

# FOREST BIRD COMMUNITIES OF THE RICHMOND RIVER DISTRICT, NEW SOUTH WALES

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Birds in sclerophyll (eucalypt) forests and rainforests in northern NSW were counted monthly over 30 months between 1977 and 1982. The bird communities of two dry sclerophyll forests were similar, a feature of both being the high frequency of lorikeets and honeyeaters (43–55% of all birds). They showed greater similarities to eucalypt woodland communities (elsewhere in NSW) than to moist forest communities. Coastal wet sclerophyll forest shared the same number of species with both dry sclerophyll forests and rainforests, but a greater affinity with the latter was indicated by the dominant species. The species composition of dry and subtropical rainforests were similar, although relative abundance values for many primary rainforest species, particularly the larger frugivores, were lower in dry rainforest. No exotic species were recorded from any site. Seasonal patterns were similar for all sclerophyll forests. Species numbers were generally highest in autumn and/or spring, and lowest in summer. Numbers of individuals were highest in winter and lowest in summer, a pattern that differs from that reported from some eucalypt forest and woodland communities elsewhere in south-eastern Australia. In the rainforests, both the numbers of species and of individuals were highest in summer and lowest in winter, contrasting with the seasonality of the sclerophyll forests.

## INTRODUCTION

Birds at five forest sites near Casino in the Richmond River district, north-eastern New South Wales, were surveyed in a census programme sampling all seasons. Dry sclerophyll forest, coastal wet sclerophyll forest, dry rainforest and subtropical rainforest were investigated to determine the composition and seasonality of bird communities.

This paper is the fourth in a series reporting the results of systematic surveys of birds using specific habitats in the Richmond River district (Gosper 1981a and b, 1983). A description of the Richmond River district, including the distribution and extent of major forest types, has been given previously (Gosper 1986).

## STUDY AREAS

*Site A: Myrtle State Forest (152°58'E, 29°09'S; 40–50 m asl).* Dry open sclerophyll forest (10–25 m): Spotted Gum *Eucalyptus maculata* association, with Northern Grey Ironbark *E. siderophylla*, Grey Ironbark *E. paniculata* and Pink Bloodwood *E. intermedia*; mistletoe common; patchy understorey, commonly *Acacia leiocalyx*, Red Ash

*Alphitonia excelsa* and locally *Banksia integrifolia*; Black She-oak *Casuarina littoralis* and *Melaleuca nodosa* forming thickets in some situations; ground cover absent or sparse, mostly grasses *Themeda australis* and *Imperata cylindrica*. Flat; forest low and open, tending to woodland in parts. Selectively logged over a long period, with last intensive logging in early 1960s. Small clearing adjacent to census area.

*Site B: Royal Camp State Forest (152°53'E, 29°02'S; 70–100 m asl).* Dry open sclerophyll forest (12–25 m), canopy generally less open than Site A: Spotted Gum association, with Grey Ironbark subdominant; also Forest Red Gum *Eucalyptus tereticornis*; mistletoe common. Discontinuous understorey including wattles *Acacia concurrens* and *A. irrorata*, Forest She-oak *Casuarina torulosa*, Red Ash and *Banksia*, with paperbarks *Melaleuca quinquinervia* in swampy gully; groundcover mainly absent or sparse, but grassy in places. Flat to undulating. Selectively logged over a long period, with last intensive logging in early 1960s. Section of the census route impinged on a watercourse (intermittent flow), lined by a narrow strip of depauperate gallery rainforest, with an overstorey of Flood Gum *E. grandis*. Myrtles *Waterhousea floribundum*

*Acmena smithii* and *Tristaniopsis laurina*, Red Ash, *Cryptocarpa glaucescens* and *Lantana Lantana camara* characterized this strip. A cleared paddock bordered the site on one side.

*Site C: Blackwall Range, Bagotville (153°24'E, 28°58'S; 10–90 m asl).* Tall open and regenerating coastal wet sclerophyll forest (15–36 m): Tallowood *Eucalyptus microcorys* — Blackbutt *E. pilularis* — Red Mahogany *E. resinifera* association, with Flooded Gum (wetter gullies), Brush Box *Lophostemon confertus*, Grey Gum, Swamp Mahogany *E. robusta* (low lying areas) and Turpentine *Syncarpia glomulifera*; understorey mostly dense, with *Lantana*, *Helichrysum diosmifolium*, *Hibiscus heterophyllus*, *Banksia*, and Red Ash; Forest She-oak common on drier slopes; Cabbage Tree Palm *Livistona australis* and some Bangalow Palm *Archontophoenix cunninghamiana* in moist gullies; ground cover of herbs in more open parts. Lower slopes of low coastal range. Site disturbed over a long period, probably since 1880s, with advanced regeneration (age unknown) and scattered over-mature trees prominent; disused snigging tracks and log dump clearing overgrown with weeds. Semi-cleared areas adjacent.

*Site D: Cherry Tree North State Forest (152°45'E, 28°54'S; 220–400 m asl).* Low closed forest or dry (monsoon) rainforest (6–18 m): Lacebark *Brachychiton discolor* — Yellowwood *Rhodospheera rhodanthema* — White Cedar *Melia azedarach* association, with scattered overstorey of emergents including Hoop Pine *Araucaria cunninghamii*, Silky Oak *Grevillea robusta*, Native Teak *Flindersia australis*, and figs *Ficus* spp.; dense low canopy with vines; other trees include Yellow Tulip *Drypetes australasica*, Thorny Yellowwood *Zanthoxylum brachyacanthum*, Ivorywood *Siphonodon australis*, Quinine Bush *Alstonia constricta* and Koda *Elretia acuminata*; understorey of thorny shrubs in parts, elsewhere open; small-leaved shrubs include Native Holly *Alchornea ilicifolia*, Orange Thorn *Citrobatus* spp and Chain Fruit *Alyxia niscifolia*; groundcover sparse or absent. Steeply sloping southerly and easterly aspects. Rainforest fringes heavily overgrown with *Lantana*. Site close to cleared paddocks on one side and wet sclerophyll on another. Part of site within a forestry preserve that has probably not been logged since c. 1900 (A. Floyd, pers. comm, per G. Holmes).

