Corella, 2002, 26(3): 74–78

WINTER MIXED-SPECIES FORAGING FLOCKS IN *ACACIA* WOODLANDS OF WESTERN AUSTRALIA

WILLIAM E. DAVIS, JR.[1] and HARRY F. RECHER[2]

[1]College of General Studies, Boston University, Boston, MA 02215 USA
[2]Centre for Ecosystem Management, School of Natural Sciences, Edith Cowan University, Joondalup, Western Australia, Australia 6027

Received: 29 July, 2001

A mixed-species foraging flock of more than 100 individuals and up to ten species was monitored over five days in winter in *Acacia* woodland near Gascoyne Junction, Western Australia. The flock had a core of five species, including Budgerigars *Melopsittacus undulatus*, woodswallows and chats, plus eleven other species, which joined the flock as it passed through their territories. Budgerigars were the lead species. Other large mixed species foraging flocks led by woodswallows were observed near Mt. Magnet. Budgerigars were absent from the Mt. Magnet flocks which otherwise contained the same core species and up to 12 additional species. The core species were birds that move seasonally in response to food availability and the large size of the Gascoyne and Mt. Magnet flocks relative to most previously reported mixed species foraging flocks in Australia may reflect the abundance of food following rain in these *Acacia* woodlands.

INTRODUCTION

Mixed-species winter foraging flocks are common in temperate and tropical forests and woodlands. In Australasia, mixed-species winter foraging flocks have been reported for dry sclerophyll forest (open forest) (Bell 1980; Hermes 1981), woodlands (Gannon 1934; Hindwood 1937), mallee (Chalender 1937), coastal forest and heathland (Sedgwick 1949, 1988), mixed habitats (Plumb 1948) and tropical rainforest (Bell 1983; Diamond 1987). Most flocks reported were dominated by insectivores and had fewer than five species and 20 individuals. A different category of mixed-species foraging flocks, with more than 100 individuals and as many as 'dozens of bird species,' described as a 'bird wave', has been recorded in tropical rainforests of New Guinea by Diamond (1987) and in open woodland in the Kimberley District of Western Australia by Sedgwick (1988). Here, we report on observations of a mixed-species foraging flock of 'wave' proportions, and other smaller foraging associations in *Acacia* (Mulga) woodlands in Western Australia.

STUDY AREA AND OBSERVATIONS

Gascoyne Junction

From 1–5 August 1999 (late winter or early spring for the region), while collecting foraging data on the avian community in *Acacia* woodlands 35 kilometres west of Gascoyne Junction (25°02'S, 115°12'E) in the Carnarvon Basin, we encountered a large mixed-species foraging flock (Table 1). The area was characterized by low sand ridges with *Acacia* and *Cassia* species which separated broad, flat areas dominated by dense *Acacia* woodlands (up to 60% projected canopy cover). The woodlands were dominated by Mulga *Acacia aneura*, Bowgada *A. linophylla*, Curara *A. tetragonophylla*, and Gidgee *A. pruinocarpa*. Within the woodlands were extensive open areas dominated by low shrubs, herbaceous plants, and grasses (e.g. Wind Grass *Aristida contorta*, Broad-leaved Wanderrie Grass *Monachather paradoxa*, Creeping Wanderrie Grass *Eragrostris lanipes*, *Stipa* spp.). Although degraded and grazed by goats and sheep, the grasses had a heavy crop of seeds and lepidopteran and pergid (Hymenoptera) larvae were abundant on the acacias, shrubs and ground vegetation. There were also numerous grasshoppers (Orthoptera).

The abundance of seed and insects had attracted large numbers of birds including flocks of Budgerigars *Melopsittacus undulatus* of up to 300+ individuals. Associated with the Budgerigars was a large number (100+) of other birds collectively forming a mixed-species foraging flock of wave proportions (Table 1).

