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AGGRESSIVE BEHAVIOUR OF RED WATTLEBIRDS *Anthochaera carunculata* AND NOISY FRIARBIRDS *Philemon corniculatus*

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The aggressive behaviour of Red Wattlebirds and Noisy Friarbirds was quantified in a 240 ha remnant of eucalypt woodland near Armidale, New South Wales, from 1990 to 1992. Wattlebirds spent 1.8 per cent and Friarbirds 1.7 per cent of their time in aggressive activities. Wattlebirds chased from 1.2 to 3.7 and Friarbirds 0.5 to 1.8 birds per hour from the vicinity of their nests with young. Higher aggression rates were shown away from the nest in the 1991 breeding season (7.7 and 6.5 chases per hour, figures for Wattlebirds first) and at a heavily flowering *Grevillea robusta* tree on the University of New England campus (6.1 and 17.7 chases per hour, for Wattlebird and Friarbird respectively).

Aggression is not indiscriminate, but is principally aimed at potential competitors and predators. The most frequent victims of aggression were conspecifics (24% in Wattlebirds, 37% in Friarbirds), other large honeyeaters (32%, 10%), potential nest predators (14%, 22%) and small honeyeaters (12%, 14 %). Small insectivores were only occasionally chased. The impact of these large honeyeaters on other birds may be small in large woodland remnants, though it could be more significant in small or degraded patches.

INTRODUCTION

Honeyeaters (Meliphagidae), especially the larger species, are well-known for their aggressive behaviour (Longmore 1991). Dow (1977) presented data on the indiscriminate interspecific aggression of the Noisy Miner *Manorina melanocephala* and the smaller Bell Miner *M. melanophrys* can exclude many nectarivorous and insectivorous birds from its breeding colonies (Loyn *et al.* 1983 and Clarke 1984). Longmore (1991) described the Red Wattlebird *Anthochaera carunculata* as 'large, noisy, active, very aggressive ... pugnacious, especially when nesting ... so aggressive that smaller birds will not stay long in the same tree.' Of the Noisy Friarbird *Philemon corniculatus*, he said '... extraordinary cacophony of sound, squabble ceaselessly, vigorously harass other birds ...'. The literature contains adequate evidence of aggressiveness in wattlebirds (Le Souef 1902; Favaloro 1931; Whittell 1933; Bruce 1973; Ford 1981; McFarland 1983) and friarbirds (Batey 1907; Favaloro 1931; Chaffer 1933; Hindwood 1939; Wheeler 1966; McCulloch 1990). Both species also occasionally prey on nests or young birds (Wattlebird — Brown and Brown 1986; Friarbird — Chaffer 1945; Smith 1980).

Despite the abundance of casual observations, neither species has been the subject of a long-term quantitative study, though data are presented on aggression by Wattlebirds in Ford (1981), Ford and Paton (1982) and McFarland (1986). We studied Red Wattlebirds and Noisy Friarbirds from 1990 to early 1993 and quantified their aggressive behaviour in a variety of ways. Our results indicate that neither species is as persistently aggressive as the literature suggests, and indeed most interactions are intraspecific or with other large honeyeaters.

STUDY SITE AND METHODS

Most of the work was carried out at Eastwood State Forest, 10 km SE of Armidale. This 240 ha remnant of eucalypt woodland has been described in detail elsewhere (e.g. Ford *et al.* 1985). The dominant tree species in order of abundance are: New England Stringybark *Eucalyptus caliginosa*, Blakely's Red Gum *E. blakelyi*, Manna Gum *E. viminalis*, Yellow Box *E. melliodora* and Long-leaved Box *E. bridgesiana*.

Red Wattlebirds are present throughout the year at Eastwood. Noisy Friarbirds are present between August and early April, and occasionally in winter. About 20 pairs of Wattlebirds bred each year, whereas Friarbirds fluctuated between 10 and 50 pairs per year, giving densities of about 0.1–0.2 and 0.1–0.5 birds/ha respectively (Ford *et al.* 1985, unpubl.)