*Site E: Cambridge Plateau, Richmond Range State Forest (152°45'E, 28°48'S; 460–580 m asl).* Tall closed subtropical rainforest (25–40+ m) with irregular upper canopy: Black Booyong *Argyrodendron actinophyllum* — Purple Cherry *Syzygium crebrinerve* — Yellow Carabeen *Sloanea woollsii* association, with White Booyong *A. trifoliolatum*, Giant Stinging Tree *Dendrocnide excelsa*, Pigeonberry Ash *Cryptocarya erythroxylon* and Black Muskheart *Alangium villosum*; figs *Ficus* spp conspicuous; climbers (28 spp; J. and G. Holmes, pers. comm.) and epiphytes abundant; mostly fairly open below canopy with typical understorey plants Palm-lily *Cordyline petiolaris*, Walking Stick Palm *Linospadix monostachya* and Veiny Wilkiea *Wilkiea huegeliana*; groundcover mostly sparse but broad-leaved herbs, especially Cunjevoi *Alocasia macrorrhizos* common in parts. Black Booyong association is typical of higher altitudes, and its presence at Cambridge Plateau probably reflects the very sheltered, cool, moist southerly aspect (A. Floyd, pers. comm, per G. Holmes). Selectively logged in 1966 but showing good recovery. Logging tracks mostly overgrown with Celerywood *Polyscias elegans*, Bleeding Heart *Omalanthus populifolius* and Wild Tobacco *Solanum mauritianum* common.

## METHODS

Censusing took place over a period of 30 months, except at Cherry Tree (Site D), where regular counts were made over 19 months (Table 1). Counts were made in each calendar month where possible, with the interval between counts not exceeding eight weeks. A fixed route, usually a circuit, was used at each site. In heavier forests, old logging tracks were used, where these remained (Sites C, E), to allow easier observation of the canopy. The actual routes (distances) were based on time taken to complete and were determined after one or more trial surveys. A duration of 2.5–3 hours to complete a census was chosen. Over the period of the programme, actual time taken varied both at and between sites (Table 1). Counts were begun not later than an hour after sunrise. A census route was walked slowly with frequent pauses to record birds encountered. Minor deviations to the side were made to identify birds detected from the route proper. All birds seen or heard were counted. Only forest birds (but including raptors and aerial feeders) are included in the analyses. Evidence of breeding was recorded, but little effort was made to locate nests. Notes of bird activity (e.g. attendance at flowering or fruiting trees, calling frequency) were also kept.

In closed forests, the detection of some inconspicuous species relied greatly on hearing their calls; therefore changes

in calling behaviour, as is shown by some fruit-pigeons outside the breeding season (Crome 1975), may have resulted in under-recording.

Censusing in dry sclerophyll forests in summer was affected by (i) interference to auditory detection of birds by the drumming of cicadas (Hemiptera), which may begin soon after sunrise in hot humid weather and (ii) the apparent earlier and more abrupt decline in morning bird activity. Although censusing throughout the year was carried out at the same time, relative to sunrise, these factors in combination may have reduced the bird detectability and therefore depressed recording rates in summer months.

Census data were analysed to show for each site:

- recording rates for individual species in terms of (i) percentage of counts on which a species was found to be present (frequency of occurrence), and (ii) mean number of individuals per census, as an index of relative abundance (Table 2);
- 20 most abundant species (Table 3);
- seasonality of the bird communities in terms of the mean number of (i) species, and (ii) individuals per census in each season (Table 4);
- seasonal variation in the relative abundance of selected species (Table 5).

## RESULTS

The bird communities of the dry sclerophyll forest (DSF) sites (A and B) were similar in species composition. Seventy-nine species were common to both, out of species totals of 87 (Myrtle) and 96 (Royal Camp) (Table 2). Eight of the ten most abundant species at each site were the same (Table 3). The incursion of streamside vegetation was an important influence at Royal Camp, accounting for most of the birds not listed at Myrtle.

A feature of the DSF avifauna was the frequency of honeyeaters and lorikeets, which comprised seven of the ten most abundant species at both sites (Table 3). Fifteen species of honeyeaters were recorded during the study, and a further two have been observed in the same 10' grid square (Gosper 1986, unpub. data). Honeyeaters comprised 31 per cent of all individuals counted at Myrtle and 29 per cent at Royal Camp. Lorikeets comprised 24 per cent and 14 per cent respectively.

Coastal wet sclerophyll forest (WSF) at Bagotville (Site C) supported an essentially moist forest assemblage (Tables 2 and 3). Honeyeaters comprised 18 per cent of all birds counted, with Lewin's and Yellow-faced Honeyeaters contributing more than half of this total. Lorikeets made up only 5 per cent. Relative to DSF sites, frugivores were more abundant (Table 2). A number of species characteristically associated with the more extensive WSFs in the catchment ranges of the Richmond River were scarce or absent from the Bagotville site (Gosper 1986, unpub. data; Harden *et al.* 1986).

The species compositions of the subtropical rainforest (STRF) site at Cambridge Plateau (E) and the dry rainforest (DRF) site at Cherry Tree (D) were similar (Table 2). Seventy species were common to both, out of site totals of 74 (Cambridge Plateau) and 81 (Cherry Tree). Eight of the ten most common species were the same for both sites (Table 3), seven of which were also among the ten most abundant species in rainforest at Mt Nardi (700–800 m asl), elsewhere in the Richmond River district (Harden *et al.* 1986). Brown Gerygone, Silvereye, Large-billed Scrubwren and Lewin's Honeyeater made up 36 per cent and 43 per cent of all birds counted at

TABLE 1

Census programme for five sites in Richmond River district, New South Wales.

SITE	MYRTLE	ROYAL CAMP	BAGOTVILLE	CHERRY TREE	CAMBRIDGE PLATEAU
Survey period	Aug. 1977 –Jan. 1980	Aug. 1977 –Jan. 1980	Feb. 1980 –June 1982	Feb. 1980 –June 1982	Feb. 1980 –June 1982
Number of censuses	29	29	29	19*	30
Mean duration of censuses (hrs)	2.7	3.0	2.8	2.7	3.4

\*Regular censusing not begun until March 1981 (monthly thereafter).

TABLE 2

Recording rates of individual species at each site, as a percentage of censuses on which recorded, and in parentheses, mean number of individuals per census. R = recorded at site but not during survey.

