erythrophloeum chlorostachys*) (Table 1).

About half (13) of all records of Shrike-tits during the censuses were from two sites (AC and NE), where birds were encountered on 50% and 38% of censuses, respectively

Table 1. Characteristics of the eight census sites where Northern Shrike-tits were found, and the number of censuses in which they were recorded. Total number of censuses in brackets. Note that “KT*” stands for the Kolorbidahbidah turnoff and the symbols in the last column stand for the following plants: Al, *Acacia leptocarpa*; As, *Asteromyrtus symphiocarpa*; Ce, *Calytrix exstipulata*; Cl, *Corymbia latifolia*, Cp, *C. polycarpa*; Ei, *Eucalyptus tintinnans*; Et, *E. tetradonta*; Gp, *Grevillea pteridifolia*, Ll, *Lophostemon lactifluus*; Ma, *Melaleuca acacioides*; Pp, *Petalostigma pubescens*; Rc, *Erythrophloeum chlorostachys*.

Site code	Distance (km) from KT*	Woodland type	Elevation (m asl)	No. censuses recorded (n)	Estimated % <i>M. viridiflora</i>	Other plant species present
CA	3.4 N	Paperbark	33	1 (13)	60	Cl, Ce, As
PT	1.2 N	Mixed	31	2 (13)	10	Cp, Ll, Gp,
NE	1 W	Paperbark	20	6 (16)	85	Cl, Al
AC	2.3 W	Paperbark	13	7 (14)	75	Cl, Ei, Gp, Al
QU	3.4 W	Mixed	10	2 (14)	30	Pp, Cl, Et, Rc
GR	9 W	Paperbark	5	3 (13)	75	Ma, Gp, Al
SO	10 W	Paperbark	6	1 (14)	90	Ma, Al
FI	11 W	Paperbark	5	3 (14)	95	Al, Ma

(Table 1). Shrike-tits were recorded in each of the three Dry season and three Wet season months sampled, but were least frequently encountered in May (Figure 4). Relative frequencies for January and December may be under-represented or over-represented due to sampling biases caused by rain and flooding, respectively. In addition, Shrike-tits were observed on Nangak floodplain during 'Bird Week' tours on 22 June and 8 September 2009, on 30 June 2010 and on 2 September 2018. On each occasion, one or two birds were in paperbark woodland similar to that on the Mumeka-Kolorbidahbidah Road

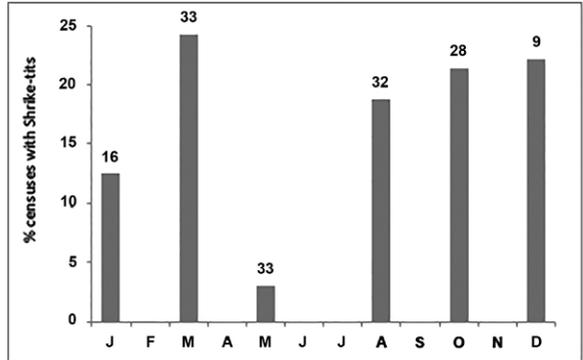


Figure 4. Percentage of censuses on which Northern Shrike-tits were encountered on paperbark and mixed woodland sites. Number of censuses shown above each bar (total number = 151).

Of the eight census sites where Shrike-tits were observed, six (five paperbark woodland sites and one 'mixed' woodland site) were located west of the Kolorbidahbidah turnoff. Birds were recorded in five of these sites on one morning in March 2009, and over two consecutive days in October 2008, indicating there were at least five permanent territories along this 10 km section of road. However, birds were never recorded at two sites near the middle of this section, leaving a gap of 2–5 km. Based on a total road length of 8 km, and assuming that each of the five pair-territories was roughly circular, the diameter of each territory would be 1.6 km and the average size of territories would be 201 ha. Calculating density based on a total road length of 8 km gives an estimated mean density of 0.01 birds ha⁻¹.

