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NESTING BY BLACK-FACED WOODSWALLOWS *Artamus cinereus* IN THE WHEATBELT OF WESTERN AUSTRALIA

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Between 1973 and 1976 a population of Black-faced Woodswallows *Artamus cinereus* was studied at Manmanning, Western Australia. Forty-six breeding groups with an average group size of 3.34 birds were monitored in four years. Of 73 nests that were laid in, 48 hatched and 37 fledged young, a nesting success of 51 per cent. Young that survived the winter and did not find a mate stayed with their parents into the next breeding season and many helped to raise siblings. This species is one of the few to benefit from the clearing of heathlands for agriculture. In return they appear to be expert predators of grasshoppers.

INTRODUCTION

Little has been published about woodswallows despite their near-endemic status, their conspicuousness and their widespread distribution. The first detailed account of Black-faced Woodswallows *Artamus cinereus* was given by Immelmann (1966) after he had spent a year in Australia. Their geographic distribution, sedentary nature and morphological variation were described by Keast (1958), but the rest of the literature on this species consists of brief mentions of occurence or specific activities (North 1909; Cameron 1933; Immelmann 1960; Serventy and Whittell 1967; Saunders and Ingram 1995).

In the course of fieldwork on the Galah *Cacatua roseicapilla* (Rowley 1990) I carried out an opportunistic study of Black-faced Woodswallows. I have already described in detail co-operative breeding by one particular group of this species (Rowley 1999). Here I describe the biology of the whole population over four years.

STUDY AREA AND METHODS

The main study area in the wheatbelt was around Manmanning (30'51"S, 117'06"E), a railway siding 170 kilometres north-east of Perth. Clearing this part of the wheatbelt began in 1926 and by the time we worked there most of the district had been cleared and ploughed, leaving about 8 per cent of the original heathland and woodland in isolated patches of 10–100 hectares and alongside roads and the railway line.

The wheatbelt of Western Australia has a typical Mediterranean climate with a hot dry summer and with two-thirds of the rain falling in the four months from May to August. The length of the growing season influences the ecology of this environment, and varies according to the onset and quantity of this rain (yearly average for Manmanning was 362 millimetres; see Table 3 for annual totals).

In our main work we marked Galahs with individual wing-tags and followed their movements throughout a 95 square kilometre study area (Rowley 1990). While we were doing this we frequently saw *A. cinereus* perched conspicuously on telephone lines or poles, and on fencelines. We opportunistically found their nests, noted the location, height and substrate used, and followed their progress. Nestlings were measured and banded when 12–14 days old with ABBBS[1] metal bands and an individual combination of colour bands (bi-colour for brood and a plain colour for year). By erecting a mistnet close to where the nestlings were handled during banding we netted and colour-banded many adults as they swooped in defence of their young.

One group, where the members were all colour-banded, was followed intensivly over four years. Fifty-four hours of observation from a hide placed three metres from the nest enabled the role of individual birds to be assessed; these details were published earlier (Rowley 1999). Unfortunately *A. cinereus* are monomorphic in plumage and none of the measurements available for them or the other members of the genus appear to be reliably diagnostic of sex (Baker *et al.* 1997; B. Dettmann, pers. comm.). Two of the helpers at the nest under close observation were known to have been males because they had been seen to copulate with unbanded females at earlier nests that had failed.

Means are given in the text ± *s.d.*

RESULTS

Group size

Between 1973 and 1976, 46 groups of *A. cinereus* were monitored with an average of 3.41 ± 1.44 adults per group. From the history of one group over four years described in a previous paper (Rowley 1999) and other observations it is probable that the members of these groups, other than the breeding pair, were progeny of previous seasons that remained with their family.

Nesting

Seventy-three nests were built in 14 different substrates at a mean height of 1.64 ± 0.46 metres (Table 1). The unlined nests were made of grass and rootlets woven together in a crotch where several small branches met, or in a tangle of parasitic creeper. The internal diameter was 7–9 centimetres and the depth 5–6 centimetres; the weave was so open that one could sometimes see the eggs through the bottom of the nest.

At Manmanning the eggs laid on successive days, usually in the morning before 0900 hours, were white speckled with red-brown. The first eggs were often left uncovered but were rarely left unguarded as there was usually a sentry nearby. Incubation appeared to begin in earnest with the laying of the second egg in three egg clutches (n = 4) or the third egg in four egg clutches (n = 2); the first two nestlings always hatched on the same day. Immelmann (1966) recorded incubation starting with the third egg in four egg clutches. At five nests we knew when the eggs

[1]Australian Bird and Bat Banding Scheme.