SPECIES	SITE									
	A		B		C		D		E	
Pacific Baza <i>Aviceda subcristata</i>	—	(—)	3	(<0.1)	7	(0.2)	—	(—)	7	(0.1)
Whistling Kite <i>Haliastur sphenurus</i>	14	(0.2)	7	(<0.1)	10	(0.1)	—	(—)	—	(—)
Brown Goshawk <i>Accipiter fasciatus</i>	3	(<0.1)	—	(—)	—	(—)	—	(—)	—	(—)
Collared Sparrowhawk <i>A. cirrhocephalus</i>	—	(—)	17	(0.2)	—	(—)	11	(0.2)	—	(—)
Grey Goshawk <i>A. novae-hollandiae</i>	—	(—)	—	(—)	—	(—)	5	(<0.1)	13	(0.3)
Wedge-tailed Eagle <i>Aquila audax</i>	7	(0.1)	14	(0.1)	3	(<0.1)	16	(0.2)	R	(—)
Little Eagle <i>Hieraaetus morphnoides</i>	3	(<0.1)	—	(—)	—	(—)	5	(0.1)	—	(—)
Peregrine Falcon <i>Falco peregrinus</i>	3	(<0.1)	7	(<0.1)	—	(—)	—	(—)	—	(—)
Australian Brush-turkey <i>Alectura lathami</i>	—	(—)	—	(—)	—	(—)	43	(0.7)	73	(1.8)
Painted Button-quail <i>Turnix varia</i>	45	(0.8)	10	(0.2)	7	(0.1)	—	(—)	—	(—)
Rose-crowned Fruit-Dove <i>Ptilinopus regina</i>	—	(—)	—	(—)	24	(0.4)	16	(0.6)	33	(1.9)
Wompoo Fruit-Dove <i>P. magnificus</i>	—	(—)	—	(—)	3	(<0.1)	5	(<0.1)	80	(3.6)
Topknot Pigeon <i>Lopholaimus antarticus</i>	—	(—)	—	(—)	38	(8.0)	37	(7.1)	67	(14.1)
White-headed Pigeon <i>Columba leucomela</i>	—	(—)	—	(—)	28	(0.7)	R	(—)	43	(1.3)
Brown Cuckoo-Dove										
<i>Macropygia amboinensis</i>	—	(—)	7	(0.1)	34	(0.8)	63	(1.8)	93	(8.7)
Peaceful Dove <i>Geopelia placida</i>	90	(3.7)	93	(4.0)	—	(—)	17	(0.3)	—	(—)
Bar-shouldered Dove <i>G. humeralis</i>	—	(—)	—	(—)	3	(<0.1)	79	(2.3)	3	(<0.1)
Emerald Dove <i>Chalcophaps indica</i>	—	(—)	—	(—)	41	(0.7)	63	(2.2)	63	(1.0)
Common Bronzewing <i>Phaps chalcoptera</i>	3	(<0.1)	10	(0.1)	—	(—)	—	(—)	—	(—)
Wonga Pigeon <i>Leucosarcia melanoleuca</i>	—	(—)	—	(—)	69	(0.9)	95	(2.4)	27	(0.3)
Glossy Black-Cockatoo										
<i>Calyptorhynchus lathami</i>	10	(0.3)	3	(<0.1)	—	(—)	—	(—)	—	(—)
Yellow-tailed Black-Cockatoo										
<i>C. funereus</i>	3	(<0.1)	3	(0.1)	3	(0.1)	16	(0.6)	27	(0.6)
Sulphur-crested Cockatoo <i>Cacatua galerita</i>	—	(—)	—	(—)	3	(<0.1)	84	(5.4)	73	(1.6)
Rainbow Lorikeet										
<i>Trichoglossus haematodus</i>	100	(21.8)	97	(8.6)	20	(1.0)	42	(1.3)	3	(0.4)
Scaly-breasted Lorikeet <i>T. chlorolepidotus</i>	90	(13.1)	100	(20.1)	62	(9.8)	37	(1.7)	3	(0.1)
Little Lorikeet <i>Glossopsitta pusilla</i>	93	(17.3)	83	(7.7)	3	(<0.1)	5	(0.7)	11	(0.8)
Australian King-Parrot <i>Alisterus scapularis</i>	31	(0.8)	55	(1.4)	52	(1.5)	78	(3.7)	87	(5.6)
Crimson Rosella <i>Platycercus elegans</i>	—	(—)	—	(—)	—	(—)	11	(0.4)	97	(6.9)
Eastern Rosella <i>P. eximius</i>	28	(0.8)	93	(3.3)	9	(0.7)	—	(—)	—	(—)
Oriental Cuckoo <i>Cuculus saturatus</i>	—	(—)	—	(—)	3	(<0.1)	—	(—)	—	(—)
Pallid Cuckoo <i>C. pallidus</i>	3	(<0.1)	—	(—)	—	(—)	—	(—)	—	(—)
Brush Cuckoo <i>C. variolosus</i>	28	(0.4)	17	(0.2)	17	(0.2)	5	(0.1)	7	(0.1)
Fan-tailed Cuckoo <i>C. pyrrhophanus</i>	34	(0.5)	45	(1.2)	45	(0.9)	37	(0.8)	57	(1.4)
Shining Bronze-Cuckoo										
<i>Chrysococcyx lucidus</i>	28	(0.3)	34	(0.4)	34	(0.7)	79	(2.0)	37	(0.7)
Little Bronze-Cuckoo										
<i>C. malayanus</i>	—	(—)	3	(<0.1)	—	(—)	—	(—)	—	(—)
Common Koel <i>Eudynamis scolopacea</i>	—	(—)	10	(0.1)	28	(0.6)	16	(0.2)	—	(—)
Channel-billed Cuckoo										
<i>Scythrops novaehollandiae</i>	7	(<0.1)	—	(—)	7	(0.1)	16	(0.3)	7	(0.1)
Southern Boobook <i>Ninox novaeseelandiae</i>	—	(—)	3	(<0.1)	—	(—)	—	(—)	—	(—)
Tawny Frogmouth <i>Podargus strigoides</i>	3	(<0.1)	3	(<0.1)	3	(<0.1)	10	(0.1)	—	(—)
White-throated Needletail										
<i>Hirundapus caudacutus</i>	7	(0.1)	3	(0.2)	14	(1.1)	5	(1.1)	13	(0.9)
Laughing Kookaburra <i>Dacelo novaeguineae</i>	90	(2.6)	100	(3.9)	97	(3.8)	42	(1.2)	67	(1.6)
Forest Kingfisher <i>Halcyon macleayi</i>	7	(<0.1)	7	(0.1)	—	(—)	—	(—)	—	(—)
Sacred Kingfisher <i>H. sancta</i>	41	(1.1)	41	(1.8)	10	(0.3)	—	(—)	—	(—)
Rainbow Bee-eater <i>Merops ornatus</i>	59	(2.7)	55	(2.6)	79	(6.7)	27	(1.6)	20	(1.2)

