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A LONG-TERM BANDING STUDY OF BIRDS IN A SPOTTED GUM FOREST NEAR CAMPBELLTOWN, NEW SOUTH WALES

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Data on recapture and seasonal and annual variation in capture rates, obtained during a 21-year banding project in Spotted Gum forest 50 kilometres south-west of Sydney, New South Wales, are given for a range of frequently captured species. Six species are shown to be resident, whilst a further five species were probably resident. Four species were migratory. Numbers of four species of honeyeater were positively correlated with the flowers of the main nectar source, the Spotted Gum, but in all four, other factors appear also to have influenced capture rates. The numbers of at least one honeyeater, the Eastern Spinebill, were not correlated with the flowering of Spotted Gum. The New Holland Honeyeater was an irregular, irruptive visitor. Numbers of the Fuscous Honeyeater and White-browed Scrubwren showed long-term trends, the former inexplicably so and the latter in apparent correlation with fluctuations in vegetation and climate.

INTRODUCTION

In the 200 years of European settlement of Australia, much of what was forest and woodland has been cleared for agriculture (Sivertsen 1995). In that time, the woodlands of the Cumberland Plain in the Sydney basin have been reduced by 94 per cent (Benson and Howell 1990). The restriction of bush birds to remnant patches reduces the total population, may render individual populations unviable due to their small size, and may inhibit dispersal and recolonisation processes (Robinson 1993). However, studies of change in bird populations must also consider other sources of change, which may include longer term change to vegetation at the local scale (for example, as a result of fire or grazing) which may not be repeated across the entire landscape. Yet other sources of change that may affect the results of particular bird studies are those attributable to seasonal migration or nomadism.

I have previously described patterns of change to and variation in the avifauna of the Humewood/Beulah forest, a remnant forest of Spotted Gum *Corymbia maculata* on the Cumberland Plain near Campbelltown, New South Wales, based primarily on observations over a 20 year period (Leishman 1994). In this paper, I present banding data obtained in the same forest patch over a 21 year period. The banding data is summarized for the more frequently-captured species to demonstrate patterns of residency, migration and long-term change.

STUDY AREA

The study was conducted in the 32 hectare Humewood/Beulah forest (34°08'S, 150°47'E), a block of privately-owned forest 8 kilometres south of Campbelltown and *c.* 50 kilometres south-west of Sydney, New South Wales. The Humewood/Beulah forest is part of a larger forest patch, and is also connected by linear riparian vegetation to the Nepean River (Fig. 1). Nevertheless, it is a significant remnant of Spotted Gum forest on the Cumberland Plain. There is no evidence that the Humewood/Beulah forest has ever been cleared, although a few individual trees have been removed. Blackened stringybark trunks indicate a history of fire, but the last fire in the forest occurred in about 1963, ten years before this study commenced.

The study area is 220 metres above sea level. The climate is temperate maritime with warm to hot summers and mild to cool winters with occasional frosts. Mean annual rainfall is 740 millimetres with reasonable consistency throughout the year but seasonal peaks in January to March and June. Geologically, the area consists of Wianamatta shales that have been eroded in places to expose underlying Hawkesbury sandstones. The shales produce clay soils with a higher moisture-retention capacity than the soils associated with the sandstones. Within the study area, the sandstones are exposed along the bisecting Woodhouse Creek, with shales predominant on the higher ground.

The vegetation is tall, dry sclerophyll forest with a dense understorey of small trees and shrubs. On the shale, the dominant trees are Spotted Gum *Corymbia maculata*, Thin-leaved Stringybark *Eucalyptus eugenioides* and Red Ironbark *E. fibrosa*, with scattered Rough-barked Apple *Angophora floribunda*. On the sandstone along Woodhouse Creek, the dominant trees are Blackbutt *E. pilularis* and Forest Oak *Allocasuarina torulosa*. Major understorey trees and large shrubs are Yellow Pittosporum *Pittosporum revolutum*, Native Blackthorn *Bursaria spinosa*, Narrow-leaved Geebung *Persoonia linearis*, Two-veined Hickory *Acacia binervata* and Tick Bush *Kunzea ambigua*, the latter especially in the western parts. The dense ground cover of small shrubs and grasses features Wallaby Weed *Olearia viscidula*, Peach Heath *Lissanthe strigosa* and Tufted Hedgehog Grass *Echinopogon caespitosus*.

