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MIXED-SPECIES FORAGING FLOCKS IN WINTER AT DRYANDRA STATE FOREST, WESTERN AUSTRALIA

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Point counts (n = 100) were used to assess the pattern of bird distribution during winter in Dryandra Woodland near Narrogin, Western Australia. Ninety-two birds were recorded with the majority of individuals (68%) occurring in mixed-species foraging flocks. From mid-July to early August, mixed-species foraging flocks were followed to identify the species present and estimate numbers of individuals of each species. Including birds recorded during point counts, 779 individuals of 41 species were observed in 133 mixed foraging flocks. An Index of Association for species present in three-or-more-species flocks revealed two major groupings of species; a group dominated by Rufous Treecreepers *Climacteris rufa* and Yellow-plumed Honeyeaters *Lichenostomus ornatus*, which was associated with Wandoo *Eucalyptus wandoo* woodlands, and another associated with woodlands where treecreepers and Yellow-plumed Honeyeaters were scarce or absent. Both groups usually contained species from at least three foraging guilds suggesting a partitioning of resources within mixed flocks.

INTRODUCTION

During studies of the foraging ecology of eucalypt woodland birds at Dryandra Woodland in Western Australia (Recher and Davis 1998), we recorded mixed-species foraging flocks and other associations of birds in winter. In this paper, we describe the structure of foraging flocks in eucalypt woodlands at Dryandra with regard to species composition, foraging profiles of participating members, and suggest reasons for the non-random distribution of winter birds.

STUDY AREA AND METHODS

Studies were conducted in the Dryandra Woodland (centred on 32°45'S, 116°55'E) near the town of Narrogin 180 kilometres south-east of Perth, Western Australia. Wandoo *Eucalyptus wandoo* and Powderbark Wandoo *E. accedens* woodlands interspersed with Brown Mallet *E. astringens* plantations were the main habitats we worked in (see Recher and Davis 1998 for details). Between 13–25 July and 4–7 August 1997, from about 10:00 to 17:00 hours, mixed-species foraging flocks were followed to identify the species present and estimate numbers of individuals of each species (Table 1). On six days during this period, in addition to recording mixed-species flocks, solitary birds and single species flocks were also recorded. No birds at flowering trees or shrubs were included to avoid confusing foraging aggregations (*sensu* Powell 1979) with possible flocking behaviour.

To ascertain the evenness or patchiness of bird distribution, on 22–24 July 1997, 100 one-minute point counts were made and all birds seen were recorded. The point counts were conducted along unsealed roads at 0.5 kilometre intervals.

A similarity index was calculated for all species combinations among the 16 species most frequently encountered in flocks with three or more species in the following way:

$$\text{Similarity} = 2c/(a + b),$$

where c = the number of flocks in which two species occurred together, a = the number of flocks in which species a occurs, and b = the number of flocks in which species b occurs.

RESULTS

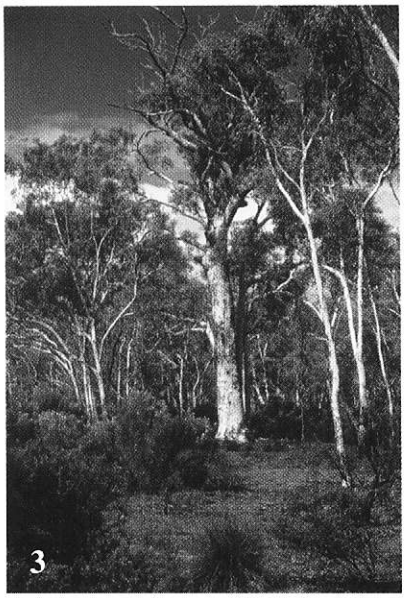
Including observations during point counts, 779 individuals of 41 species were recorded in 133 mixed-species flocks (Table 1). Ninety-two individuals of 22 species were recorded during point counts, with 90 per cent of birds in flocks. No birds were seen on 74 of the point counts, solitary birds on nine, single-species flocks on seven (20 individuals), two-species flocks on three (8), and three or more species flocks on seven (55).

Similar results were obtained on the six days when all birds were recorded: 33 solitary birds; 32 single-species flocks (84 individuals); 31 two-species flocks (99), and 33 three or more species flocks (244). Ninety-three per cent of birds were in flocks. Of all mixed-species flocks recorded, 52 were two-species flocks, while 81 had three or more species. Of the birds recorded in mixed-species flocks, 79 per cent (617 individuals) were in flocks with three or more species.