Time budgets were constructed for each species in September to December 1990, by following individuals for up to 10 minutes and recording their activity at 15 second intervals. One activity was aggression when the species was recorded chasing or being chased by the focal bird. Also in 1990, hour-long watches were made at nests of both species and visits to the nest and any aggressive behaviour were noted.

As we felt that the above methods could have underestimated the incidence of aggression, in spring 1991 individual birds were followed for up to 20 minutes and all aggressive interactions were recorded. In 1991 and 1992 we also followed parent birds in their foraging movements around nests for up to one hour, rather than watching the nest, and recorded all aggressive interactions in which they were involved. Although a few birds were colour-banded in 1991 and 1992, nearly all observations were on unbanded birds.

Honeyeaters are often aggressive at flowering trees, and one large Silky Oak *Grevillea robusta* outside the Botany Department at UNE attracted numerous Wattlebirds and Friarbirds in December 1991. We made half-hour-long watches at this tree and recorded the number of birds of each species present, all departures and arrivals and all chases and displacements.

RESULTS

Red Wattlebirds and Noisy Friarbirds show a variety of aggressive behaviours. They may fly towards another bird, which then departs, before the aggressor lands on its vacated perch. More often they will pursue the other bird for some distance, often out of sight, sometimes for over 100 m. Occasionally they make contact with the bird being pursued, snapping at the tail or back with their beaks, or even grasping it with their claws. On a few occasions interlocked birds tumbled to the ground with feathers flying. This typically involved conspecifics or other large honeyeaters, but once a Friarbird vigorously struck a Black-faced Cuckoo-shrike *Coracina novaehollandiae*. Five Noisy Friarbirds vigorously harassed a Collared Sparrowhawk *Accipiter cirrhocephalus* which was carrying a dead immature Fan-tailed Cuckoo *Cuculus pyrrhophanus*. One of them held the hawk in its claws, almost bringing it to the ground.

Some chasing by Red Wattlebirds in the breeding season (August to January) involved courtship. The larger male chases its smaller mate, often snapping at its tail. Females often have quite ragged tail feathers by the end of the season. This means that our data may overestimate the frequency of aggression in Wattlebirds. In contrast, many interactions between Friarbirds in the breeding season involve members of neighbouring pairs. Too few birds have been colour-banded and chases are so rapid that the frequency of these behaviours is not known.

The incidence of aggression, in terms of interactions per hour and proportion of total time in aggression, collected by all methods, is shown in Table 1. In 1990, when all activities were recorded at 15 second intervals, less than 2 per cent of the time was spent in aggression by both species. In 1991, when individual chases were counted while following birds, we recorded an average of 7.7 and 6.5 chases per hour by Wattlebirds and Friarbirds away from the nest. The duration of chases was not recorded; most are short and birds are frequently lost during long chases. Hence, these numbers of chases per hour will be close to the number of 15 second periods per hour in which aggression occurred. As there are 240 such periods per hour, 7.7 and 6.5 chases per hour convert into 3.2 per cent and 2.7 per cent of the time. Aggression rates by the two methods are thus similar.

Rates of aggression around the nest were somewhat lower than elsewhere, ranging from 0.5 to 3.7 chases per hour (Table 1). No data were

TABLE 1

Frequency of aggression, number of chases per hour per individual or percentage of time in aggression by Red Wattlebirds and Noisy Friarbirds in different years, collected at different sites. Number of hours of data collected in parentheses. No data from Friarbird nests in 1991.