Apart from these sites west of the Kolorbidahbidah turnoff, Shrike-tits were found at two census sites located 1.2 km (PT) and 3.4 km (CA) respectively, north of the turnoff (Figure 2, Table 1), so likely involving one or two additional pairs. In addition to those recorded during the censuses, one pair was repeatedly recorded during 'Bird Week' tours in the Nangak area at the northern end of the Tomkinson floodplain, approx. 17 km from the nearest census site (CA). Therefore, the minimum population of the area surveyed was eight pairs. Using the polygon function in Google Earth, I estimate the area of suitable habitat on the eastern side of the Tomkinson River and south to my census sites west of the Kolorbidahbidah turnoff to be at least 100 km². Using this area and the above estimate of density suggests a population of approx. 50 pairs. This might even be conservative as there is probably suitable habitat to the south of the road, since low elevations (less than or equal to 10 m asl) extend at least 4 km inland.

Foraging behaviour

Shrike-tits were observed foraging at least once at each of the nine sites, involving months in both the Wet season (December, January and March) and the Dry season (June, August, October). All but two of the sites were in paperbark woodland, overwhelmingly dominated by Broad-leaved Paperbark, so it is not surprising that 89% of trees in which birds were seen to forage belonged to this species (Table 2). Other species utilised were eucalypts of three species, plus Coastal Paperbark and Cooktown

Table 2. Trees in which Northern Shrike-tits were seen foraging in the study area. Values are numbers of records. GK, Nangak; other abbreviations as per Table 1.

Site	n (days)	Mv	Eucalypts	Ma/Rc
AC	5	34	2(Cl), 2(Et)	2(Rc)
FI	2	8		
SO	2	10		2(Ma)
CA	1	6		
GR	1	5		
NE	1	3		
QU	1	3		
PT	1		1(Cp)	
GK	1	4		
Total		73	5	4

Ironwood (Table 2). Birds of both sexes were observed to glean insects off leaves in Broad-leaved Paperbark (n=11) and *Corymbia* species (n=2). Other foraging manoeuvres seen were chiselling dead branches (n=5) at least once to extract a beetle, prying loose bark on branches (n=5), and piercing swollen twigs, probably to obtain the gall-forming insect larva (n=2). Other prey items were a spider and an unidentified arthropod extracted from tied leaves in two separate paperbarks. On one occasion, the stick case of a moth (Lepidoptera: Psychidae) was opened, its silk lining discarded, and its contents extracted before being carried to another tree.

Breeding

Although nesting was not observed directly, I watched birds building nests at one census site in two seasons, and saw juvenile birds, one of which was dependent, at two other sites. On 20 October 2008, from 07:15 hr I observed an adult female taking bark three times to a nearly complete nest approx. 15 cm below the top of a short (approx. 6.5 m high), spindly Broad-leaved Paperbark at Site NE. Almost one year later, at the same site, on 8 September 2009 from 07:30 hr, I observed the female taking bark, then spider-web, to an incomplete nest approx. 30 cm below the top of a short (approx. 7.5 m) Long-fruited Bloodwood (*Corymbia polycarpa*), while a nearby male, presumably its mate, called every 3–5 minutes for at least one hour.

On 3 March 2010, I watched an adult female feed a juvenile at least five times within 30 min at Site AC (Figure 2). Two days later, I observed an adult pair accompanied by a juvenile at Site CA (Figure 2), although no feedings were seen during the 15 min they were watched. As these two sites were separated by 6 km, it is extremely unlikely that these juveniles refer to the same individual.

Vocalisations

Shrike-tits were heard calling in each census month except for May. Calls were most frequently noted in October when call phrases were repeated up to 26 times without pause, and up to 10 times in March, but rarely in June, August, December and January. Call phrases in the study area typically consisted of three or four notes, the middle or the penultimate note being disyllabic with the second syllable upslurred, or two notes with the first strongly upslurred and the second slightly higher pitched than the start of the first note. On eight occasions, such phrases were uttered 4–10 (mostly 4–6) times in succession, with 1–3 sec between each phrase, but 15–26 times on three other occasions. Such series were repeated for up to 15 min, with gaps of approx. 30 sec to 5 min. Both sexes vocalised, though females were normally silent when the male was nearby. A descending chatter or chuckling call was also uttered by both sexes occasionally.