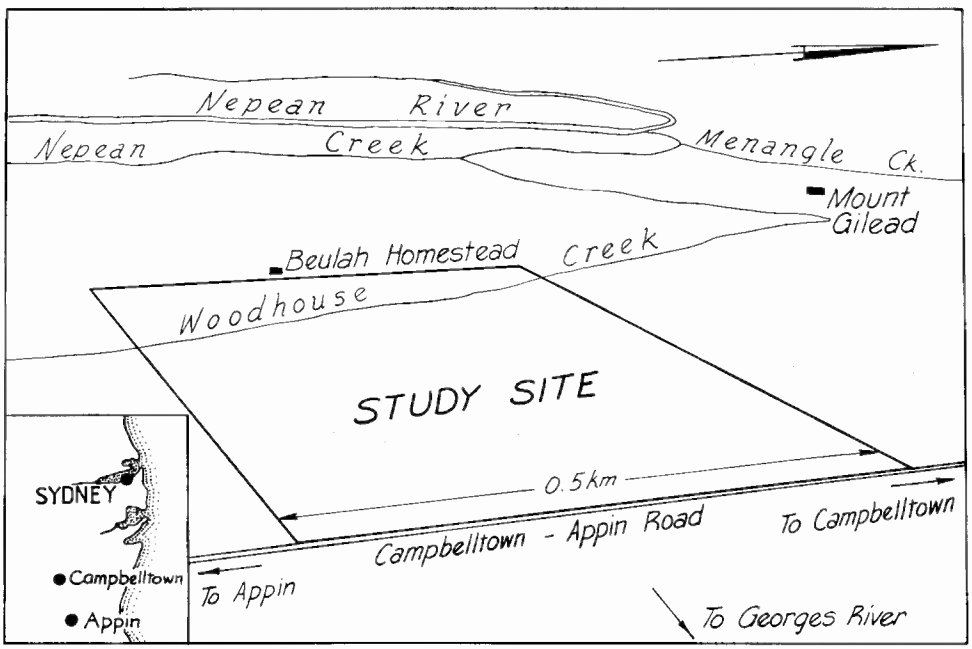
During the 21 years of the study, there was considerable change to the vegetation of the study area. Intense grazing by cattle from 1973 to 1975 (but not thereafter) eliminated understorey from some areas, particularly large patches of Yellow Pittosporum. This understorey recovered only slowly, being evidently held back by a severe drought from 1979 to 1982 in which rainfall was less than 60 per cent of average for three of the four years. The reverse trend was evident in other parts of the forest, with gradual reduction in the density of the understorey species such as Two-veined Hickory, the cumulative effect of which was to render the forest much more open. In the western section of the forest there was widespread death of Tick Bush, apparently due to age, whilst in some adjacent areas there was regeneration of the species. I suspect the gradual opening up of the forest understorey in places was a natural succession attributable to the absence of fire for (by the end of the study) approximately 30 years.

METHODS

Banding

Banding studies commenced in December 1973 and continued until July 1994. During that period, the forest was visited for banding a total of 144 times, with from 1 to 17 visits per year and with more than three visits in all years except 1973, 1987, 1990, 1991, 1992 and 1993. Visits were made at all times of the year, with from six visits during November to 18 visits in each of March and April. During each visit, I also kept records of the flowering of the major nectar source, Spotted Gum.