We first encountered the flock on 1 August and recorded ten species within the flock (Table 1). On succeeding days we determined that the flock had a core of five species: Budgerigar, Black-faced Woodswallow *Artamus cinereus*, Crimson Chat *Epthianura tricolor*, White-winged Triller *Lalage sueurii*, and Black-faced Cuckoo-shrike *Coracina novaehollandiae*, which were recorded in all encounters with the flock. None of these species were breeding at the time of our observations. Southern Whiteface *Aphelocephela leucopsis*, Willie Wagtail *Rhipidura leucophrys*, Crested Bellbird *Oreoica gutturalis*, Zebra Finch *Taeniopygia guttata*, Splendid Fairy-wren *Malurus splendens*, White-browed Babbler *Pomatostomus superciliosus*, Red-capped Robin *Petroica goodenovii*, Horsfield's Bronze-Cuckoo *Chrysococcyx basalis*, Chestnut-rumped Thornbill *Acanthiza uropygialis*, Grey Shrike-thrush *Colluricincla harmonica* and Redthroat *Pyrrholaemus brunneus* associated and moved with the flock, but it appeared that these birds only joined the flock as it passed through their home range or territory. In contrast to the core species of the flock, all these species were nesting or feeding recently fledged young.

Flock Structure

We emphasize that this was a single flock. The flock ranged over an area of approximately three square kilometres and, while numbers and composition changed

TABLE 1

Composition of a mixed-species foraging flock in *Acacia* woodlands near Gascoyne Junction, Western Australia in August 1999. Numbers are estimates, as precise counts were not possible. AM and PM indicate the time of day that the size of the flock was estimated.

Species	Date/Time of Day					
	AUG. 1 AM	AUG. 2 AM	AUG. 2 PM	AUG. 4 PM	AUG. 5 AM	AUG. 5 AM
Budgerigar	100+	100+	100+	300+	100+	100+
Black-faced Woodswallow	30+	30+	30+	30+	30+	30+
White-winged Triller	50+	50+	50+	50+	50+	50+
Crimson Chat	30+	30+	30+	30+	30+	30+
Black-faced Cuckoo-shrike	1+	4	1+	1+	2	1
Southern Whiteface		1+	2			
Willie Wagtail	1			1	1	1
Crested Bellbird	1			1	1	1
Zebra Finch		2		2		
Splendid Fairy-wren				2	2	
White-browed Babbler	2+					
Red-capped Robin	1+					
Horsfield's Bronze Cuckoo		1				
Chestnut-rumped Thornbill	1+					
Grey Shrike-thrush		1				
Redthroat					2	
Number of Individuals	217+	219+	213+	417+	216+	213+
Number of Species	10	9	6	9	9	7

(Table 1) and the flock frequently separated into smaller units, it remained coherent and identifiable over the five days we observed it. In every instance, the Budgerigars were the flock leaders: when the Budgerigars moved, the others followed. On several occasions, the Budgerigars flew 500 metres or further, and all core species followed. Other species associated with the flock did not follow on these long moves.

Foraging Patterns

The Budgerigars fed on grass seed, taking seeds from the ground or from stems. They foraged actively, with segments of the flocks swirling about from one grassy patch to another. Crimson Chats took insects (mostly caterpillars) from the ground and low vegetation. Black-faced Woodswallows hawked for flying insects (sallied), or pounced on insects on the ground, while White-winged Trillers gleaned and snatched insects (mainly caterpillars, but also grasshoppers) from *acacias* and ground vegetation. Black-faced Cuckoo-shrikes rarely foraged on the ground and mostly gleaned or snatched caterpillars from *acacia* foliage. Southern Whitefaces and Zebra Finches foraged on the ground for seeds, while all the others were insectivorous.

TABLE 2

Species composition of a mixed-species foraging flock in *Acacia* woodlands near Mt Magnet, Western Australia in August 1999. AM and PM indicate the time of day that the flock was observed. Numbers of birds were not estimated.

Species	Date/Time of Day					
	AUG. 8 AM	AUG. 8 PM	AUG. 9 AM	AUG. 9 PM	AUG. 10 AM	AUG. 11 PM
Black-faced Woodswallow	+	+	+	+	+	+
White-winged Triller	+	+	+	+	+	+
Black-faced Cuckoo-shrike		+	+	+	+	+
Crimson Chat			+	+	+	+
Willie Wagtail	+		+	+	+	+
Crested Bellbird	+		+	+	+	+
Rufous Whistler	+	+	+			+
Singing Honeyeater			+	+		
Spiny-cheeked Honeyeater		+			+	
Yellow-throated Miner	+				+	
Bourke's Parrot			+	+		
Grey-crowned Babbler			+			
Grey Shrike-thrush			+			
Western Warbler			+			
Mulga Parrot			+			
Galah			+			
Horsfield's Bronze Cuckoo			+			
Southern Whiteface			+			
Number of Species	6	5	16	8	8	7