	Red Wattlebird		Noisy Friarbird	
	No. chases/hr	% of time	No. chases/hr	% of time
Time Budgets				
1990		1.8% (16.3)		1.7% (16.7)
1991	7.68 (19.7)		6.5 (5.5)	
Nest Watches				
1990	1.18 (111)		0.5 (129)	
1991	3.67 (20.1)			
1992	2.03 (24.6)		1.8-1 (41)	
Grevillea				
1991	6.1 (13.5)		17.7 (13.5)	

collected around Friarbird nests in 1991 as we found no nests in which the eggs hatched. In 1990 the nests, rather than the birds, were watched so that there were periods when no birds were visible. Therefore the aggression rates would have been underestimated. In 1991 and 1992 individuals were followed and rates were calculated only for the periods when the focal bird was visible. Assuming, as in the previous paragraph, that an aggressive act involves one 15 second period, the percentage of time spent in aggression would range from 0.2 per cent to 1.5 per cent.

The number of chases and displacement at the flowering *Grevillea robusta* tree ranged from one to 576 per hour (mean = 198, n = 13, s.d. = 177). The higher figure is an underestimate as it was sometimes impossible to keep track of all chases, arrivals and departures. The impression at the tree was often one of continuous noisy squabbling, which was commented upon by several people in offices nearby. As there were up to five Red Wattlebirds and as many as 20 Noisy Friarbirds in the tree at any time, the aggression rates per bird present were not particularly high (Table 1). Wattlebirds showed a lower individual rate of chasing in the *Grevillea* than they did in Eastwood during the spring of the same year. Friarbirds individually chased three times as frequently at the *Grevillea* as in the woodland.

The *Grevillea* tree was watched for two half-hours during steady rain. Only the occasional bird visited the flowers and only a single interaction occurred. Excluding the rainy hour from the total had little effect on the aggression rates.

On average, 40.6 Friarbirds and 11.6 Wattlebirds arrived and 42.2 and 11.8 departed during the hour. If the wet hour is excluded, there were 47.1 and 13.6 arrivals and 49.6 and 13.8 departures respectively. Friarbirds were significantly more aggressive, being the aggressors in 92 per cent of cases, despite on average accounting for only 81 per cent of the birds present ($\chi^2 = 224$, $p < 0.001$, df = 1, Table 2). Friarbirds chased Wattlebirds twice as frequently as Wattlebirds chased Friarbirds ($\chi^2 = 42.4$, $p < 0.001$, df = 1).

Few birds of other species visited the tree. Only 12 Silvereyes *Zosterops lateralis*, two Musk Lorikeets *Glossopsitta concinna*, two Noisy Miners and one Yellow-faced Honeyeater *Lichenostomus chrysops* were observed over the 13.5 hours.

At least 33 species of birds were seen to be chased by the large honeyeaters, 25 by Wattlebirds and 26 by Friarbirds (Table 3). In contrast, only six and nine species showed aggression towards Wattlebirds and Friarbirds respectively. Many of the interactions involved conspecifics, 24 per cent for Wattlebirds and 37 per cent for Friarbirds, often territory-holders pursuing intruders. As mentioned before, some chases, among Wattlebirds at least, involved the male chasing its mate. Friarbirds interact with intruders by calling and displaying, frequently in duet, rather than by chasing. These behaviours were not counted as aggression.

Other large honeyeaters were the chief interspecific victims of Red Wattlebirds, with Friarbirds accounting for 14 per cent and Noisy Miners for 18 per cent of chases. Wattlebirds were sometimes chased by these species, which accounted for 72 per cent of the 18 cases of aggression towards Wattlebirds. Despite this, Wattlebirds were the aggressors in 92 per cent of interactions with other large honeyeaters.

Friarbirds interacted rather less with other large honeyeaters, but unlike Wattlebirds were about as likely to be the victim (44%) as the aggressor (56%). Two incidents indicated that Red Wattlebirds may be dominant over Noisy Friarbirds at the breeding site. On November 19, 1991, a female Friarbird was taking bits of stringybark to a nearly complete nest, with her colour-banded mate nearby, when a male Wattlebird chased her three times. He then landed near the male Friarbird, faced him and called. The latter opened his beak weakly but otherwise did not respond. The male Wattlebird called again and was joined by a colour-banded female Wattlebird.