Figure 1. *Aerial photograph of the study site, looking north-west and showing forested and unforested adjacent areas including riparian vegetation that connects the study area to the Nepean River. (Photograph: Jeff De Pasquale, reproduced with permission of Cumberland Newspapers. Key illustration: Marion Westmacott.)*



Each visit comprised one, or occasionally two days of banding. Except for the first two years, when banding was concentrated in the south-eastern section of the forest, most banding took place in the centre of the forest. Net sites were used on a regular basis. The number of nets operated varied from 6 to 12 and occasionally as many as 24, depending on the number of assisting banders available to handle the birds. Each net was either 12 or 18 metres in length and three metres in height, with a 32 millimetre mesh size that was optimal for small- and medium-sized bush birds. Nestlings and other birds were also banded as opportunities arose to do so.

Analysis

The *number of captures* is calculated by including each capture of each individual, whereas the *number banded* includes each individual only once. The *recapture rate* is defined as the number of individuals recaptured as a percentage of the number banded. Capture rates are mean numbers caught per visit. Monthly and annual capture rates have been calculated by pooling monthly captures across years, and annual rates across months respectively.

Monthly and annual indices of variability were calculated by dividing the mean capture rate of the third highest month or year by the third lowest mean monthly or annual capture rate. Thus, high index values indicate high rates of variation in capture rates. For the analysis of years, only the 16 years in which there were four or more visits were included in the analysis. For comparisons of years according to the intensity of flowering, the first and last years of the study were excluded, as the programme did not operate for the full year.

In all analyses of capture rates it is acknowledged that rates are likely to have been influenced by inequalities and variation in the pattern of sampling, and that interactions between years and months may well go undetected. For these reasons, I have made use of simple and relatively robust exploratory analyses that emphasize comparisons of species rather than the actual capture rates. In most cases, analysis is pursued only for those species for which more than 30 individuals were banded.

RESULTS

Capture and recapture rates

A total of 6 189 birds of 66 species were banded during the study. The most frequently banded species were (in decreasing order): Yellow-faced Honeyeater *Lichenostomus chrysops*, White-naped Honeyeater *Melithreptus lunatus*, Yellow-tufted Honeyeater *Lichenostomus melanops*, Silvereye *Zosterops lateralis* and Red-browed Finch *Neochmia temporalis*. For twenty-three species, more than 30 individuals were banded (Table 1). This latter group are hereafter referred to as *frequently banded species*.

Recapture rates of frequently banded species varied from 2 to 65 per cent, being equal to or greater than 50 per cent in the White-throated Treecreeper *Cormobates leucophaeus*, White-browed Scrubwren *Sericornis frontalis*, Eastern Yellow Robin *Eopsaltria australis* and Brown Thornbill *Acanthiza pusilla* and less than 5 per cent in the Rufous Fantail *Rhipidura rufifrons*, New Holland Honeyeater *Phylidonyris novaehollandiae*, Yellow-faced Honeyeater and Silvereye (Table 1). Seven individuals of three species (White-throated Treecreeper, Brown Thornbill and Eastern Yellow Robin) were recaptured ten or more times, whereas 66 individuals of thirteen species were recaptured five or more times (Table 1). In the latter class, the Eastern Yellow Robin was outstanding, with 24 individuals recaptured five or more times. The maximum recorded longevity was greater than 10 years for five species (as listed in Table 1 plus Laughing Kookaburra *Dacelo novaeguineae*) and greater than five years for 14 further species (as listed in Table 1 plus Eastern Whipbird *Psophodes olivaceus*, Crested Shrike-tit *Falcunculus frontatus*, Grey Shrike-thrush *Colluricincla harmonica*, Olive-backed Oriole *Oriolus sagittatus* and Dusky Woodswallow *Artamus cyanopterus*). See Leishman (1994) for more detail about longevity, as well as for information about species recaptured away from the study area.

Four parameters derived from the recapture data (recapture rate, mean number of recaptures of recaptured individuals, maximum number of recaptures of any individual and maximum recorded longevity) were all positively correlated with each other when considered

TABLE 1

Banding and recapture rates and maximum longevity of species for which more than 30 birds were banded (*frequently banded species*).