TABLE 1

Substrate used by nesting Black-faced Woodswallows *Artamus cinereus* at Manmanning, Western Australia 1973–1976.

Substrate	Number	Mean Ht.(m)	Range
Eucalyptus wandoo	17	1.87	1.40–2.45
Euc. spp. (mallee)	10	1.90	1.15–2.40
Acacia sp.	4	1.26	0.95–1.70
Actinostrobus pyramidalis	3	1.74	0.94–2.55
Casuarina sp.	11	1.70	1.01–3.15
Dead tree	1	2.29	—
Dryandra sp.	2	1.21	1.18–1.24
Gastrolobium spinosum	2	1.00	0.82–1.19
Grevillea armigera	3	1.57	1.55–1.65
Grevillea sp.	4	0.98	0.90–1.10
Hakea scopera	2	1.30	1.20–1.40
Leptospermum sp.	7	1.67	1.20–2.10
Melaleuca sp.	6	1.50	1.35–1.80
Santalum acuminatum	1	1.70	—
TOTAL	73	1.64	0.82–3.15

were laid and when they hatched; each gave an incubation period of 14 days from the laying of the second egg to its hatching. At two of these nests the young fledged 18 days after hatching; in northern Australia Immelmann (1966) recorded young fledging after only 12 days in the nest.

At 13 nests the date of hatching was known and from repeated measurements of the flattened Folded Left Wing (FLW) and the Central Rectrix we plotted the growth of these known age nestlings (Fig. 1). From these graphs it was possible to age nestlings that were not found until they had been hatched for a while, and to estimate when the first egg had been laid in that clutch. Figure 2 shows the estimated date of clutch initiation in 69 nests in four years. No eggs were laid before October; most first clutches were started in October-November with repeats laid in late November-December and a few in January; we had no record of two broods successfully producd in the same season.

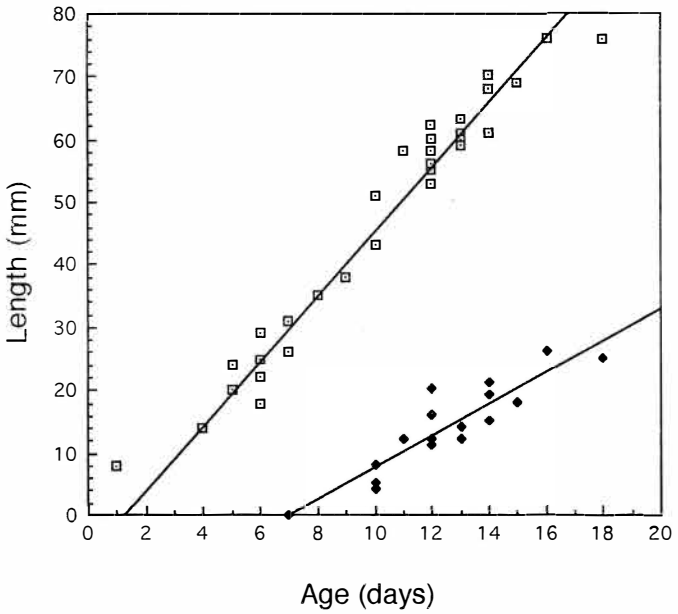


Figure 1. *Growth of nestling* Artamus cinereus *at Manmanning, Western Australia, 1974, from repeated length measurements of folded, flattened, left wing (squares; y = -6.35 + 5.13x) and left central rectrix (diamonds; y = -17.60 + 2.52x); data from 34 nestlings in 13 known-age broods, 1973–1975.*

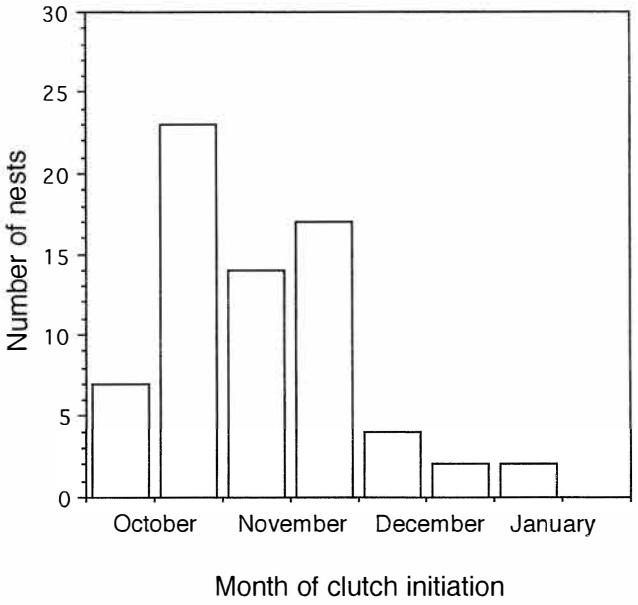


Figure 2. *The distribution of estimated dates of clutch initiation (n = 69), in half-month periods, by* Artamus cinereus *at Manmanning, Western Australia, 1973–1976.*