Other flocks

We also observed mixed-species foraging flocks in *Acacia* woodlands 14 to 21 kilometres west of Mt. Magnet (28°05'S, 117°52'E) along the Yalgoo Road in the Murchison District from 8 to 11 August. Mulga and Bowgada dominated these woodlands, but as many as six other species of *Acacia* were common. Projected vegetation cover ranged between 5 and 40 per cent. Stands of *Acacia* were separated by extensive open areas with scattered *Acacia* and a few shrubs. Although there had been good autumn rains, herbs and grasses were sparse or absent. Lepidopteran and pergid larvae were abundant, but grasshoppers were scarce. The stony surface of the soil and the sparse ground cover reflected a long history (>100 years) of grazing by domestic and feral stock.

Unlike at Gascoyne, there were several mixed-species foraging flocks where we made our observations at Mt. Magnet. These flocks were much smaller than the Gascoyne flock and Budgerigars were absent, but otherwise they had the same core species: Black-faced Woodswallow, White-winged Triller, Black-faced Cuckoo-shrike and Crimson Chat (Table 2). Eighteen species were recorded in mixed-species foraging flocks at Mt Magnet (Table 2). Willie Wagtail, Crested Bellbird, Rufous Whistler *Pachycephala rufiventris*, Singing Honeyeater *Lichenostomus virescens*, Spiny-cheeked Honeyeater *Acanthagenys rufogularis* and Yellow-throated Miner *Manorina flavigula* were species that were regular members of these flocks, but absent from the Gascoyne flock. Bourke's Parrot *Neopsephotus bourkii*, Grey Shrike-thrush, Grey-crowned Babbler *Pomatostomus temporalis*, Western Warbler *Gerygone fusca*, Mulga Parrot *Psephotus varius*, Galah *Cacatua roseicapilla*, Horsfield's Bronze-Cuckoo and Southern Whiteface appeared to associate with the flocks casually as the flock moved through their home range or territory. We later noted mixed-species foraging flocks with the same array of species in *Acacia* woodlands south of Mt Magnet.

In the absence of Budgerigars, Black-faced Woodswallows and sometimes White-winged Trillers, appeared to be the flock leaders, moving first and being followed by the others. However, leadership was not as clearly defined as in the Gascoyne flock.

DISCUSSION

Of the mixed-species foraging flocks reported in Australasia, the Gascoyne flock most closely resembled the bird wave observed by Sedgwick (1988) in the Kimberley. Sedgwick's flock had 14 species with the vanguard comprised of White-winged Trillers and Black-faced Woodswallows. Other species in the flock were parrots and insectivores from a broad spectrum of foraging guilds, including ground-pouncers, seed-eaters and canopy-gleaners. Together, there were "... hundreds, if not thousands ..." of individuals (Sedgwick 1988). The Gascoyne flock contained hundreds of individuals and as many as 10 species at one time; 16 species were recorded in the flock over a period of five days (Table 1).

Although not as large as the Gascoyne flock, the number of individuals and species in mixed-species foraging flocks at Mt. Magnet was consistently larger than reported for most mixed-species foraging flocks in Australia and differed from the Gascoyne flock only in the absence of Budgerigars. Typically, mixed-species foraging flocks in Australian forests and woodlands have fewer than 20 individuals and ten species: the modal numbers of species in mixed-species foraging flocks from different habitats are 6–7 (coastal forest), 5 (wheatbelt forest), 3 (heathland), 2 (heath borders) (Sedgwick 1949); 3 (dry sclerophyll forest) (Bell 1980); 2, 3 (lowland rainforest) (Bell 1983); 4 (dry sclerophyll forest) (Hermes 1981); and 2 (wandoo woodland) (Davis and Recher 2002).

Are there any reasons for mixed-species foraging flocks in acacia woodlands to be larger than in other woodlands or forests?

The most common suggestions as to why birds join mixed-species foraging flocks are enhanced foraging opportunities (Krebs 1973; Rand 1954), protection from predators (Miller 1922) or both (Hindwood 1937). For some species, the reason may be less complex and individuals may simply be attracted by the noise and activity as flocks pass through an individual's territory or home range. This appeared to be the case with many species (e.g. Chestnut-rumped Thornbill, Grey Shrike-thrush) at Gascoyne and Mt. Magnet which were nesting or feeding fledglings. Such an 'excitement effect' does not explain the adherence of the core species to the flocks.