Species	Number banded	Number of captures	Recapture rate (%)	Number of times recaptured (number of individuals)												Max. recorded longevity (years/months)
				1	2	3	4	5	6	7	8	9	10	12	14	
White-throated Treecreeper	39	127	65	9	2	2	6	3	1				1		1	9/00
Superb Fairy-wren	156	300	43	40	9	8	6	5	1	1						4/02
Variegated Fairy-wren	62	74	19	12												2/03
Spotted Pardalote	101	110	7	5	2											2/00
White-browed Scrubwren	49	113	57	12	4	7	3	1	1							4/00
Brown Thornbill	105	234	50	22	19	3	3	2	1				2	1		11/10
Striated Thornbill	73	107	35	22	3	2										8/01
Noisy Miner	58	62	7	4												2/06
Yellow-faced Honeyeater	1807	1910	4	50	10	5		2			1					7/03
Yellow-tufted Honeyeater	470	664	22	66	15	11	6	3	3		1					7/04
Fuscous Honeyeater	198	259	21	29	7	2	3									7/01
White-naped Honeyeater	847	925	7	45	11	1					1					11/08
New Holland Honeyeater	46	47	2	1												0/01
Eastern Spinebill	154	202	17	14	7	2	2		1							6/00
Rose Robin	37	43	11	2	2											4/01
Eastern Yellow Robin	211	551	56	44	25	18	8	8	6	6		2	1		1	11/09
Golden Whistler	240	342	22	31	11	5	3	2	2							8/05
Rufous Whistler	88	162	39	17	6	7	2				2					14/00
Rufous Fantail	64	65	2	1												0/01
Grey Fantail	236	279	12	23	3	3		1								7/10
Grey Butcherbird*	31	33	6	2												3/07
Red-browed Finch	378	514	24	60	18	7	2	1	1							5/01
Silvereye	389	419	4	8	7	1		1								4/11

*Grey Butcherbird *Cracticus torquatus*. Other scientific names are in the text.

TABLE 2

Matrix of Spearman rank correlation coefficients for frequently banded species for four parameters derived from recapture data.

	Mean recaptures	Max. recaptures	Max. longevity
Recapture rate	0.77 ***0.64 **	0.58 **	
Mean recaptures	0.88 ***	0.67 ***	
Max. recaptures			0.83 ***

Parameters, derived from Table 1:
Mean recaptures = mean number of times recaptured individuals were recaptured
Max. recaptures = maximum number of times any individual was recaptured
Max. longevity = Maximum recorded longevity
Recapture rate — as in Table 1
Probabilities are two-tailed, with n = 23: ** = $P < 0.01$; *** = $P < 0.001$

across the frequently banded species (Table 2), suggesting the obvious — that long-lived species tend to be recaptured more often. Variation from this consistency, as shown by large D^2 values in the calculation of the correlation coefficients, is potentially informative. Four patterns of large D^2 values were noted (Table 3 *cf* Table 1): low maximum recorded longevity and high recapture rate and/or mean number of recaptures (Superb Fairy-wren *Malurus cyaneus* and White-browed Scrubwren); high maximum recorded longevity and high maximum number of recaptures combined with particularly low recapture rate (White-naped Honeyeater, Yellow-faced Honeyeater); low recapture rate and moderate mean number of recaptures (Silvereye) and high recapture rate and considerable maximum recorded longevity, but low mean number of recaptures (Striated Thornbill *Acanthiza lineata*).

TABLE 3

D^2 values of 100 or greater obtained in the calculation of Spearman rank correlation coefficients (Table 2).