Table 2 — continued

SPECIES	A		B		SITE C		D		E	
Dollarbird <i>Eurystomus orientalis</i>	28	(0.4)	34	(0.8)	34	(0.7)	16	(0.2)	3	(<0.1)
Noisy Pitta <i>Pitta versicolor</i>	—	(—)	—	(—)	7	(<0.1)	42	(0.8)	69	(1.9)
Welcome Swallow <i>Hirundo neoxena</i>	7	(0.2)	17	(0.5)	17	(0.4)	—	(—)	3	(<0.1)
Tree Martin <i>Cecropis nigricans</i>	14	(0.3)	28	(1.1)	7	(0.3)	5	(0.1)	3	(<0.1)
Black-faced Cuckoo-shrike <i>Coracina novaehollandiae</i>	72	(2.1)	72	(2.4)	72	(1.6)	16	(0.2)	7	(<0.1)
White-bellied Cuckoo-shrike <i>C. papuensis</i>	86	(2.2)	79	(2.3)	10	(0.1)	—	(—)	—	(—)
Yellow-eyed Cuckoo-shrike <i>C. lineata</i>	—	(—)	—	(—)	3	(<0.1)	42	(1.9)	7	(0.1)
Cicardabird <i>C. tenuirostris</i>	24	(0.5)	28	(0.5)	62	(1.9)	32	(0.5)	3	(<0.1)
White-winged Triller <i>Lalage sueurii</i>	3	(<0.1)	—	(—)	3	(<0.1)	—	(—)	—	(—)
Varied Triller <i>L. leucomela</i>	—	(—)	3	(<0.1)	86	(1.5)	89	(3.9)	20	(0.2)
White's Thrush <i>Zosterops dauma</i>	—	(—)	—	(—)	—	(—)	5	(0.1)	47	(0.9)
Rose Robin <i>Petroica rosea</i>	34	(1.1)	41	(1.2)	45	(2.6)	38	(0.8)	40	(1.4)
Hooded Robin <i>Melanodryas cucullata</i>	52	(1.1)	—	(—)	—	(—)	—	(—)	—	(—)
Eastern Yellow Robin <i>Eopsaltria australis</i>	55	(1.0)	97	(4.2)	86	(2.1)	100	(9.8)	100	(5.1)
Jacky Winter <i>Microeca leucophaea</i>	69	(1.4)	97	(2.9)	—	(—)	—	(—)	—	(—)
Pale-yellow Robin <i>Tregallasia capito</i>	—	(—)	—	(—)	—	(—)	58	(1.1)	80	(1.6)
Crested Shrike-tit <i>Falcunculus frontatus</i>	34	(0.5)	24	(0.4)	—	(—)	17	(0.6)	20	(0.4)
Golden Whistler <i>Pachycephala pectoralis</i>	55	(2.4)	62	(3.7)	93	(7.8)	95	(9.9)	97	(10.3)
Rufous Whistler <i>P. rufiventris</i>	90	(4.0)	86	(3.5)	62	(1.4)	—	(—)	—	(—)
Little Shrike-thrush <i>Colluricincla megarhyncha</i>	—	(—)	7	(0.3)	86	(2.0)	11	(2.0)	7	(<0.1)
Grey Shrike-thrush <i>C. harmonica</i>	93	(3.4)	97	(3.4)	86	(2.3)	95	(3.9)	100	(3.7)
Black-faced Monarch <i>Monarcha melanopsis</i>	—	(—)	10	(0.2)	48	(1.3)	42	(4.8)	37	(3.0)
Spectacled Monarch <i>M. trivirgatus</i>	—	(—)	10	(0.1)	37	(0.5)	47	(1.6)	10	(0.2)
Leaden Flycatcher <i>Myiagra rubecula</i>	59	(2.0)	52	(2.0)	66	(2.2)	—	(—)	—	(—)
Restless Flycatcher <i>M. inquieta</i>	69	(1.0)	38	(0.4)	—	(—)	5	(<0.1)	—	(—)
Rufous Fantail <i>Rhipidura rufifrons</i>	—	(—)	38	(0.6)	52	(1.8)	63	(5.6)	50	(2.9)
Grey Fantail <i>R. fuliginosa</i>	90	(3.8)	100	(10.6)	83	(8.1)	89	(3.6)	97	(3.9)
Willie Wagtail <i>R. leucophrys</i>	97	(2.8)	90	(2.0)	2	(<0.1)	—	(—)	—	(—)
Logrunner <i>Orthonyx temminckii</i>	—	(—)	—	(—)	—	(—)	84	(3.3)	63	(1.7)
Eastern Whipbird <i>Psophodes olivaceus</i>	—	(—)	93	(1.9)	100	(6.7)	100	(9.1)	100	(4.9)
Spotted Quail-thrush <i>Cinclosoma punctatum</i>	—	(—)	3	(0.1)	—	(—)	—	(—)	—	(—)
Grey-crowned Babbler <i>Pomatostomus temporalis</i>	69	(1.4)	—	(—)	—	(—)	—	(—)	—	(—)
Tawny Grassbird <i>Megalurus timoriensis</i>	—	(—)	—	(—)	3	(<0.1)	—	(—)	—	(—)
Superb Fairy-wren <i>Malurus cyaneus</i>	97	(7.6)	100	(9.4)	10	(0.5)	5	(0.4)	—	(—)
Variegated Fairy-wren <i>M. lamberti</i>	76	(5.0)	90	(5.7)	97	(8.1)	—	(—)	3	(<0.1)
Red-backed Fairy-wren <i>M. melanocephalus</i>	59	(2.4)	45	(2.2)	21	(0.9)	—	(—)	—	(—)
Large-billed Scrubwren <i>Sericornis magnirostris</i>	—	(—)	7	(<0.1)	48	(1.6)	95	(14.5)	100	(17.8)
Yellow-throated Scrubwren <i>S. citreogularis</i>	—	(—)	—	(—)	—	(—)	16	(0.2)	77	(2.5)
White-browed Scrubwren <i>S. frontalis</i>	55	(0.3)	38	(0.8)	97	(4.9)	95	(6.6)	100	(8.2)
Speckled Warbler <i>S. sagittatus</i>	—	(—)	48	(0.7)	—	(—)	—	(—)	—	(—)
Weebill <i>Smicronis brevirostris</i>	45	(1.0)	7	(0.1)	—	(—)	—	(—)	—	(—)
Brown Gerygone <i>Gerygone mouki</i>	—	(—)	52	(0.9)	17	(0.7)	100	(47.6)	100	(42.8)
White-throated Gerygone <i>G. olivacea</i>	45	(0.7)	90	(1.5)	3	(<0.7)	—	(—)	—	(—)
Brown Thornbill <i>Acanthiza pusilla</i>	31	(0.6)	100	(5.8)	97	(5.1)	100	(4.3)	100	(3.8)
Buff-rumped Thornbill <i>A. reguloides</i>	72	(2.8)	14	(0.4)	—	(—)	—	(—)	—	(—)
Yellow Thornbill <i>A. nana</i>	—	(—)	—	(—)	—	(—)	50	(1.6)	23	(0.5)
Striated Thornbill <i>A. lineata</i>	3	(0.3)	97	(6.6)	—	(—)	—	(—)	—	(—)
Varied Sittella <i>Daphoenositta chrysoptera</i>	21	(0.5)	10	(0.5)	66	(2.5)	—	(—)	—	(—)
White-throated Treecreeper <i>Climacteris leucophaea</i>	66	(1.8)	76	(1.9)	90	(2.0)	28	(0.6)	33	(0.7)

