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DISTRIBUTION AND ABUNDANCE OF LANDBIRDS IN THE COUNTY OF CAMDEN, NEW SOUTH WALES

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From 1988 to 1991, 15 to 37 teams of observers performed bi-annual, timed counts in 22 sub-areas of the County of Camden. Cumulatively, 92 observers counted 254 886 birds of 243 species. Data from these counts were combined with data from similar counts in seven other sub-areas of the County of Camden from 1982 to 1987 to quantify distribution and abundance of 167 landbird species in six physiographic regions.

INTRODUCTION

The County of Camden (5 500 km²) is an area of land centred approximately on the Hume Highway about 54 km south of Sydney, New South Wales (Fig. 1). The topography comprises a narrow coastal plain abutting prominent escarpment slopes that rise to 600 m above sea level (asl) and a relatively large inland plateaux between 300 m and 800 m asl. Geology, soils and climate are varied and account for a broad range of vegetation communities including rainforest, wet and dry sclerophyll forest, eucalypt woodland and heathland. Such a range of habitats and climates may give rise to patchiness in distribution of landbirds but as yet, no attempt has been made to quantify abundance of species in the different physiographic regions of the County.

Gibson (1977) and Smith *et al.* (1989) listed bird species in the County as rare, scarce, uncommon, moderately common and common. In the larger but overlapping one-degree block (34–35°S, 150–151°E) of *c.* 10 000 km², Blakers *et al.* (1984) used reporting rates as a measure of abundance. Wood and Simcock (1993) presented the results of bi-annual counts from 1982 to 1987 in the small coastal area (*c.* 800 km²) around Wollongong. In the first counts from 1982-87, the Illawarra District was divided into seven sub-areas (Fig. la) and the abundance of all species was estimated in each sub-area in late autumn and mid-spring. A second series of bi-annual counts was organised by the author from 1988 to 1991 in 24 other sub-areas covering most of the remainder of the County (Fig. la).

The aim of this report is to use combined count data from 1982 to 1991 (first and second counts combined) to quantify the distribution and abundance of landbirds in the six physiographic regions of the County (Fig. lb).

STUDY AREA

The coastal plain is dominated by low hills and flood plains composed mostly of Quaternary alluvium. Its western boundary is the Illawarra escarpment, the crest of which forms an impressive line of sandstone cliffs with steep talus slopes to the south and east. These slopes, up to 200 m wide, are derived from Permian and Triassic sediments in the east and Gerringong volcanics in the south. West of the escarpment, the Woronora plateau (the Southern Highlands) consists of Hawkesbury Sandstone with some deeply incised valleys. The plateau is highest in the south near Mittagong and Moss Vale (mean 700 m asl) and dips gradually northwards to approximately 180 m asl near Camden. Undulating or rolling terrain on the plateau is covered by Wianamatta shales, overlaid with basalt intrusions at high altitudes (Table 1). Detailed geology has been mapped at 1 : 250 000 (Anon. 1996).

Climate is variable due to orographic influences and proximity to the coast. The average January maximum temperatures at Wollongong and Moss Vale are 25.9°C and 21.6°C respectively whereas corresponding minimum temperatures in July are 7.8°C and 1.2°C respectively. Light snow falls a few times every three or four years at elevations above 700 m. Rainfall is fairly evenly distributed throughout the year. It is highest along the escarpment (*c.* 1 600 mm per annum) declining eastwards and westwards. Lowest rainfall (*c.* 700 mm per annum) is recorded along the Wollondilly River. During the period 1982-1991, drought was experienced in 1982 (Fig. 5 in Wood and Simcock 1993) and 1991 (Fig. 2).

Although 25 per cent of the County has been cleared for agriculture, substantial tracts of natural habitat are preserved as National Parks (*c.* 23%) and water catchment areas (*c.* 11%). State Forests comprise about 187 km² (3.5%) of which about 36 km² is planted with *Pinus radiata*. Physiographic regions 1, 2, 3 and 6 are dominated by dry sclerophyll forest whereas wet sclerophyll forest grows mainly in regions 4 and 5 (Table 1). The largest proportion of heathland and scrubby woodland occurs in region 6. Sub-tropical and warm temperate rainforests are present at scattered sites where rainfall is more than 1 200 mm per year (Mills and Jakeman 1995). Rainforest distribution is highly fragmented as over 70 per cent has been cleared since European settlement (Mills 1987, 1988). Largest total areas of rainforest are near the escarpments in regions 3 (*c.* 1 700 ha) and 4 (*c.* 2 400 ha). Other natural vegetation is a complex array of more than 60 forest types (Anon. 1989), influenced by abrupt changes in rainfall, topography and soils. Common sclerophyllous forests are from the