Discussion

Coastal location and habitat

There are only a few records of the Northern Shrike-tit in coastal or near-coastal localities. Barnard (1914) found the species at Borrooloola, approx. 50 km upstream from the Gulf of Carpentaria on the McArthur River. William McLennan spent almost four months from September 1915 to January 1916 exploring the country around his camp near the mouth of the King River, approx. 80 km WNW of present-day Maningrida, but did not encounter the species (White 1917a, 1917b). In the northwestern Kimberley region, however, Hill (1911) collected a pair near the old Pago mission, approx. 20 km NNE of Kalumburu, within 700 m of the eastern shore of Napier Broome Bay, and saw another pair 17 km inland, in March and June 1910, respectively. Almost 90 years later, two birds were recorded in tall eucalypts along a creek at the ruins of Pago itself in May 1999 (Vigilante 1999). The 1990 record of two birds south of Ramingining (Robinson *et al.* 1992) was 48 km from the nearest coastline and 60 km from the nearest of the Tomkinson floodplain sites. Although the sites west of the Kolarbidahbidah turnoff were 33–36 km from the nearest coastline, birds seen in the northern section (Nangak) of the Tomkinson floodplain were only 18 km inland. Since the discovery of this population, however, a team of Northern Territory Government scientists and Yirrkala Rangers found the species on 21 June 2009 at a site approx. 75 km southwest of Nhulunbuy (ALA 2020: catalogue no. 1151673), only approx. 16 km from the southern shores of Arnhem Bay, northeast Arnhem Land.

On the McArthur River, Barnard (1914: 47) found only a few pairs, and they were “always on the dry stringybark ridges”. Of 14 habitat records collated by Robinson & Woinarski (1992), seven (50%) were in woodlands dominated by Darwin Woollybutt, Darwin Stringybark and Shiny-leaved Bloodwood, while four others were in woodlands dominated by other species of eucalypts, such as Round-leaved Bloodwood, Hills Salmon Gum and Cabbage Gum (*C. polysciada*). Of the remaining three sites, one was dominated by Weeping Paperbark (*M. leucadendra*) and River Red Gum (*E. camaldulensis*),

and another by a *Melaleuca 'miniata'* (presumably misnamed). In the Maranboy area, nests were found in open woodland dominated by Round-leaved Bloodwood, Darwin Box (*E. tectifica*), Large-leaved Cabbage Gum (*C. grandifolia*) and Cooktown Ironwood (Ward *et al.* 2009). In the Kimberley region, their habitat was described as open eucalypt forests and woodlands especially of Darwin Stringybark and Rusty Bloodwood (*C. ferruginea*) on sandstone hills (Johnstone & Storr 2004).

In contrast to the above findings, the Northern Shrike-tits in the present study occurred mainly in paperbark woodland on a seasonally-inundated floodplain, and were absent from the adjacent eucalypt forest, which was dominated by the same eucalypt species as at half of the locations collated by Robinson & Woinarski (1992). The habitat preference of this population is thus clearly atypical for the species, yet the estimated size of the population (8–50 pairs) and its occupation of the area for at least 14 years (2000–2014) suggests that seasonally inundated paperbark woodland is an eminently suitable habitat. Although its congener, the Eastern Shrike-tit, is regarded as a eucalypt forest specialist over most of southeastern Australia (Higgins & Peter 2002), in northeastern New South Wales and southeastern Queensland it occurs just as frequently in subtropical rainforest (Nielsen 1991; Gosper 1992; R. Noske, unpubl. data). Moreover, geographical variation in habitats occurs even among such apparently highly specialised tropical bird species as the Mangrove Robin (*Peneoenanthe pulverulenta*) and the Chestnut Rail (*Enlabeornis castaneiventris*) (e.g. Woinarski *et al.* 1998; Noske *et al.* 2018).