Table 2 — continued

SPECIES	A		B		SITE C		D		E	
Brown Treecreeper <i>C. picumnus</i>	79	(2.7)	62	(1.4)	—	(—)	—	(—)	—	(—)
Little Wattlebird <i>Anthochaera chrysoptera</i>	69	(3.3)	55	(1.4)	62	(1.2)	—	(—)	—	(—)
Noisy Friarbird <i>Philemon corniculatus</i>	90	(12.8)	93	(8.1)	83	(2.4)	5	(0.1)	—	(—)
Little Friarbird <i>P. citreogularis</i>	55	(1.4)	52	(1.4)	7	(0.1)	—	(—)	—	(—)
Regent Honeyeater <i>Xanthomyza phrygia</i>	—	(—)	3	(<0.1)	—	(—)	—	(—)	—	(—)
Blue-faced Honeyeater <i>Entomyzon cyanotis</i>	62	(2.4)	45	(1.4)	3	(0.2)	—	(—)	—	(—)
Noisy Miner <i>Manorina melanocephala</i>	17	(0.5)	—	(—)	59	(1.9)	—	(—)	—	(—)
Lewin's Honeyeater <i>Meliphaga lewinii</i>	3	(<0.1)	100	(6.5)	97	(11.6)	100	(26.0)	100	(15.9)
Yellow-faced Honeyeater										
<i>Lichenostomus chrysops</i>	83	(7.8)	69	(10.1)	52	(9.1)	47	(5.4)	40	(3.1)
Fuscous Honeyeater <i>L. fuscus</i>	97	(28.7)	97	(26.2)	—	(—)	5	(0.2)	—	(—)
Black-chinned Honeyeater										
<i>Melithreptus gularis</i>	41	(0.7)	48	(1.1)	—	(—)	—	(—)	—	(—)
White-throated Honeyeater <i>M. albogularis</i>	59	(1.8)	48	(1.3)	59	(2.6)	5	(0.1)	—	(—)
White-naped Honeyeater <i>M. lunatus</i>	—	(—)	—	(—)	10	(0.3)	—	(—)	—	(—)
Brown Honeyeater <i>Lichmera indistincta</i>	—	(—)	48	(1.0)	3	(<0.1)	5	(0.1)	—	(—)
White-checked Honeyeater										
<i>Phylidonyris nigra</i>	3	(<0.1)	41	(0.9)	7	(0.7)	—	(—)	—	(—)
Eastern Spinebill										
<i>Acanthorhynchus tenuirostris</i>	7	(0.2)	7	(0.1)	21	(0.6)	37	(0.7)	27	(0.7)
Scarlet Honeyeater <i>Myzomela sanguinolenta</i>	69	(6.9)	7	(0.1)	21	(0.6)	37	(0.7)	27	(0.7)
Mistletoebird <i>Dicaeum hirundinaceum</i>	62	(2.5)	83	(12.6)	72	(7.0)	50	(4.9)	30	(1.1)
Spotted Pardalote <i>Pardalotus punctatus</i>	38	(2.2)	48	(2.6)	62	(4.9)	28	(0.9)	30	(1.2)
Striated Pardalote <i>P. striatus</i>	76	(2.4)	83	(6.5)	72	(2.3)	—	(—)	—	(—)
Silvereye <i>Zosterops lateralis</i>	24	(2.1)	59	(10.1)	83	(19.6)	100	(27.1)	97	(20.3)
Red-browed Firetail <i>Emblema temporalis</i>	76	(4.7)	93	(7.5)	93	(6.2)	95	(5.4)	97	(7.5)
Diamond Firetail <i>E. guttata</i>	17	(0.2)	—	(—)	—	(—)	—	(—)	—	(—)
Double-barred Finch <i>Poephila bichenovii</i>	14	(0.4)	79	(4.8)	—	(—)	—	(—)	—	(—)
Olive-backed Oriole <i>Oriolus sagittatus</i>	34	(0.7)	41	(0.9)	55	(1.4)	—	(—)	10	(0.1)
Figbird <i>Sphecotheres viridis</i>	—	(—)	—	(—)	90	(2.8)	50	(2.9)	27	(1.0)
Spangled Drongo <i>Dicrurus hottentottus</i>	3	(<0.1)	24	(0.3)	84	(2.4)	—	(—)	—	(—)
Satin Bowerbird <i>Ptilonorhynchus violaceus</i>	—	(—)	—	(—)	48	(1.5)	37	(1.7)	47	(3.1)
Regent Bowerbird <i>Sericulus chrysocephalus</i>	—	(—)	—	(—)	48	(1.3)	83	(6.4)	100	(13.0)
Green Catbird <i>Ailuroedus crassirostris</i>	—	(—)	—	(—)	—	(—)	37	(0.5)	87	(3.7)
Paradise Riflebird <i>Ptiloris paradiseus</i>	—	(—)	—	(—)	—	(—)	32	(0.4)	90	(2.3)
White-winged Chough										
<i>Corcorax melanorhamphos</i>	3	(0.1)	—	(—)	—	(—)	—	(—)	—	(—)
Australian Magpie-lark <i>Grallina cyanoleuca</i>	7	(0.1)	7	(0.2)	—	(—)	—	(—)	—	(—)
White-breasted Woodswallow										
<i>Artamus leucorhynchus</i>	—	(—)	—	(—)	14	(0.1)	—	(—)	—	(—)
Dusky Woodswallow <i>A. cyanopterus</i>	86	(4.0)	34	(1.4)	3	(<0.1)	—	(—)	3	(<0.1)
Grey Butcherbird <i>Cracticus torquatus</i>	66	(1.1)	3	(0.1)	93	(1.9)	16	(0.3)	3	(<0.1)
Pied Butcherbird <i>C. nigrogularis</i>	7	(<0.1)	31	(0.7)	7	(0.2)	—	(—)	—	(—)
Australian Magpie <i>Gymnorhina tibicen</i>	21	(0.4)	41	(1.2)	41	(1.0)	5	(<0.1)	3	(<0.1)
Pied Currawong <i>Strepera graculina</i>	—	(—)	17	(0.2)	97	(7.0)	63	(1.8)	100	(6.4)
Torresian Crow <i>Corvus orru</i>	55	(1.2)	66	(1.4)	72	(1.6)	88	(3.2)	23	(0.5)



Cambridge Plateau and Cherry Tree, respectively; at Mt Nardi these species comprised 42 per cent of all birds identified (Harden *et al.* 1986). The frequency of large, primarily fruit-eating birds was a feature of the STRF site. For example, arboreal fruit-eating pigeons made up 11 per cent of all birds counted at Cambridge Plateau, compared with 3.5 per cent at Cherry Tree.