None of our observations suggested a 'beater' effect (Diamond 1987; Powell 1985) whereby flock members benefited from prey disturbed by the flock. Although the mixed-species flocks ranged over large areas and were not observed to forage over the same ground twice in the same day, there did not appear to be any pattern to the direction of movements. Nor did it appear that flocks were avoiding foraging over ground that had been recently visited. Instead, movements were erratic and commonly stimulated by some disturbance (e.g. a bird of prey). However, we cannot completely discount the possibility that by flocking, moving over large areas and following a random path, there was a foraging benefit gained by reducing the chance of visiting areas that had been recently foraged in by other birds.

At Gascoyne, movements were initiated by Budgerigars who often took flight at the appearance of raptors. Avian predators were common at Gascoyne. Little Falcons *Falco longipennis* followed the flock and frequently attempted to catch Budgerigars. Nankeen Kestrel *F. cenchroides*, Brown Falcon *F. berigora*, Wedge-tailed Eagle *Aquila audax* and Collared Sparrowhawk *Accipiter cirrhocephalus* were also resident. At Mt. Magnet, Wedge-tailed Eagle, Brown Falcon and Brown Goshawk *A. fasciatus* were observed.

While the tight, rapidly moving and twisting flocks formed by Budgerigars and other parrots clearly protected individuals against avian predators, none of the other species in the mixed-species flocks behaved in this way. Possibly, they benefited from the distraction of predators by the Budgerigars or gained an advantage from early warnings of predators from other flock members but we have no real evidence of mixed-species flocks forming to

reduce the risk of predation or that the members of flocks suffered lower rates of predation than solitary birds or smaller flocks. It could be argued that these large flocks attracted predators and increased the risk of predation for at least some species.

The core species, Budgerigars, woodswallows, trillers, cuckoo-shrikes, and chats, in the flocks at Gascoyne and Mt. Magnet are birds which are social, gregarious and flocking. In our experience, all may move hundreds, if not thousands, of kilometres according to rainfall and the availability of food. Although the insectivorous species feed on the same insects, they differed in their use of foraging resources by exploiting different substrates, foraging at different heights and using different foraging manoeuvres. It is possible that these and ecologically similar species in these semi-arid *Acacia* woodlands respond to similar environmental cues and aggregate where food and other resources are favourable. Forming mixed-species flocks may then become a social phenomenon without the need for clear benefits to members. Thus, the large size of flocks we observed at Gascoyne and Mt. Magnet and which Sedgwick (1988) reported for the Kimberley may be simply a consequence of the aggregation of large flocks of individual species in areas of food abundance.

ACKNOWLEDGMENTS

This study was conducted while WED was a Visiting Research Fellow at Edith Cowan University and the support of the university is gratefully acknowledged.

REFERENCES

Bell, H. L. (1980). Composition and seasonality of mixed-species feeding flocks of insectivorous birds in the Australian Capital Territory. *Emu* **80:** 227–232.

Bell, H. L. (1983). A bird community of lowland rainforests in New Guinea. 5. Mixed-species feeding flocks. *Emu* **82:** 256–275.

Chandler, L. G. (1937). The flocking of birds. *Emu* **37:** 7–9.

Davis, W. E., Jr. and Recher, H. F. (2002). Mixed-species foraging flocks at Dryandra State Forest, Western Australia. *Corella* **26:** 70–73.

Diamond, J. (1987). Flocks of brown and black New Guinean birds: a bicoloured mixed-species foraging association. *Emu* **87:** 201–211.

Gannon, G. R. (1934). Associations of small insectivorous birds. *Emu* **34:** 122–129.

Hermes, N. (1981). Mixed-species flocks in a dry sclerophyll forest in autumn and winter. *Corella* **5:** 41–45.

Hindwood, K. A. (1937). The flocking of birds with particular reference to the association of small insectivorous birds. *Emu* **36:** 254–261.

Krebs, J. R. (1973). Social learning and significance of mixed species flocks of chickadees (*Parus spp.*) *Can. J. Zool.* **51:** 1275–1288.

Miller, R. C. (1922). The significance of the gregarious habit. *Ecology* **3:** 122–126.