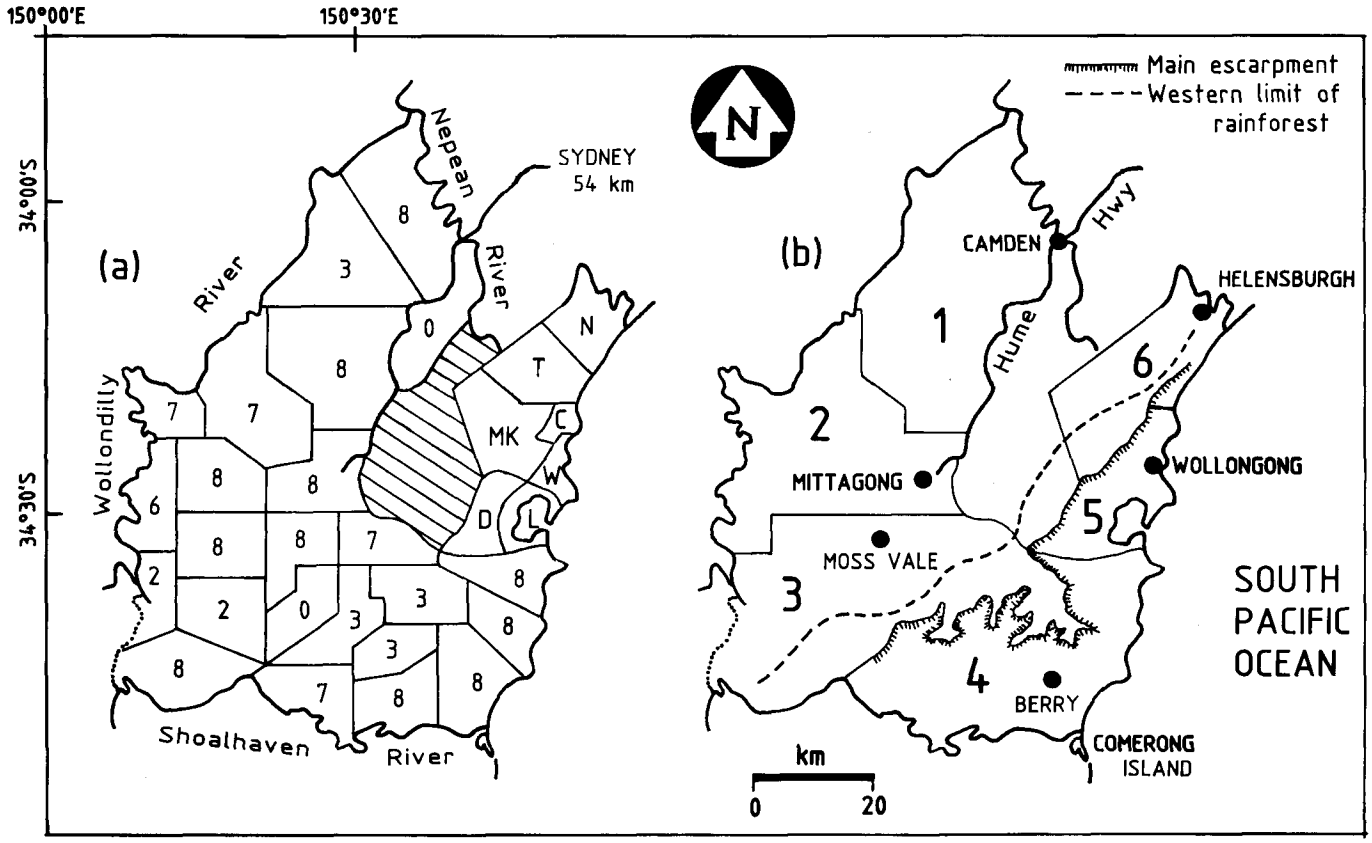

Figure 1. *The County of Camden showing (a) seven sub-areas (N, T, MK, C, W, D, L) that were surveyed from 1982-1987 and 24 other sub-areas, 22 of which were surveyed from 1988-1991. Numbers in the 24 sub-areas indicate the total number of surveys. No surveys were conducted in the water catchment area shown cross-hatched. Figure 1(b) shows six physiographic regions (coded 1-6) for which data were regrouped in this report.*