TABLE 2

Interactions among Red Wattlebirds and Noisy Friarbirds at a *Grevillea robusta* tree in December 1991.

	Aggressor		
Victim	Noisy Friarbird	Red Wattlebird	Total
Noisy Friarbird	2 154	105	2 259
Red Wattlebird	223	92	315
Total	2 377	197	2 574
Mean No. birds present (excluding wet hour)	11.7	2.8	

TABLE 3

Frequency of aggressive interactions involving Wattlebirds and Friarbirds and other species near the nest and elsewhere in 1990 to 1992. Ch = Wattlebird or Friarbird chasing the species, BC = being chased by it.

	Red Wattlebird				Noisy Friarbird			
	Nest		Elsewhere		Nest		Elsewhere	
Species	Ch	BC	Ch	BC	Ch	BC	Ch	BC
Red Wattlebird *Anthochaera carunculata*	49		58	1	4	2	4	6
Noisy Friarbird *Philemon corniculatus*	37	3	26	2	49	2	13	
Noisy Miner *Manorina melanocephala*	38		39	7	2	1	7	5
Other Large Honeyeater			2		1			
All Large Honeyeaters	**124**	**3**	**125**	**10**	**56**	**5**	**24**	**11**
Potential Predators								
Brown Goshawk *Accipiter fasciatus*					1			
Collared Sparrowhawk *A. cirrhocephalus*			2				5	
Laughing Kookaburra *Dacelo novaeguineae*	1				1			
B-f Cuckoo-shrike *Coracina novaehollandiae*	11		17		5			
Grey Shrike-thrush *Colluricincla harmonica*					6			
Olive-backed Oriole *Oriolus sagittatus*	3		6		4	1		
Grey Butcherbird *Cracticus torquatus*	7				1			
Australian Magpie *Gymnorhina tibicen*	2		2		1			
Pied Currawong *Strepera graculina*	1		9	2	11			
Australian Raven *Corvus coronoides*					1			
Forest Raven *C. tasmanicus*			2					
Raven *Corvus* sp.					1			
All Predators	**25**		**38**	**2**	**32**	**1**	**5**	
Others								
Crested Pigeon *Ocyphaps lophotes*					1			
S-crested Cockatoo *Cacatua galerita*	2							
Crimson Rosella *Platycercus elegans*	2		6		3			
Eastern Rosella *P. eximius*	26		8		9			
Sacred Kingfisher *Halcyon sancta*					4	1		
Rufous Whistler *Pachycephala rufiventris*			2					
Leaden Flycatcher *Myiagra rubecula*					1	6		
Striated Thornbill *Acanthiza lineata*	6		6		1			
Yellow-rumped Thornbill *A. chrysorrhoa*							1	
Thornbill *Acanthiza* sp.	4							
Yellow-faced Honeyeater *Lichenostomus chrysops*		2			2			
Fuscous Honeyeater *L. fuscus*	43		5		7	3	7	
White-naped Honeyeater *Melithreptes lunatus*		1						
Eastern Spinebill *Acanthorhynchus tenuirostris*							2	
Other Small Honeyeater	4				2		4	
Spotted Pardalote *Pardalotus punctatus*			1					
Striated Pardalote *P. striatus*	1						1	
Pardalote *Pardalotus* sp.	5		1					
Common Starling *Sturnus vulgaris*			1					
Dusky Woodswallow *Artamus cyanopterus*			2			3		
White-winged Chough *Corcorax melanorhamphos*	1							
Unidentified Small Bird	9		4		6			
All Other Species	**103**	**3**	**36**	**0**	**36**	**13**	**15**	**0**
Total	**252**	**6**	**199**	**12**	**124**	**19**	**44**	**11**