Co-occurrence of species

There were two major groupings of species in winter flocks at Dryandra (Table 2). Group 1 was an association of Rufous Treecreeper *Climacteris rufa*, Grey Shrike-thrush *Colluricincla harmonica*, Western Yellow Robin *Eopsaltria griseogularis*, and Yellow-plumed Honeyeater *Lichenostomus ornatus*. Group 2 was an association of Weebill *Smicrornis brevirostris*, Grey Fantail *Rhipidura fuliginosa*, Western Thornbill *Acanthiza inornata*, Silvereye *Zosterops lateralis*, Golden Whistler *Pachycephala pectoralis*, Western Warbler[1] *Gerygone fusca*, Yellow-rumped Thornbill *Acanthiza chrysorrhoa*, Scarlet Robin *Petroica multicolor*, Red-capped Robin *Petroica goodenovii*, Inland Thornbill *Acanthiza apicalis*,

[1]Western Gerygone



Figures 1, 2 and 3. *Powderbark Wandoo* Eucalyptus accedens *woodlands near the town of Narrogin, 180 kilometres south-east of Perth, Western Australia.*

Figure 4. *Wandoo at Dryandra Woodland, Western Australia. Photographs courtesy of Harry Recher.*

and Striated Pardalote *Pardalotus striatus*. Among the robins, Scarlet and Red-capped Robins showed only a weak association, and neither was found in flocks with Western Yellow Robins. Port Lincoln Parrots[2] *Barnardius zonarius* were associated with members of both groups. Twenty-five species were uncommon and could not be assigned to either group.

Except for species that routinely aggregated in single species flocks (e.g. babblers, sittellas, Yellow-plumed Honeyeater, Australian Magpie *Gymnorhina tibicen*), most species in mixed-species foraging flocks were represented by one to three individuals. In three or more species flocks, species were represented by a single individuals in 60 per cent of flocks, by two in 24 per cent, by three in 7 per cent, by four in 4 per cent, by five in 3 per cent, and by six in 1 per cent; once, a flock contained 14 Black-capped Sittellas[3] *Daphoenositta pileata*.

Foraging guilds

The two groups of frequently associated species showed a diversity of foraging behaviours with most species assigned to different foraging guilds (Table 3). Both groups contained species using different foraging heights, substrates, and manoeuvres.

Agonistic behaviour

Within the foraging flocks, agonistic encounters were infrequent. On two occasions Yellow-plumed Honeyeaters chased Western Yellow Robins, and once each they chased a Red-capped Robin, a Rufous Treecreeper, and a Dusky Woodswallow *Artamus cyanopterus*. However, Yellow-plumed Honeyeaters are aggressive to other birds regardless of whether or not they are members of mixed foraging flocks (pers. obs.).

DISCUSSION

The small number of conspecific individuals in the mixed foraging flocks may reduce intraspecific competition and confer an advantage to membership in mixed-species flocks over single-species flocks (e.g. protection against predators) (Moynihan 1962). There was little aggression among members of the flocks observed and most individuals used different foraging resources (e.g. different foraging heights and substrates) (Table 3). This contrasts with Cody (1971) who reported inter- and

[2]Australian Ringneck
[3]Varied sittellas *Daphoenositta chrysoptera*
The names of birds in the textvary from Christidis and Boles as shown above.

TABLE 1

Bird species found in mixed-species flocks at Dryandra State Forest during winter, with the number of occurrences in three or more species flocks (A) (n = 81), in two species flocks (B) (n = 52), and total numbers of individuals recorded in all flocks (C) (n = 133). Species are listed in decreasing frequency of occurrence in three or more species associations.