	Parameters compared					
Species	1–2	1–3	1–4	2–3	2–4	3–4
Superb Fairy-wren			100			
White-browed Scrubwren			225		169	
Striated Thornbill	100				100	
Yellow-faced Honeyeater		225	110.25			
White-naped Honeyeater		132.25	169	110.25	144	
Silvereye	110.25					

Parameters (see Table 2 for more complete explanation):
1 = Recapture rate
2 = Mean recaptures
3 = Max. recaptures
4 = Max. longevity

Seasonal variation

Thirteen frequently banded species were captured in every month (months pooled across years, Table 4). Within this group, there were marked differences in the monthly index of capture rates. The Eastern Yellow Robin, Brown Thornbill and Superb Fairy-wren had monthly indices of 2.0 or less (i.e. they were caught at relatively uniform rates throughout the year). Monthly indices of less than 4.0 were obtained for the Variegated Fairy-wren *Malurus lamberti*, White-browed Scrubwren, Yellow-tufted Honeyeater, Fuscous Honeyeater *Lichenostomus fuscus*, Grey Fantail *Rhipidura fuliginosa* and Red-browed Finch, even though not all these species were captured in every month. In contrast, high monthly indices were obtained for the White-naped Honeyeater (13.6) and Yellow-faced Honeyeater (8.0) even though both these species were recorded in every month of the year.

TABLE 4

Monthly and annual patterns of capture summarized for frequently banded species.

Species	No. months captured	No. years captured*	Capture rate indices Monthly	Annual
White-throated Treecreeper	12	16	5.6	3.3
Superb Fairy-wren	12	15	2.0	6.0
Variegated Fairy-wren	11	14	3.3	4.2
Spotted Pardalote	11	15	5.2	6.6
White-browed Scrubwren	11	14	2.6	10.7
Brown Thornbill	12	16	1.5	4.6
Striated Thornbill	10	14	7.4	7.7
Noisy Miner	9	12	∞	∞
Yellow-faced Honeyeater	12	16	8.0	19.1
Yellow-tufted Honeyeater	12	13	2.7	∞
Fuscous Honeyeater	12	11	3.5	∞
White-naped Honeyeater	12	14	13.6	70
New Holland Honeyeater	2	4	∞	∞
Eastern Spinebill	12	15	4.2	4.0
Rose Robin	6	13	∞	∞
Eastern Yellow Robin	12	16	1.5	1.9
Golden Whistler	12	16	5.2	3.4
Rufous Whistler	8	16	∞	9.3
Rufous Fantail	7	15	∞	8.9
Grey Fantail	12	16	3.4	2.9
Grey Butcherbird	8	14	∞	5.0
Red-browed Finch	12	16	3.6	7.5
Silvereye	12	16	4.3	10.2

See text for details of methods of calculation of monthly and annual indices.
*out of 16 years in which there were four or more banding visits.

Seven species exhibited marked patterns of seasonality in their capture rates (Fig. 2). The Sacred Kingfisher *Todiramphus sanctus*, Rufous Whistler *Pachycephala rufiventris* and Rufous Fantail were recorded only from September to April, and the Rose Robin *Petroica rosea* only from March to August. The Yellow-faced and White-naped Honeyeaters were recorded in all months but were markedly more abundant in June, July and August. The White-eared Honeyeater *Lichenostomus leucotis* was recorded only from March to July, but the significance of this is questionable because it is based on only eight captures in seven different years.

Variation between years

Nine species were captured either during every year of the study or at least in all of the sixteen years in which I made more than three banding visits to the site, and a further four species were captured in all but one of the 16 years (Table 4). Low annual indices (indicating that the species was captured at relatively constant rates across years) were obtained for the Eastern Yellow Robin (1.9), Grey Fantail (2.9), White-throated Treecreeper (3.3) and Golden Whistler *Pachycephala pectoralis* (3.4). Amongst species captured in all or most years, annual indices were high (indicating marked variation between years in capture rates) for the White-naped Honeyeater (70), Yellow-faced Honeyeater (19.1), White-browed Scrubwren (10.7) and Silvereye (10.2).