Productivity

In 43 nests we counted a constant number of eggs on at least two days, which gave a median clutch size of three and a mean of 3.21 ± 0.67 (range 2–5). Of these nests, 11 failed to hatch any eggs, the remainder produced 92 nestlings, 63 of which were banded (at 12–14 days old), and most of which fledged (Table 2). Data from the RAOU Nest Record Scheme provided 69 usable clutch sizes (of 269 records) from different parts of Australia, giving a mean of 3.43 ± 0.63 eggs. Nestlings were brooded for the first five days of their life, after which they were largely uncovered except on very hot days when an attendant stood over them with spread wings, providing shade (see Rowley 1999). The nestlings usually left the nest together and stayed nearby for a day or two. To summarize the data

TABLE 2

Size of *Artamus cinereus* clutches and broods at Manmanning, 1973–1976.

Clutch size Year	N	0	1	2	3	4	5	Total	Mean ± s.d.
1973	7			1	4	1	1	23	3.3
1974	15			0	10	4	1	51	3.4
1975	12			1	9	2	0	37	3.1
1976	9			2	5	2	0	27	3.0
Total	43			4	28	9	2	138	3.21 ± 0.67
Hatch									
1973	7	0	1	1	4	1	0	19	2.7
1974	15	2	0	2	7	4	0	41	2.7
1975	12	2	2	1	6	1	0	26	2.2
1976	9	7	0	0	2	0	0	6	0.7
Total	43	11	3	4	19	6	0	92	2.10 ± 1.45
Band									
1973	7	1	1	1	3	1	0	16	2.29
1974	15	5	0	3	6	1	0	28	1.87
1975	12	5	2	1	4	0	0	16	1.33
1976	9	8	0	0	1	0	0	3	0.33
Total	43	19	3	5	14	2	0	63	1.47 ± 1.45

from the 43 nests for which we had complete information: 56 per cent of these nests fledged young; 66.6 per cent of eggs that were laid, hatched and 45.6 per cent produced 63 fledglings. On average a group produced 1.46 young per year.

A larger sample of 73 nests that we knew were laid in, but for which we did not know the clutch size, showed a lower nesting success of 51 per cent because it included nests that failed before the clutch was complete (Table 3). There is some indication that rainfall influenced nesting success with the high rainfall year of 1974 most productive. In 1975 and 1976 several losses were due to wild storms in October which in both years unseated nests and tipped out eggs or nestlings.

TABLE 3

Nest success of 73 nests of *Artamus cinereus* at Manmanning, 1973–1976, with annual rainfall.

Year (rainfall mm)	Number of Nests (%) laid in	hatched	fledged
1973 (329)	17	13 (76)	10 (59)
1974 (439)	27	21 (70)	18 (67)
1975 (377)	17	11 (65)	7 (41)
1976 (307)	12	3 (25)	2 (17)
Total	73	48 (66)	37 (51)

Fate of banded birds

The 34 adults and 92 nestlings banded with individually recognizable colour-band combinations were often very hard to resight and recognize because the birds have such short tarsi that the bands were frequently hidden by the body feathers when perched. Unless there was a focal point such as a nest, a perched bird often flew before the bands could be read. Ten banded nestlings were resighted one year later; six had remained with their natal group but four (sex unknown) had dispersed to other groups, 2, 1.5, 1 and 1 kilometres away (Fig. 3). The locations of 54 numbered nests in three years are plotted in Figure 3; although the same areas tended to be used each year a completely new structure was built, often at a different site, since nests did not last over winter.

Although the sample is not large enough to estimate survival meaningfully, the data in Table 4 and resightings of banded birds throughout the winter showed that at least a proportion of the woodswallow population was resident at Manmanning through successive years and that such dispersal movements as we knew about were very local. However, for logistical reasons, the surrounding area was not searched for more widespread moves.