No exotic bird species were recorded in any of the forests censused. Seasonal variation in species richness and numbers of individuals was evident at all sites (Table 4). At sclerophyll forest sites, species totals were lower in summer than at any other time of year, and were generally highest in autumn and spring. The numbers of individuals were lowest in summer and highest in winter (Table 4, Fig. 1a,b,c). Seasonal patterns at the rainforest sites differed from the eucalypt forests. At these sites, species totals were highest in summer (spring at Cherry Tree) and lowest in winter. This was most pronounced at Cambridge Plateau (c. 500 m asl), where mean winter values (total numbers of individuals) were only 58 per cent of summer values (Table 4).

## DISCUSSION

### *Bird Communities*

The composition of the bird communities at all sites was influenced to some degree by proximity to other habitats, particularly cleared grazing land, and by disturbance to the forest structure caused by past logging activities (see site descriptions above). These features probably resulted in the increased presence of species typical of open habitats (cf Shields *et al.* 1985), notably at Royal Camp, Bagotville and Cherry Tree (Table 2). Increased openness of the habitat created by logging tracks, particularly in closed forest, may also affect the apparent abundance of some species. For example, higher recording rates obtained for the Red-browed Firetail and Silver-eye at Cambridge Plateau, compared with those reported by Harden *et al.* (1986), may reflect the use for censusing of old logging tracks, with their heavy weed growth. Edge conditions in rainforest are favoured by these species (Pattemore and Kikkawa 1975; pers. obs.). Results of this survey agree with studies by Kikkawa (1968, 1974), who found that in northern New South Wales there were greater similarities between wet sclerophyll forests and rainforests on one hand and dry

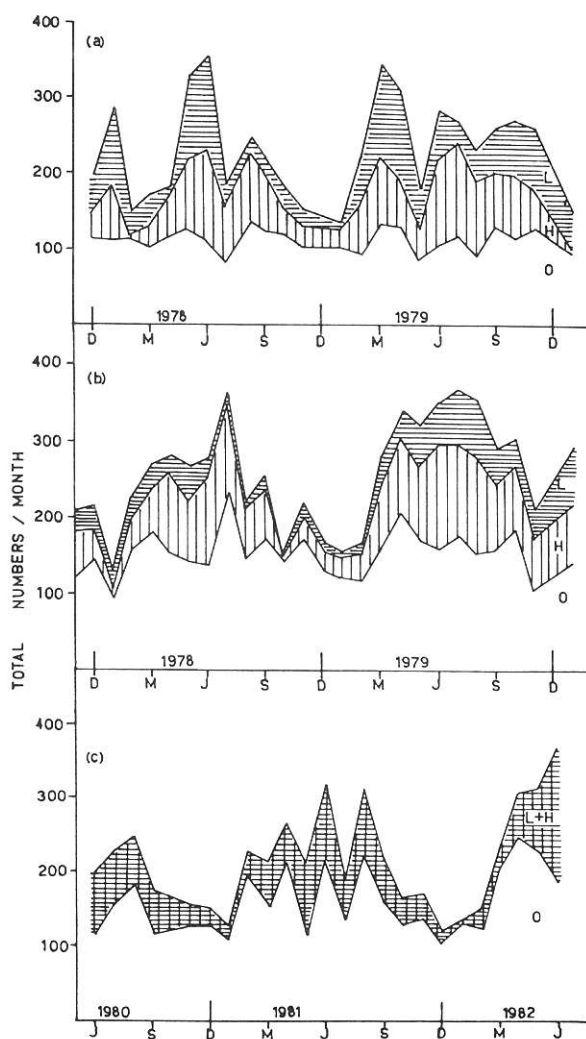


Figure 1. Numbers of lorikeets (L), honeyeaters (H) and other species (O) in each month at (a) Myrtle, (b) Royal Camp and (c) Bagotville.

sclerophyll forests and woodlands on the other. Affinity with eucalypt woodlands was apparent at the Myrtle site in particular, where the forest was lower and more open. Typical woodland birds, such as the Hooded Robin, White-winged Chough and Diamond Firetail, were found at this site (see also Gosper 1986). In fact, both sites share many species with eucalypt woodlands elsewhere in north-eastern New South Wales. For example, 49 of 57 species (86%) listed by Ford *et al.*

(1985) from two woodland sites near Armidale on the Northern Tablelands were also present at Myrtle and Royal Camp. The most common bird at all sites was the Fuscous Honeyeater.

Coastal WSF at Bagotville (site total 94 sp.) shared 61 species with Myrtle (site total 87) and 61 with Cambridge Plateau (site total 74 sp.); however, closer affinities with the wetter forest sites are indicated by comparison of the dominant species at each of the survey sites. Eleven of the most abundant species at Bagotville were also ranked among the 20 commonest at the rainforest sites, compared with only seven at Myrtle (Table 3).

Although the Cambridge Plateau and Cherry Tree sites were utilized by the same species, there

were marked differences in the relative abundance values obtained for many primary rainforest birds, particularly larger frugivores (Tables 2 and 3). This may reflect differences in the quality of the sites, particularly in food resources. The data suggest that, while not impoverished in terms of bird species, DRF may support significantly lower densities of some primary rainforest birds.

### Seasonality

The tendency toward autumn and/or spring peaks in species totals at sclerophyll forest sites can be explained by overlapping periods in the movement of birds through, and into and out of, eucalypt forests in the district:

TABLE 3

The 20 most abundant species at each site (relative abundance expressed as a percentage of total population).