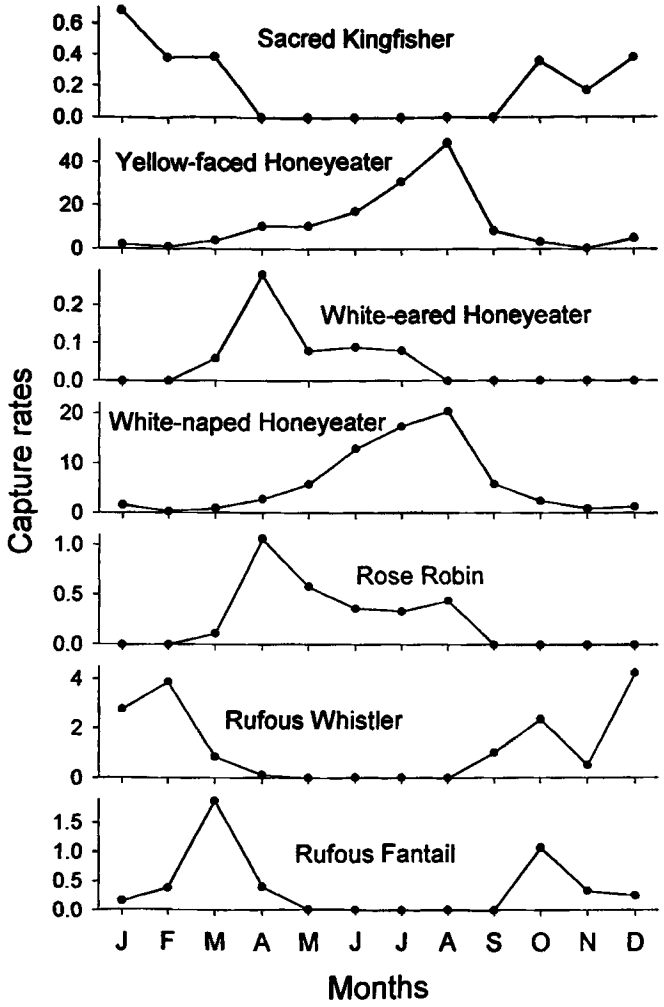


Figure 2. *Monthly capture rates (months pooled across years) in the Humewood/Beulah forest for seven markedly seasonal species. Note the variable scale of the capture rate axis; the low capture rates of the Sacred Kingfisher and White-eared Honeyeater correspond to 21 and 8 captures respectively.*

Spotted Gum flowered at the study site between March and August. Flowering occurred in seven years (1976, 1980, 1983, 1985, 1987, 1989 and 1992) out of 21, with heavy flowering in four of these (1980, 1983, 1985, 1989). Flowering never occurred in two consecutive years.

Capture rates of eight common honeyeaters are compared for years with different levels of flowering of Spotted Gum in Table 5. Differences between species in their apparent response to flowering are evident and strongly suggestive of trends. Four honeyeaters (Yellow-faced, Yellow-tufted, Fuscous and White-naped) were markedly more common in years of heavy flowering than years of nil, light or moderate flowering of Spotted Gum, though all four were also captured in years with no flowering. In contrast, capture rates of the Eastern Spinebill displayed no obvious relationship with Spotted Gum flowering. It is unclear whether capture rates of the Noisy Miner *Manorina melanocephala* and Brown-headed Honeyeater *Melithreptus brevirostris* were related to the flowering of Spotted Gum. The New Holland Honeyeater was captured in only four years, but three of these were years of heavy flowering.

Two species displayed long-term trends in capture rates. The Fuscous Honeyeater was captured in every year from 1974 to 1981, again in 1983 and 1985 and then not again until 1994. In 1994 the mean monthly capture rate was only 0.2 (i.e. only one individual was caught in the five visits made that year), whereas in previous years in which I captured the species, rates ranged from 0.4 to 9.2.

TABLE 5

Mean (± standard deviation) capture rates per banding visit in years of heavy (n = 4), light to moderate (n = 3) or no flowering (n = 13) of Spotted Gum for the eight species of honeyeaters of which more than 20 individuals were captured.