Foraging

During 28 hours of observation from a hide placed near a nest, 96 food items that were fed to nestlings were identified to order or family (Table 5). Although these data are biased in favour of the larger items, 68 were presumed to have been taken from the ground and 28 whilst in flight. Grasshoppers provided more than a third of identifiable prey, but since Immelmann (1966) describes *A. cinereus* in the Kimberleys catching jumping grasshoppers while flying close to the ground, the Manmanning birds may have been

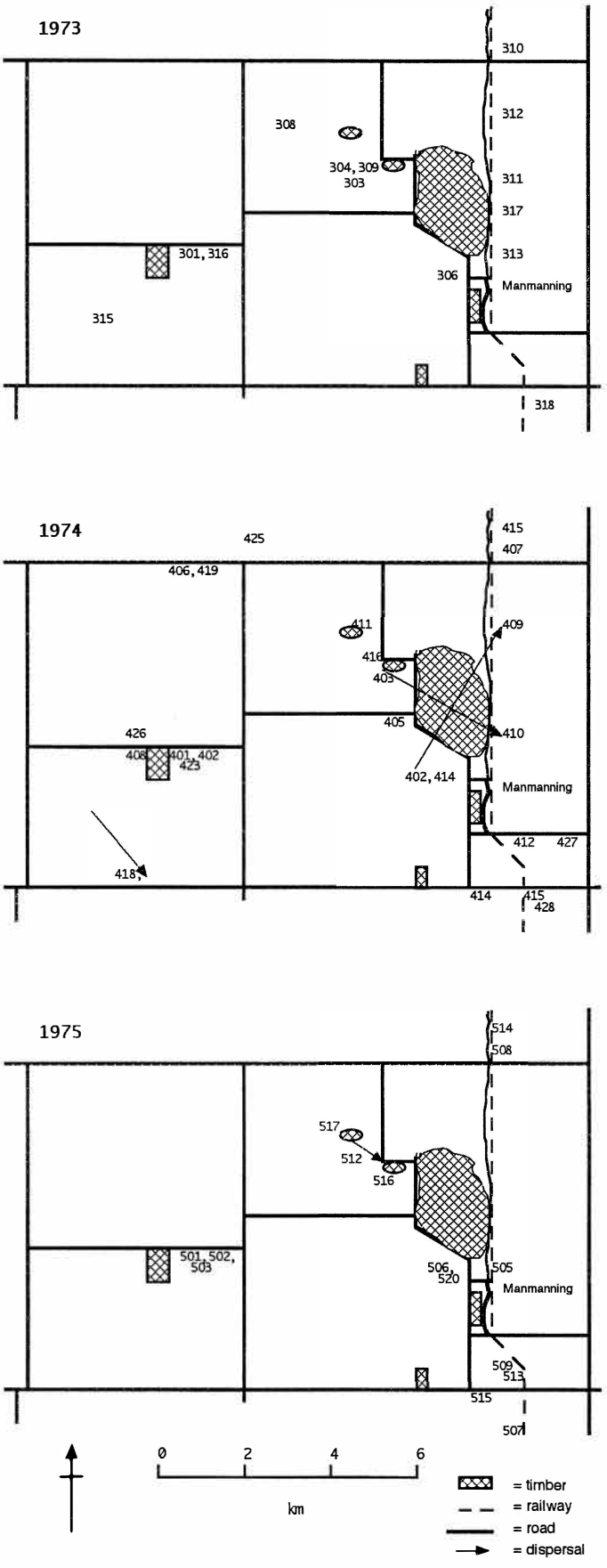


Figure 3. *Location of numbered nest sites of* Artamus cinereus *at Manmanning, Western Australia, in three years; three dispersals in 1974 and one in 1975 are indicated.*

TABLE 4

Resighting of banded *Artamus cinereus* at Manmanning, Western Australia, 1973–1976.

Age	Year of resighting 1973	1974	1975	1976
Adults	11*	5	3	1
		23*	5	2
Nestlings	28*	7	3	3
		42*	2	2
			16*	1

*Number banded each year.

TABLE 5

Food items delivered to *Artamus cinereus* nestlings at Manmanning, 1975.

Order	Common name	Prey taken from ground	in flight
Scincidae	skink	1	
Diplopoda	millipedes	5	
Chilopoda	centipedes	8	
Arachnoidea	spiders	8	
Odonata	dragonflies		2
Orthoptera	grasshoppers	35*	
	molecrickets	2	
Phasmida	phasmids	2	
Dictyoptera	cockroach	1	
Hemiptera	plant bug	1	
Neuroptera	lacewings		2
Lepidoptera	butterfly		1
	moths		3
	caterpillars	3	
Diptera	blowflies		11
	horseflies		2
Hymenoptera	ants	5	
	bee	1	
	wasp	1	
Coleoptera	wireworms	2	
	Total	73	23

*Immelmann (1966) described *A. cinereus* frequently catching jumping grasshoppers whilst flying close to the ground; from the hide I could not see how these * prey were caught.