MYRTLE		ROYAL CAMP		BAGOTVILLE		CHERRY TREE		CAMBRIDGE PLATEAU	
Fuscous Honeyeater	13.4	Fuscous Honeyeater	10.4	Silvereye	9.5	Brown Gerygone	17.8	Brown Gerygone	15.9
Rainbow Lorikeet	10.2	Scaly-breasted Lorikeet	8.0	Lewin's Honeyeater	5.6	Silvereye	10.2	Silvereye	7.5
Little Lorikeet	8.1	Scarlet Honeyeater	5.0	Scaly-breasted Lorikeet	4.8	Lewin's Honeyeater	9.7	Large-billed Scrubwren	6.6
Scaly-breasted Lorikeet	6.1	Silvereye	4.2	Yellow-faced Honeyeater	4.4	Large-billed Scrubwren	5.4	Lewin's Honeyeater	5.9
Noisy Friarbird	6.0	Grey Fantail	4.2	Grey Fantail	3.9	Golden Whistler	3.7	Topknot Pigeon	5.2
Yellow-faced Honeyeater	3.6	Yellow-faced Honeyeater	4.0	Variegated Fairy-wren	3.9	Eastern Yellow Robin	3.7	Regent Bowerbird	4.8
Superb Fairy-wren	3.6	Superb Fairy-wren	3.7	Topknot Pigeon	3.9	Eastern Whipbird	3.4	Golden Whistler	3.8
Scarlet Honeyeater	3.2	Rainbow Lorikeet	3.4	Golden Whistler	3.8	Topknot Pigeon	2.7	Brown Cuckoo-Dove	3.2
Variegated Fairy-wren	2.3	Noisy Friarbird	3.2	Pied Currawong	3.4	White-browed Scrubwren	2.5	White-browed Scrubwren	3.0
Red-browed Firetail	2.2	Little Lorikeet	3.1	Scarlet Honeyeater	3.4	Regent Bowerbird	2.4	Red-browed Firetail	2.8
Rufous Whistler	1.9	Red-browed Firetail	3.0	Rainbow Bee-eater	3.3	Rufous Fantail	2.1	Crimson Rosella	2.6
Dusky Woodswallow	1.9	Striated Thornbill	2.6	Eastern Whipbird	3.3	Yellow-faced Honeyeater	2.0	Pied Currawong	2.4
Grey Fantail	1.9	Lewin's Honeyeater	2.6	Red-browed Firetail	3.0	Red-browed Firetail	2.0	Australian King-Parrot	2.1
Peaceful Dove	1.7	Striated Pardalote	2.6	Brown Thornbill	2.5	Sulphur-crested Cockatoo	2.0	Eastern Yellow Robin	1.9
Grey Shrike-thrush	1.6	Brown Thornbill	2.3	Spotted Pardalote	2.4	Scarlet Honeyeater	1.8	Eastern Whipbird	1.8
Little Wattlebird	1.5	Variegated Fairy-wren	2.3	White-browed Scrubwren	2.4	Black-faced Monarch	1.8	Grey Fantail	1.4
Buff-rumped Thornbill	1.3	Double-barred Finch	1.9	Laughing Kookaburra	1.8	Brown Thornbill	1.6	Brown Thornbill	1.4
Willie Wagtail	1.3	Eastern Yellow Robin	1.7	Figbird	1.4	Grey Shrike-thrush	1.5	Grey Shrike-thrush	1.4
Brown Treecreeper	1.3	Peaceful Dove	1.6	Rose Robin	1.3	Varied Triller	1.4	Green Catbird	1.4
Rainbow Bee-eater	1.3	Laughing Kookaburra	1.5	White-throated Honeyeater	1.3	Australian King-Parrot	1.4	Wompoo Fruit-Dove	1.3



TABLE 4

Seasonality at each site, expressed as mean number of species per census and (in parentheses) mean number of individuals per census.

SEASON	MYRTLE	ROYAL CAMP	BAGOTVILLE	CHERRY TREE	CAMBRIDGE PLATEAU
Summer	34.6 (188.5)	41.1 (197.4)	37.3 (150.5)	43.0 (310.0)	38.3 (326.5)
Autumn	41.3 (251.2)	47.5 (295.0)	42.3 (246.5)	33.4 (253.6)	34.7 (285.0)
Winter	36.1 (266.4)	44.6 (324.0)	40.4 (262.6)	31.0 (237.0)	30.3 (191.0)
Spring	42.0 (262.0)	46.5 (237.8)	40.5 (169.6)	35.2 (325.7)	36.3 (270.6)

- (i) presence of summer migrants in passage (mostly moist forest species, e.g. monarchs, Rufous Fantails) in marginal habitat such as that at Site C;
- (ii) presence of locally breeding summer migrants recently arrived (spring) or before departure (autumn);
- (iii) presence of autumn-winter visitors recently arrived (autumn) or late departing stragglers (spring).

The winter peak in overall numbers of individuals in sclerophyll forests is mainly attributable to two elements. The first, involving about 14 species (primarily insectivores), can loosely be grouped as 'winter visitors'. Seasonal differences in recording rates for such species as Rose Robin, Golden Whistler, Grey Fantail, Lewin's Honeyeater, Yellow-faced Honeyeater, Eastern Spinebill, Spotted Pardalote and Silveryeye (Table 5) indicate a winter visitor pattern, although the nature and extent of movements vary greatly between individual species (see below). The seasonal shift in the numbers of individuals in this winter visitor group was most pronounced at the Bagotville site.

The second element was the winter influx of blossom-feeding honeyeaters and lorikeets, especially at the DSF sites (Fig. 1). This coincided with the period of most consistent flowering of nectar-producing plants, primarily *Eucalyptus*, *Banksia*, *Melaleuca* and mistletoes. Casual recording of the level of flowering and attendance by birds at blossoms over the period of the survey

showed that there were always some flowers available to and exploited by blossom-feeders from March to September. Outside this period, sporadic flowering of eucalypts only was noted; in many months no flowering was observed. Concentrations of honeyeaters and lorikeets at winter-flowering eucalypts in coastal New South Wales has been documented previously (Keast 1968; Smith 1984). Near Bega, on the south coast of New South Wales, Smith (1984) found Spotted Gum forests attracted more honeyeaters and lorikeets than did other forest types, and these species' numbers and distributions each winter varied according to the intensity of flowering.

In the present study, lorikeet numbers fluctuated more markedly than did those of honeyeaters (Fig. 1a,b). Sporadic summer flowering of eucalypts tended to be exploited more by lorikeets. This suggests that lorikeet movements may be more local and that their mobility enables them to readily locate new sources of flowering in the area.

Honeyeaters most regularly observed feeding at flowers were Noisy Friarbird, Scarlet Honeyeater and Little Wattlebird, together with Eastern Spinebill, White-checked and Brown Honeyeaters, although these last three occurred only in low numbers at the census sites (Table 2). At locations of prolific flowering, Fuscous and Yellow-faced Honeyeaters and Silveryeyes also foraged extensively at blossoms.