Honeyeater species	Flowering of Spotted Gum		
	Heavy	Light to moderate	Nil
Noisy Miner	0.6 (0.7)	0.2 (0.1)	0.4 (0.5)
Yellow-faced Honeyeater	38.0 (14.1)	6.4 (1.7)	8.2 (10.0)
Yellow-tufted Honeyeater	14.4 (2.3)	2.4 (0.8)	2.2 (1.9)
Fuscous Honeyeater	4.4 (4.1)	0.4 (0.5)	1.1 (1.7)
Brown-headed Honeyeater	0.4 (0.4)	<0.1 (0.1)	0.1 (0.2)
White-naped Honeyeater	23.8 (13.0)	4.1 (2.7)	2.7 (2.5)
New Holland Honeyeater	1.6 (2.1)	0.0 (0.0)	<0.1 (0.2)
Eastern Spinebill	1.6 (0.8)	1.8 (1.5)	1.4 (0.8)

The White-browed Scrubwren was captured at rates of greater than 1.0 per trip from the commencement of the study in 1973 until 1975, and again from 1987 until the end of the study in 1994. In the intervening years of 1976 to 1986, capture rates were consistently and mostly markedly lower than 1.0 and in two years with seven and eight banding visits respectively, was not captured at all. Its demise coincides with heavy grazing by cattle which destroyed much understorey during the early years of the study. The recovery of the understorey and Scrubwren numbers appears to have been inhibited by the sequence of drought years from 1979 to 1982. However, there was no significant correlation between annual capture rates of the White-browed Scrubwren and those of two other shrub-layer species, the Superb Fairy-wren and the Variegated Fairy-wren (Spearman rank correlation tests, two-tailed P both >0.15).

DISCUSSION

Long-term banding projects have made useful contributions to the identification and interpretation of seasonal and long-term trends in bird populations (e.g. Tidemann *et al.* 1988; Egan *et al.* 1997). The information they provide is often complementary to that gathered by formal counts or informal observations. This may arise because of variation within and between species in their detectability, with mist-netting offering potential advantages for cryptic species or those that vary seasonally in their detectability by observation because of variation in calling frequencies (Keast 1994; Gibb 1996). Egan *et al.* (1997, Fig. 3) detected Silvereyes in more months by capture in mist-nets than by counting, but the White-throated Gerygone *Gerygone olivacea*, Olive-backed Oriole and Yellow-faced Honeyeater were detected more often during counts and observations. Even where counts prove more effective at determining population trends, banding or other marking of individuals is needed to determine whether or to what extent a persistent population consists of resident individuals, and whether migrants and nomads demonstrate

fidelity to sites between years (e.g. Franklin and Noske 1998). This study is therefore complementary to my previous observational record (Leishman 1994) of patterns of seasonality and long-term trends in species populations in the Humewood/Beulah Spotted Gum forest.

A caution on the interpretation of banding data is, however, that capture rates need not always reflect populations, as in the example from Egan *et al.* (1997) cited in the previous paragraph. Species may vary in trappability between times of year. Individuals may become 'trap-shy'. Particular circumstances, such as the position of food resources (e.g. flowers) may influence capture rates. The effects of such (usually unquantified) sources of error may be minimized by analyses that emphasize differences between species rather than absolute capture rates. Using this conservative approach to analysis, this project has produced data that appear robust and interpretable for most of the 23 frequently banded species (Table 6).

TABLE 6

Patterns of occurrence of 23 frequently captured bird species in the Humewood/Beulah forest as suggested by 21 years of banding data.