She had had a nest less than 100 metres away, which had failed about two weeks previously. The Wattlebirds duetted, after which the male and then the female inspected the Friarbird nest. The male Friarbird showed no response and when the female Friarbird returned to the nest with more material she was chased away by both Wattlebirds. On November 23, 1991, the female Friarbird was dismantling her first nest and building a new one about 60 metres further away from the Wattlebird territory. She remained paired with the same male. On November 16, 1993, a Friarbird attempted to return to a nest, where it had been incubating 11 days previously, but was chased away by a male Red Wattlebird. A female Red Wattlebird then took material from the Friarbird nest, but dropped it. A newly completed Wattlebird nest was found 20 metres from the Friarbird nest. No further activity was seen at the Friarbird nest, but two young hatched in the Wattlebird nest on December 3 and were found dead in the nest on December 11, 1993.

Several other species that were pursued were potential predators of adults or eggs and nestlings (14% and 22% of chases by Wattlebirds and Friarbirds). This excludes other large honeyeaters, which are also potential nest predators. Probably only the Brown Goshawk *Accipiter fasciatus* and Collared Sparrowhawk *A. cirrhocephalus* presented any threat to adults. Wattlebirds chased a range of potential nest predators even when not near their nests, whereas Friarbirds mostly chased them when they were close to their nests.

Small honeyeaters were prominent among the other species with which Wattlebirds and Friarbirds interacted, accounting for 12 per cent and 14 per cent of chases respectively. Rosellas were also common targets of the large honeyeaters' attacks. Small insectivores, such as pardalotes and thornbills were only infrequent victims of aggression. The Leaden Flycatchers *Myiagra rubecula*, Fuscous Honeyeaters *Lichenostomus fuscus* and Dusky Woodswallows *Artamus cyanopterus* that attacked Friarbirds, all had active nests close to a Friarbird nest.

DISCUSSION

This study has shown that Red Wattlebirds and Noisy Friarbirds interact aggressively with a wide range of other species of birds. It lends support to the popular notion that both species are pugnacious, frequently driving away other birds (e.g. Longmore 1991). However, the frequency of aggressive acts, either as proportion of time (less than 2%) or number of chases per hour (0.5 to 7.7 away from flowering trees) is not very high.

Other studies have found that a Red Wattlebird holding a territory in a flowering tree averaged 37 chases per hour (Ford 1981) and Red Wattlebirds in banksia heathland spent from 0.4 per cent to 2.1 per cent of their time in aggression (McFarland 1986), the latter being similar to the present study. Other species of honeyeater at the same site spent from 0.3 per cent to 2.2 per cent of their time in aggression (McFarland 1986). New Holland Honeyeaters *Phylidonyris novaehollandiae* at a site in Victoria performed 2.2 aggressive acts per hour (Paton 1980) and New Holland and White-cheeked Honeyeaters *P. nigra* near Sydney averaged 2.1 attacks per hour (Armstrong 1991). Most of these studies were carried out in areas with extensive flowering of nectar-bearing shrubs.

Our observations on the *Grevillea robusta* tree showed that Noisy Friarbirds at least show higher aggression rates around nectar sources than elsewhere. Even so, individual birds probably only chased, or were chased, once every 3–4 minutes while at the tree, an activity which usually only lasted a few seconds. Birds that departed probably went to rest elsewhere, so that the aggression rates of individuals could have been lower than those estimated by watching at the flowering tree. The impression of ceaseless squabbling results from the large number of birds present and the fact that Friarbirds can be very noisy.

Our data indicate that the targets of most Wattlebird and Friarbird aggression are conspecifics, other large honeyeaters or potential nest predators. For Wattlebirds, these categories accounted for 24 per cent, 32 per cent and 14 per cent of chases and for Friarbirds 37 per cent, 10 per cent and 22 per cent. Based on data on chases in Table 3, Wattlebirds may dominate Friarbirds in the breeding areas. Indeed, we recorded two apparent cases of Friarbirds deserting their nests after harassment by Wattlebirds. This is probably because Red Wattlebirds are present year-round and start breeding early in the season, whereas Friarbirds arrive in August and do not start breeding

until November. In contrast, Friarbirds were more aggressive at a flowering *Grevillea robusta* tree and more often chased Wattlebirds than the reverse.