The pattern of winter immigration of honeyeaters observed in the Casino area appears to be consistent with reported movements of the main species involved. Blakers *et al.* (1984) cited

evidence from south-eastern Australia of winter movements to northern New South Wales and eastern Queensland and/or to lower altitudes by Noisy Friarbirds and Yellow-faced, Fuscous and Scarlet Honeyeaters. Eastern Spinebills occur as winter visitors to coastal lowlands in north-eastern New South Wales (Liddy 1966; unpub. data), although the origin of the birds is unknown. It seems unlikely that this is a simple altitudinal movement, for, in northern New South Wales at least, a simultaneous winter increase in Spinebill numbers occurs at sites on the Northern Tablelands (i.e. at the upper altitudinal limits) (McFarland and Ford 1987). The small numbers of Little Wattlebirds and White-cheeked and Brown Honeyeaters present in the sclerophyll forests in winter possibly represent local movements from other habitats, such as coastal heaths.

The seasonal patterns reported here contrast with those observed in higher altitude eucalypt forests and woodlands in south-eastern Australia. At Bombala (37°S, 850 m asl) (Recher and Holmes 1985) and at Canberra (35°30'S, 650 m asl) (Bell 1980), bird numbers were lower in winter than in other seasons. In woodlands on the Northern Tablelands near Armidale (30°30'S, 1 000 m asl), numbers tended to be higher in

winter than in spring (Ford *et al.* 1985). In open eucalypt forest further east in New England National Park (30°30'S, 1 400 m asl), data collected by McFarland (1984) suggested a winter peak in overall bird numbers. At this site, characterized by an understorey of winter flowering banksias, honeyeaters dominated the avifauna during autumn and winter. Ford *et al.* (1985) pointed out that there is a tendency for the status of some species to change from that of summer visitor to winter visitor northwards. Species conforming to this pattern make up most of the winter visitor group (see above) to eucalypt forests in the study area.

Movements by individual species, however, are complex, and may involve more than one population in combination, with north-south migration and/or altitudinal movements and local movements between habitats, e.g.,

- (i) species which are regular summer visitors further south but which are present all year round in sclerophyll forests near Casino, showing little seasonal change in recording rates (White-throated Gerygone, unpub. data);
- (ii) species present throughout the year but whose numbers are augmented by winter immigrants (Grey Fantail);

TABLE 5

Seasonal variation in relative abundance of selected species at each site. Mean number of individuals per census, October-March and in parentheses, April-September. R = recorded at site but not during survey.

SPECIES	A		B		C		D		E	
Rose-crowned Fruit-Dove	—	(—)	—	(—)	1.3	(<0.1)	1.3	(—)	3.8	(—)
Wompoo Fruit-Dove	—	(—)	—	(—)	—	(0.1)	0.1	(—)	4.7	(2.4)
Topknot Pigeon	—	(—)	—	(—)	3.9	(12.9)	4.3	(9.8)	23.5	(4.7)
White-headed Pigeon	—	(—)	—	(—)	0.3	(1.1)	—	R	2.3	(0.3)
Brown Cuckoo-Dove	—	(—)	<0.1	(0.1)	0.5	(1.0)	2.2	(1.8)	12.7	(4.4)
Yellow-eyed Cuckoo-shrike	—	(—)	—	(—)	<0.1	(—)	3.6	(0.5)	0.3	(—)
Rose Robin	—	(2.2)	—	(2.4)	—	(4.9)	0.2	(1.3)	1.7	(1.2)
Golden Whistler	0.3	(4.9)	0.7	(6.9)	4.2	(11.1)	9.1	(10.3)	13.1	(7.3)
Black-faced Monarch	—	(—)	0.4	(—)	2.0	(0.7)	7.2	(1.3)	6.1	(—)
Spectacled Monarch	—	(—)	0.3	(<0.1)	0.7	(0.3)	2.3	(0.7)	0.4	(—)
Rufous Fantail	—	(—)	1.1	(<0.1)	2.6	(1.1)	8.1	(2.9)	5.0	(0.8)
Grey Fantail	3.6	(4.1)	9.2	(12.2)	2.2	(13.7)	1.7	(4.8)	2.9	(4.9)
Lewin's Honeyeater	—	(<0.1)	6.1	(6.8)	8.7	(14.4)	29.6	(22.6)	21.1	(12.5)
Yellow-faced Honeyeater	5.4	(10.4)	1.0	(19.8)	2.4	(15.5)	0.4	(9.3)	1.0	(5.2)
Eastern Spinebill	—	(0.4)	—	(0.3)	—	(1.4)	1.1	(0.6)	0.5	(1.1)
Spotted Pardalote	0.1	(4.3)	0.1	(5.2)	0.9	(7.7)	0.4	(1.3)	0.8	(1.5)
Striated Pardalote	1.9	(2.8)	3.1	(9.7)	2.5	(2.1)	—	(—)	—	(—)
Silvereye	—	(4.1)	1.4	(19.3)	5.9	(32.4)	30.0	(21.9)	26.1	(17.1)

- (iii) species generally absent in summer but which are autumn-winter visitors to eucalypt forests (Spotted Pardalote, forms of the Striated Pardalote, Yellow-faced Honey-eater);
- (iv) species present locally in other habitats (especially rainforest) in summer or throughout the year but which in eucalypt forests are autumn-winter visitors (Golden Whistler, Silvereye); and
- (v) species present in low numbers in higher altitude moist forests in the district in summer or all year round but which occur in lowland forests, in much greater numbers, as winter visitors only (Rose Robin).

Seasonality of the rainforest communities described here agrees with Kikkawa (1968) for northern New South Wales rainforests. This pattern of summer highs and winter lows in both numbers of species and individuals is accounted for in part by the departure of breeding summer migrants and their offspring (e.g., monarchs, Rufous Fantail, Yellow-eyed Cuckoo-shrike, Red-crowned Fruit-Dove; Table 5). Much lower winter recording rates obtained for some common 'resident' species, including Silvereye, Lewin's Honeyeater and Golden Whistler (Cambridge Plateau), may indicate some movement from closed forest to more open, drier habitat and/or to lower altitudes, as suggested by Kikkawa (1968). Winter movement of colour-banded Lewin's Honeyeaters from adjacent closed canopy scrub into open forest and woodland has been reported on the Northern Tablelands (Bell 1986). At Cambridge Plateau, recording rates for fruit pigeons and some other frugivores also declined sharply in winter, indicating some movement away from the site (Table 5). There was some corresponding increase at lower elevations, particularly at Bagotville.

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