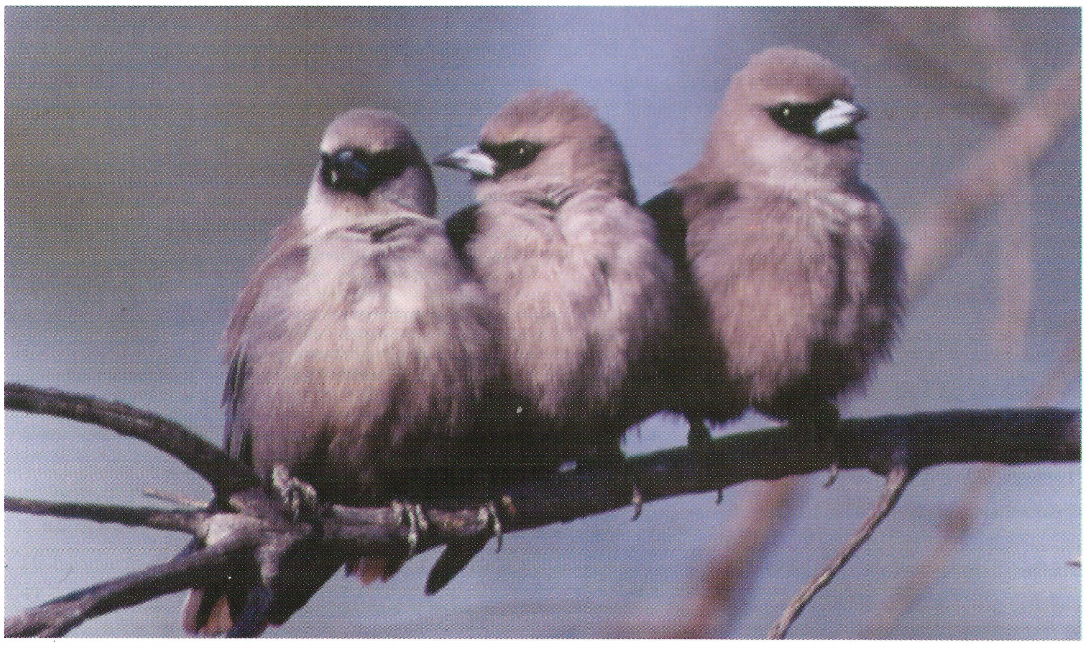
hunting in the same way, which would increase the proportion of prey taken on the wing. *A. cinereus* are obviously efficent predators of these agricultural pests. Even when they were less than seven days old, nestlings were fed whole grasshoppers, with the legs protruding from the bill until digestion made room for them to be swallowed.

DISCUSSION

This study was an opportunistic one and only limited data were gathered, but these show some interesting features over the four years. Firstly, the average groups size of 3.24 adults indicates that co-operative breeding was commonplace in this population of *A. cinereus* at Manmanning; 30 of 46 groups had three or more adults. Elsewhere I have described in detail how all the members of a colour banded group helped to raise nestlings in three successive seasons (Rowley 1999). In that group the helpers were the progeny of the group from previous seasons, as happened in two other groups. I have also described similar co-operative behaviour in Dusky Woodswallows *Artamus cyanopterus* (Rowley 2000).

Both the nesting success of 51 per cent for the 73 nests and the breeding success of 46 per cent for the sample of 43 clutches indicate a high level of productivity for an open nesting, altrical passerine in the Southern Hemisphere compared with 31 per cent calculated by Robinson (1990) for 12 other Australian passerines. This was a surprising finding, bearing in mind the exposed nature of most woodswallow nests, and can probably be largely attributed to the ferocious guarding of the nest throughout its occupancy, an aspect that is probably enhanced in larger groups.

Unfortunately the resighting of colour-banded individuals was often very difficult and so the figures given in Table 4 are not sufficently reliable to calculate survival. The



Black-faced Woodswallow *Artamus cinereus*.

resighting of banded birds throughout the winter as they gathered to roost, or perched along fencelines foraging, together with the renesting by pairs at the same location in successive years (Rowley 1999), confirms the sedentary nature of this population of a very widespread species as was suggested previously by North (1909) and Keast (1958). Most other species of *Artamus* are either nomadic or migratory, some such as *A. superciliosus* and *A. personatus* travelling the length of the continent.

The clearing of extensive areas of heathland for agriculture in Western Australia has provided an ideal habitat for *A. cinereus* and has enabled them to spread far south of their original distribution. They are therefore one of the few species to have benefitted from the changed environment (Serventy and Whittell 1967; Saunders and Ingram 1995) and have become efficent predators of grasshoppers.

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