Pattern	Species
Resident	White-throated Treecreeper
	Superb Fairy-wren
	Brown Thornbill
	Eastern Yellow Robin
	Golden Whistler
	Red-browed Finch
Probably resident	Variegated Fairy-wren
	Spotted Pardalote
	Striated Thornbill
	Eastern Spinebill
	Grey Fantail
Migrant	Rose Robin (March to August)
	Rufous Whistler (Sept. to April)
	Rufous Fantail (Oct. to April)
Partial migrant (also irruptive)	Yellow-faced Honeyeater
	White-naped Honeyeater
	Silvereye
Infrequent, irruptive visitor	New Holland Honeyeater
Long-term trend	White-browed Scrubwren
	Fuscous Honeyeater
Ambiguous or complex pattern	Yellow-tufted Honeyeater
Insufficient captures	Noisy Miner
	Grey Butcherbird

A combination of high recapture rates, frequent multiple recaptures, capture in all or most months and years, and low monthly indices of capture rates very strongly suggests that a high proportion of individuals of a species are resident at the site. Six species are considered to be resident on this basis (Table 6), whilst five more were probably so, exhibiting some but not all of the necessary described traits. There are a variety of reasons why uncertainty about residence status may occur. These could include: net-shyness reducing recapture rates (possibly Grey Fantail), low and inconsistent trappability (possibly Spotted Pardalote *Pardalotus punctatus*), and spatial shifts in the use of home ranges that are substantially larger than or marginal to the area sampled by nets (possibly Variegated Fairy-wren, Striated Thornbill, Eastern Spinebill). In the case of the Striated Thornbill, this pattern is suggested by high recapture rates and the considerable maximum recorded longevity combined with a low mean number of recaptures.

The low maximum recorded longevity but high recapture rates of the Superb Fairy-wren and White-browed Scrubwren suggest that these species may be relatively short-lived. The low recapture rate but moderate mean number of recaptures of the Silvereye may indicate a short-lived partial migrant with some individuals resident or returning to the site between years.

Seven species were partially or totally migratory at the site. The New Holland Honeyeater was an infrequent irruptive visitor.

The abundance of four species of honeyeater — Yellow-faced, Yellow-tufted, Fuscous, White-naped — was strongly correlated with the intensity of flowering of Spotted Gum, the major nectar source at the site. In contrast, the abundance of the Eastern Spinebill *Acanthorthynchus tenuirostris* was clearly not related to the flowering of Spotted Gum. However, in all four species whose capture rates were related to the flowering of Spotted Gum, other factors appear also to have influenced their occurrence. The Yellow-faced and White-naped Honeyeaters were evidently partial migrants, the high mean number of recaptures and considerable recorded longevity suggesting residence or site-faithful migration of a few individuals regardless of Spotted Gum flowering. The Fuscous Honeyeater displayed a long-term reduction in abundance, the reasons for which are not known but which are consistent with trends elsewhere on the Cumberland Plain (Egan *et al.* 1997).

The pattern of occurrence of the Yellow-tufted Honeyeater was particularly intriguing. The species was commonly caught and banded, fairly frequently recaptured with numerous multiple recaptures and considerable longevity, and was recorded in all months and with a low monthly index of capture rates, suggesting residency. The species breeds in the Humewood/Beulah forest, and marked influxes in years of Spotted Gum flowering were mostly juveniles (Leishman 1994). However, none were captured in four years, three of which were quite well-sampled (4, 5 and 7 visits). During the study one immature Yellow-tufted Honeyeater banded on 17 July 1983 was recaptured 21 kilometres NE on 9 September 1984 (Leishman 1994), indicating dispersal of this species. A possible explanation, admittedly speculative, is that adults are sedentary but populations are prone to local extinction, and that high rates of juvenile dispersal permit re-establishment of populations. This explanation is not incompatible with the banding records and observations of Morris (1975), who considered the species to be sedentary at Munghorn Gap, New South Wales, and those of Kellam (1980) who reported numerous recaptures both at the site of banding and at distances of up to 56 kilometres distant, in the Bendigo district of Victoria. It is less obviously compatible with the counts of Wykes (1985), who at two sites in Victoria found relatively constant populations during the breeding season but marked fluctuations at other times, some of which were related to local flowering and some of which were not.

Finally, the White-browed Scrubwren data suggests a sedentary species whose abundance was markedly affected by fluctuations in vegetation and climate.

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