SPECIES	A	B	C
Weebill *Smicrornis brevirostris*	32	2	83
Grey Fantail *Rhipidura fuliginosa*	28	6	45
Rufous Treecreeper *Climacteris rufa*	27	17	79
Yellow-plumed Honeyeater *Lichenostomus ornatus*	20	24	87
Golden Whistler *Pachycephala pectoralis*	19	0	21
Western Thornbill *Acanthiza inornata*	19	2	35
Striated Pardalote *Pardalotus striatus*	17	1	34
Yellow-rumped Thornbill *Acanthiza chrysorrhoa*	16	3	38
Scarlet Robin *Petroica multicolor*	15	4	24
Grey Shrike-thrush *Colluricincla harmonica*	15	2	19
Western Warbler *Gerygone fusca*[1]	13	0	14
Inland Thornbill *Acanthiza apicalis*	12	3	19
Red-capped Robin *Petroica goodenovii*	12	3	22
Silvereye *Zosterops lateralis*	12	1	25
Western Yellow Robin *Eopsaltria griseogularis*	11	7	20
Port Lincoln Parrot *Barnardius zonarius*[2]	10	7	43
Jacky Winter *Microeca fascinans*	9	2	15
Brown-headed Honeyeater *Melithreptus brevirostris*	8	0	15
White-naped Honeyeater *Melithreptus lunatus*	8	0	11
Blue-breasted Fairy-wren *Malurus pulcherrimus*	5	1	14
Black-capped Sittella *Daphoenositta pileata*[3]	5	0	16
Willie Wagtail *Rhipidura leucophrys*	4	2	6
Spotted Scrubwren *Sericornis maculatus*[4]	4	1	5
Fan-tailed Cuckoo *Cacomantis flabelliformis*	4	0	4
Australian Magpie *Gymnorhina tibicen*	4	0	11
Dusky Woodswallow *Artamus cyanopterus*	3	9	15
Western Spinebill *Acanthorhynchus superciliosus*	3	1	5
Red Wattlebird *Anthochaera carunculata*	3	0	4
Painted Button-quail *Turnix varia*	2	1	4
Restless Flycatcher *Myiagra inquieta*	2	1	2
Brown Honeyeater *Lichmera indistincta*	2	0	2
White-browed Babbler *Pomatostomus superciliosus*	2	0	11
Singing Honeyeater *Lichenostomus virescens*	1	2	6
Splendid Fairy-wren *Malurus splendens*	1	0	2
Little Wattlebird *Anthochaera chrysoptera*	1	0	1
Tawny-crowned Honeyeater *Phylidonyris melanops*	1	0	1
Crested Shrike-tit *Falcunculus frontatus*	1	0	1
Rufous Whistler *Pachycephala rufiventris*	1	0	1
Grey Currawong *Strepera versicolor*	1	0	1
Western Rosella *Platycercus icterotis*	0	1	3
Black-faced Cuckoo-shrike *Coracina novaehollandiae*	0	1	1

Appears in Christidis and Boles as:
[1]Western Gerygone
[2]Australian Ringneck
[3]Varied Sittella *Daphoenositta chrysoptera*
[4]White-browed Scrubwren *Sericornis frontalis*

TABLE 2

Index of Association (similarity) among species present in ten or more flocks having three or more species in the flock. Index varies from 0 to 1, with 1 representing the highest degree of association. For ease of reading, values 0.4 have been highlighted. See Table 1 for scientific names.

SPECIES	WB	GFT	RTC	YPH	GWH	SR	RCR	WT	STP	YRT	GST	WW	BTT	SE	WYR	PLP
Weebill	—	.53	.20	04	.31	38	.27	.35	33	.29	.13	**.44**	.18	.32	.14	.05
Grey Fantail		—	.15	0	**.47**	.23	.25	**.55**	**.49**	.32	.05	.39	**.40**	**.50**	.10	.11
Rufous Treecreeper			—	.47	.26	.14	.05	.09	.23	.10	**.50**	.10	.10	.15	.32	.27
Yellow-Plumed HE				—	.10	0	.06	0	.06	.06	.34	0	0	0	.32	.33
Golden Whistler					—	.24	.10	.22	.28	.29	.24	.12	.19	.39	.13	.07
Scarlet Robin						—	.22	**.41**	.19	**.45**	.07	.07	.22	.15	0	.16
Red-Capped Robin							—	.26	.14	.36	.22	**.40**	.33	.17	0	.18
Western Thornbill								—	.17	**.51**	0	.38	.26	.39	0	.14
Striated Pardalote									—	.30	.06	.27	.14	.14	.21	.07
Yellow-Rumped THB										—	.13	.34	.36	**.43**	.07	0
Grey Shrike-Thrush											—	.07	.07	.15	.38	.08
Western Warbler												—	.32	.32	.08	.09
Inland Thornbill													—	**.42**	.08	0
Silvereye														—	.09	0
Western Yellow Robin															—	0
Port Lincoln Parrot																—

TABLE 3

Foraging guilds of core species in Groups 1 and 2 of frequently associated species. Species assigned to foraging guilds following Recher and Davis (1998).