Breeding and vocalisations

Nests of the Northern Shrike-tit have hitherto been found only in eucalypts (including *Corymbia* spp.) and generally at heights greater than 10 m (Ward *et al.* 2009). In the Maranboy area, about halfway between Katherine and Mataranka, Ward *et al.* (2009) found five active nests, three of which were built or being built in Darwin Box, and one each in Large-leaved Cabbage Gum and Round-leaved Bloodwood. All nests were situated in the topmost branches of these trees, 10–15 cm from the edge of the crown, which varied in height from 13.4–16.0 m. The first nest I found on the Tomkinson floodplain was therefore the lowest (6.5 m) reported to date and the first nest recorded in a non-eucalypt.

Consistent with the literature, the breeding (egg laying) season of Northern Shrike-tits on the Tomkinson floodplain apparently spanned the late Dry season and the early Wet season. Nest construction began as early as the first week of September, whereas in the Maranboy area, it was first observed in October (Ward *et al.* 2009). However Shrike-tits sometimes abandon early nests before completion (Marchant 1985; Ward *et al.* 2009). While second broods are common in the Eastern Shrike-tit (Beruldsen 1965; Higgins & Peter 2002), it is not known whether Northern Shrike-tits are multi-brooded. Ward *et al.* (2009) concluded that the nesting season of Northern Shrike-tits is concentrated in the Build-up (October to December), and that late Wet season breeding is unlikely. Assuming that the duration of the nest cycle, from nest building to fledging of the

young, is the same for the two species (approx. 47 days) (Marchant 1985; Higgins & Peter 2002), then birds building as late as November, such as two pairs in the Maranboy study, would be expected, if successful, to have fledglings from mid-December to early January. Although juveniles were seen in two territories on the Tomkinson floodplain in early March, juvenile Shrike-tits are known to be at least partially dependent on their parents for three months or longer (Noske 2003a).

There are few descriptions or publicly available recordings of vocalisations of the Northern Shrike-tit. At Leach Lagoon, approx. 40 km southeast of Katherine, the calls were described as commencing with the “familiar mournful descending notes of the Eastern species but ... followed immediately with an upward group of similar duration and with a similar range of notes but in reverse” (Rix 1970: 173). Northern Shrike-tits on the Tomkinson floodplain never uttered descending notes. A sound recording of Northern Shrike-tits made by Chapman (2020; #057-090) at Drysdale River in the Kimberley region contains eight song phrases, each comprising four notes, the third quickly following the short second note, and the fourth sustained and strongly upslurred. Another recording made by Boersma (2015) at Beswick Creek, east of Maranboy, is similar consisting of a dozen or more song phrases, each comprising three quickly delivered short monotonal notes, mostly followed by a slightly higher-pitched, prolonged and upslurred fourth note, mostly after a slight pause. Calls on the Tomkinson floodplain also consisted of four notes and included upslurred notes, but evidently not at the end of the phrase. Such geographical variation is to be expected, especially since the latter population is isolated and a considerable distance from the Maranboy and Kimberley populations.

Foraging ecology and population density

Shrike-tits are arguably best known for their habit of ripping open and chiseling bark from living and dead trees with their massive bills to expose and obtain arthropod prey. Little is known about the foraging ecology of the Northern Shrike-tits but near Borrooloola, Barnard (1914) observed them hunting insects among “dead leaves and dry tree stems”, while at Larrimah, Sedgwick (1947) saw two birds tearing bark from a limb in a manner similar to that employed by Eastern Shrike-tits. At the Ramingining site, two birds were observed prising bark flakes from branches of Darwin Woollybutt and Shiny-leaved Bloodwood, as well as the bark of one standing dead tree (Robinson & Woinarski 1992). Darwin Woollybutt and Shiny-leaved Bloodwood have smooth bark on the branches and upper trunk, but shed bark is not retained on the tree.

In attempting to explain the scarcity of Northern Shrike-tits, Robinson & Woinarski (1992) drew attention to the paucity of eucalypts with decortivating bark in tropical Australia and the absence or poor representation of subgenera *Monocalyptus* and *Symphomyrtus*, which are widespread in southeastern and southwestern Australia (Brooker & Kleinig 1994). They argued that such differences in eucalypt bark characteristics and species composition, as well as the greater rainfall seasonality and higher fire frequency

of the monsoon tropics, might reduce the abundance of bark-dwelling arthropods, and hence, bark-foraging birds such as the Northern Shrike-tit. Accordingly, Robinson & Woinarski (1992) proposed that Northern Shrike-tits might have to forage over huge areas of woodland to find sufficient food.