Some of the potential nest predators (e.g. Cuckoo-shrike, Shrike-thrush and Oriole) may not pose a major threat to large honeyeater nests and could have been pursued more because they are potential competitors, taking large insects. Small honeyeaters (12% and 14% of chases) and rosellas (10% and 7% of chases) were the only other birds frequently chased by Wattlebirds and Friarbirds. Both rosellas and small honeyeaters take similar food to the large honeyeaters; nectar, insects and alternative carbohydrates such as manna and lerp (Paton 1980, Ford unpubl.) They are also frequent targets of aggression by Bell Miners (Poiani *et al.* 1990). Small birds may be aggressive towards Noisy Friarbirds near the nests, possibly seeing the Friarbird as a potential predator. Leaden Flycatchers often associate with Friarbirds when nesting, possibly for protection against predators (Marchant 1983; Ford and Trémont unpubl.). This association and explanation seems sensible from our observations, though it seems that the Flycatchers do not always appreciate their larger protector.

Most casual accounts of aggression by these two large honeyeaters relate to other honeyeaters or nectarivores, such as lorikeets (e.g. Le Souef 1902; Favaloro 1931; Hindwood 1939; Bruce 1973) or to predators (hawk — Batey 1907; cat — Whittell 1933; raven — Wheeler 1966). Both Red Wattlebirds and Noisy Friarbirds will also divebomb and peck at humans that are banding their nestling and fledglings (Ford, personal experience).

Noisy Miners are apparently indiscriminately aggressive to other birds (Dow 1977). Bell Miners are also aggressive to many other birds, but the targets are usually potential competitors and nest predators (Smith and Robertson 1978; Poiani 1991; Poiani *et al.* 1990). This is similar to the pattern shown by Red Wattlebirds and Noisy Friarbirds, though their attacks on small insectivores, other than honeyeaters, are quite infrequent. Ripley (1959) suggested that honeyeaters may show aggressive neglect, i.e. a level of aggression that is excessive and indeed wasteful, leading to nesting failure. We do not believe that this is true for Red Wattlebirds and Noisy Friarbirds as not only is aggression mostly well directed, but also its frequency may be overestimated by casual observations of many individuals at flowering trees.

Observations on aggression underestimate the impact on birds that avoid areas occupied by aggressive species. Noisy and Bell Miners occupy breeding colonies that are almost devoid of small insectivores and honeyeaters (Dow 1977; Smith and Robertson 1978). That this is the result of these species avoiding miners, is shown by the invasion of the area by small birds when miners leave or are removed (Loyn *et al.* 1983; Clarke 1984; Poiani *et al.* 1990). Small insectivorous and nectarivorous birds are not conspicuously absent where Wattlebirds and Friarbirds are breeding, possibly because they are not co-operative. However, the scarcity of other nectarivores at such an attractive nectar source as a flowering *Grevillea robusta* tree probably resulted from them avoiding the large honeyeaters.

The role of Wattlebirds and Friarbirds may be different when the habitat becomes fragmented, degraded and simplified. Honeyeaters and other birds may become concentrated in a few remaining rich patches. Whereas Red Wattlebirds and Noisy Friarbirds perhaps do not have the impact on other birds that Noisy and Bell Miners do, there may be times when their aggression is significant. Red Wattlebirds can have an impact on small birds (Woinarski 1984; Davis and Recher 1993a) and Noisy Friarbirds can significantly harass other honeyeaters, especially the endangered Regent Honeyeater *Xanthomyza phrygia* (Franklin *et al.* 1989). Breeding Regent Honeyeaters may experience a very high rate of interactions with Friarbirds, which could lead to nest abandonment (Davis and Recher 1993b; Ford *et al.* 1993).

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