	Foraging Attributes		
	Vegetation layer	Substrate	Foraging manoeuvre
GROUP 1			
Rufous Treecreeper	ground	ground/bark	glean/probe
Grey Shrike-thrush	ground/canopy	ground/bark	glean/probe
Western Yellow Robin	ground	ground	pounce
Yellow-plumed Honeyeater	canopy	bark/foliage	glean/probe
GROUP 2			
Weebill	canopy	foliage	glean/hover
Grey Fantail	shrub/canopy	air	hawk
Western Thornbill	ground/canopy	ground/foliage	glean
Silvereye	ground/canopy	ground/bark	glean
Golden Whistler	ground/canopy	foliage	glean/snatch
Western Warbler	canopy	foliage	glean/snatch
Yellow-rumped Thornbill	ground	ground	glean
Scarlet Robin	ground	ground	pounce
Red-capped Robin	ground	ground	pounce
Inland Thornbill	shrub/canopy	foliage	glean/snatch
Striated Pardalote	canopy	foliage	glean

intraspecific aggression in flocks of desert sparrows in winter. However, in Cody's study, flocks were all birds of the same foraging guild while the flocks at Dryandra typically had representatives of at least three guilds. This is similar to temperate mixed-species foraging flocks elsewhere in Australia. For example, Hermes (1981) found that most mixed foraging flocks studied in the Australian Capital Territory also contained representatives of three or more foraging guilds.

Of the 16 most frequently recorded species in Group 1 or Group 2 flocks, one or more were recorded in 80 of 81 three-or-more-species flocks. These species appear to be the regular (*sensu* Davis 1946) or core members of flocks, although some (e.g. Red-capped Robin), may only remain with the flock while it is in their territory or home range. The frequency of occurrence of non-core species may thus reflect their abundance at Dryandra. The presence of thornbills in Group 2 flocks is consistent with the findings of Bell (1980) and Gannon (1934) who considered them a group-forming or nuclear species.

Hermes (1981) and Bell (1983) suggested that the presence of some species in mixed-species flocks might be coincidental. About half of the species encountered in Dryandra in three or more species flocks were found in fewer than 5 per cent of all flocks. This low occurrence may indicate chance participation, although in some cases it may simply reflect rarity (e.g. Crested Shrike-tit *Falcunculus frontatus*, Rufous Whistler *Pachycephala rufiventris*, and Splendid Fairy-wren *Malurus splendens*).

The existence of two groups of mixed-species foraging flocks at Dryandra reflects differences in habitats and the distribution of species between habitats. Wandoo habitats with a grassy understorey and patches of shrubs on nutrient-rich soils are frequented by Rufous Treecreeper, Yellow-plumed Honeyeater, Grey Shrike-thrush, and Western Yellow Robin (Group 1). More open habitats with significant bare ground on ridges and slopes were preferred by the ground-foraging thornbills and Scarlet and Red-capped Robins (Group 2). In addition, the presence of aggressive Yellow-plumed Honeyeaters in Group 1 may discourage smaller species such as Weebill, Grey Fantail, and Striated Pardalote.

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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 rainforest in New Guinea. 5. Mixed-species foraging flocks. *Emu* **82:** 256–275.

Cody, M. L. (1971). Finch flocks in the Mohave Desert. *Theoretical Population Biology* **2:** 142–158.

Davis, D. E. (1946). A seasonal analysis of mixed flocks of birds in Brazil. *Ecology* **27:** 168–181.

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.

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

Moynihan, M. (1962). The organization and probable evolution of some mixed-species flocks of Neotropical birds. *Smithsonian Misc. Collect* **143:** 1–140.

Powell, G. V. N. (1979). Structure and dynamics of interspecific flocks in a mid-elevation Neotropical forest. *Auk* **96:** 375–390.

Recher, H. F. and Davis, W. E. (1998). The foraging profile of a wandoo woodland avifauna in early spring. *Aust. J. Ecol.* **23:** 514–527.