However, my observations reveal that some populations of Northern Shrike-tits, such as those on the Tomkinson floodplain, forage as much on foliage as on bark. Indeed, the importance of this foraging technique varies geographically and intersexually among Shrike-tits. Although Eastern Shrike-tits in the Southern Tablelands of New South Wales took almost all of their prey from loose and decorticating bark (Recher *et al.* 1985), in the Northern Tablelands females foraged mostly on leaves, petioles and thin ribbons of bark (Noske 2003b). In southwestern Western Australia, Recher (2006) found that Western Shrike-tits (*Falcunculus leucogaster*) obtained most of their prey by gleaning foliage, and argued that they were forced to do so because the bark on local eucalypts does not decorticate in long ribbons or accumulate on the tree as it does in the forests of southeastern Australia. As eucalypt foliage appears to support smaller and thus less rewarding prey than hanging ribbons of bark, pairs may be forced to forage over very large areas to obtain adequate food (Recher 2006).

As well as being sparsely distributed, the Northern Shrike-tit appears to occur at lower densities than its eastern counterpart, though not as low as that of the Western Shrike-tit. The population density of Eastern Shrike-tits in eucalypt forests in New South Wales varied from 0.01–0.15 birds ha⁻¹ on the Northern Tablelands (Howe & Noske 1980; Ford *et al.* 1985) to 0.05–0.56 birds ha⁻¹ on the Southern Tablelands (Recher *et al.* 1985). In preferred eucalypt woodland in the Maranboy area, the population density of Northern Shrike-tits was approximately 1.25 adults km² (Woinarski & Ward 2012), equivalent to 0.013 adults ha⁻¹, which is only slightly higher than that estimated here for the Tomkinson floodplain population (0.01 adults ha⁻¹). That population densities in two such different habitats were similar suggests that the abundance of suitable prey on paperbark trees on the Tomkinson floodplain does not differ markedly from that on eucalypts in the Maranboy area.

The Northern Shrike-tit is one of several bird species for which there were, until recently, few or no records from Arnhem Land, but they have recently been found in the seasonally inundated paperbark woodland of the Tomkinson floodplain (see Noske 2020, this issue). Some of these species, including the Northern Shrike-tit, appear to avoid the eucalypt forest that not only adjoins the floodplain, but dominates the landscape to the east and west. Moreover, while the abundance of foliage-gleaning insectivorous birds in the paperbark woodland was similar to that of adjacent eucalypt forests, their species composition differed markedly (Noske & Franklin in prep.). This suggests that the floodplain environment and/or paperbark trees are favourable for food and/or shelter from predators for some species, but not others. Future research could compare the abundance, diversity and biomass of arthropods on the bark and

foliage of paperbarks and eucalypts to determine how these substrates and tree species differ in their value to birds as sources of prey

To the south of the road west of the Kolarbidahbidah turnoff, the land rises gradually for 20 km to the sandstone uplands with its distinctive flora and fauna. Given that the only other known location for Northern Shrike-tits in the western half of Arnhem Land is 60 km to the southeast of the nearest Upper Tomkinson floodplain sites, the Tomkinson River population appears to be rather isolated. Moreover, as the pair at the other site was observed foraging only on the bark of each of the three common eucalypt species (Robinson *et al.* 1992), their foraging behaviour might also differ from that of the Tomkinson River population. As the unique pincer-like bills of shrike-tits have almost certainly evolved as an adaptation for tearing bark and chiselling dead wood, variation in bill dimensions might be a useful indicator of niche specialisation in different species and populations. As well as being larger, male Eastern Shrike-tits have proportionally larger bills than females (Noske 2003). Unfortunately there are very few specimens and capture records for the Northern Shrike-tit and consequently insufficient mensural data to validly compare both sexes of each species, so future research might use photographs of different populations to explore the relationship between morphology and foraging ecology in these intriguing birds.

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