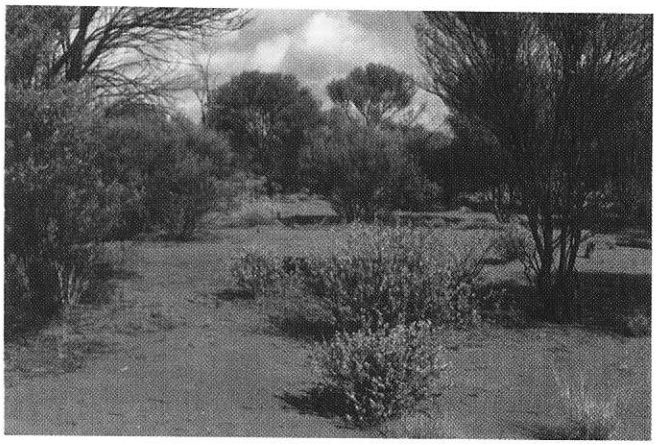
Plumb, W. (1948). A nesting season in a Wellard paddock. *Emu* **47:** 291–303.

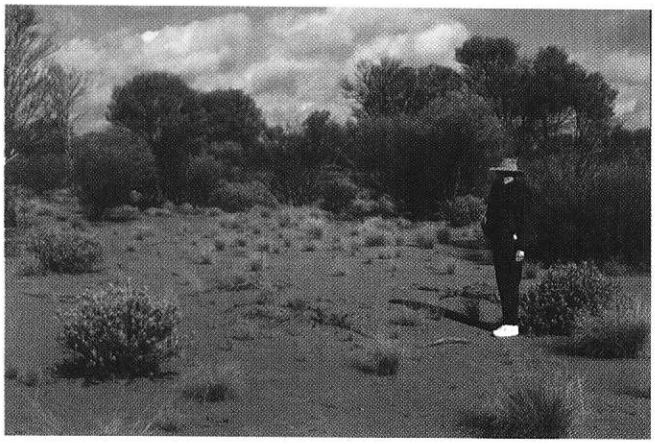
Powell, G. V. N. (1985). Sociobiology and adaptive significance of interspecific foraging flocks in the Neotropics. *In* 'Neotropical Ornithology' (Eds P. A. Buckley *et al.*) Pp. 713–732. (Ornithological Monographs No. 36, American Ornithologists' Union, Washington, D.C.)

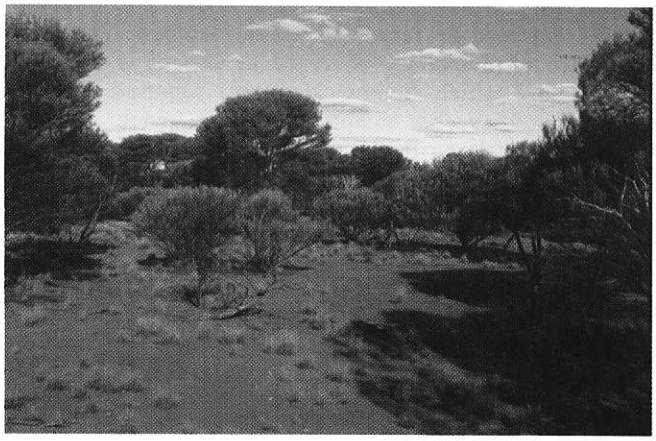
Rand, A. L. (1954). Social feeding behavior of birds. *Fieldiana: Zoology* **36:** 1–71.

Sedgwick, E. H. (1949). Mixed associations of small birds in the south-west of Western Australia. *Emu* **49:** 9–13.

Sedgwick, E. H. (1988). An Australian bird wave. *Aust. Bird Watcher* **12:** 24.







Mulga Acacia *aneura habitats* in the Gascoyne and Murchinson Districts of Western Australia and typical of acacia woodlands throughout much of western and central Australia. *Acacia aneura* reaches heights of 3 to 4 metres. Typically acacia woodlands are open with an understorey of lower shrubs and grasses. There are extensive open areas, which during summer and dry conditions, as in these photographs, appear as bare soil, but support a low ground vegetation of ephemeral grasses and herbs when it rains. When grass seed is abundant, mulga attracts large nomadic flocks of seed-eating birds. These tend to be accompanied by nomadic insectivores, such as chats and woodswallows, as the rich vegetation developing after rain encourages outbreaks of grasshoppers and moths.

All photographs courtesy of H. F. Recher.