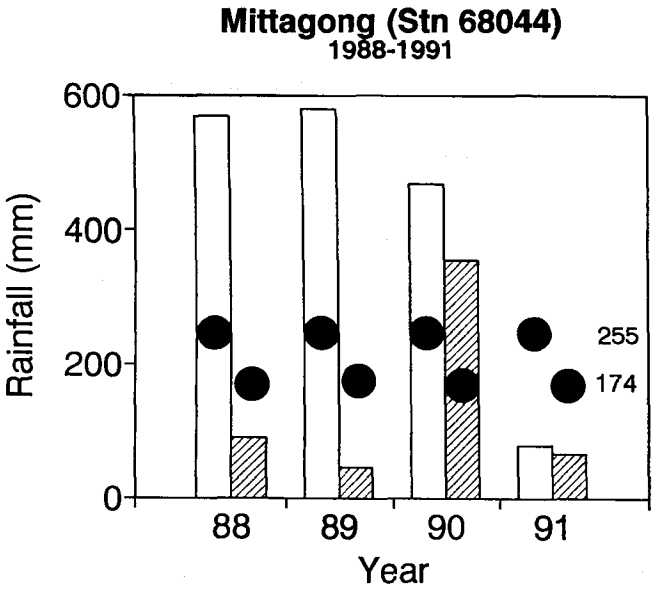

Figure 2. *Rainfall from 1988–1991 at Mittagong Climatological Station No. 68044. Grouped data are presented for the three consecutive months before each count in late autumn (clear bars) and mid-spring (stippled bars). Closed circles show corresponding 108-year mean rainfall. Rainfall from 1982–1987 is similarly presented elsewhere (see Fig. 5 in Wood and Simcock 1993).*

Blackbutt and Sydney Blue Gum-Bangalay Leagues on the escarpment slopes and from the Scribbly Gum-Stringybark-Silvertop Ash Leagues on the plateau (Anon. 1989). The Messmate-Brown Barrel League is represented at high altitudes.

METHODS

From 1988 to 1991, survey teams performed timed counts (Smith 1986) each year at the end of May (late autumn) and the end of October (mid-spring). A survey team was defined as the occupants of one vehicle. Experienced observers acted as team leaders and determined the routes to be travelled, census locations and stop durations within each sub-area. Some Nature Reserves (Barren Grounds, Wirrimbirra, Thirlmere Lakes, Cecil Hoskins and Bass Point) and *Pinus radiata* mono-culture habitats were not surveyed because extant avifauna is well documented. Comerong Island was not visited.

Individual birds of all species were counted while observers were walking, travelling or stopped. 'Squeaking' was sometimes used to aid detection. Each team consistently applied a counting procedure that was most effective in evenly sampling the habitats in its assigned sub-area. All birds seen or heard were recorded as well as the number of observers, hours of observation, and distance travelled while counting. This counting procedure was identical to that adopted in the first 1982–87 counts (see Wood and Simcock 1993). In essence, the only difference between the methods used in the first and second counts was the length of the survey period each autumn and spring. Whereas all teams counted birds on the same day in autumn and spring each year from 1982 to 1987, teams performed counts over a nine-day period in each autumn and spring from 1988 to 1991. This

nine-day survey period was introduced to offer teams a choice of count day and an opportunity to census more than one sub-area if willing. With the experience gained from the first counts, it was thought that such flexibility might be necessary to adequately sample all sub-areas, even though some double-counting may occur. Despite such flexibility, only 22 of the 24 sub-areas were surveyed and only 138 surveys were conducted in total instead of a possible 192 (Fig. 1a).

Observation effort varied markedly between regions (Table 1). For example, the team-hours spent observing in Berry escarpments was five times greater than in Northern shale (630.8 team-hours vs 126.6 team-hours). Observation density (team-hours/km^2) was 10 times greater in Wollongong escarpments than the Northern shale (1.3 team-hours/km^2 vs 0.1 team-hours/km^2). Because there were marked variations in observation effort, observation density, counting procedure and observer ability, count data were not considered amenable to significance testing.

In terms of overall coverage, there was an average of 1 567 km travelled during each survey in regions 1–4 (Table 2) and 507 km travelled during each survey in regions 5–6 (Table 2 in Wood and Simcock 1993). Even if all birds 50 m each side of the roads driven were counted, only 207 km^2 or 3.7 per cent of the County area would be surveyed each season. As mentioned earlier, most censusing was performed at regular stopping points rather than while driving, but nevertheless, the effective coverage of the County was likely to be some three or four orders of magnitude less than 3.7 per cent.

As for the first counts, birds per team hour (X) was the most appropriate measurement for comparisons of regional abundance. The ratio Xmin/Xmax gives a measurement of evenness in distribution across all regions. Overall abundance is calculated by summing the number of individuals counted in late autumn (Na) and mid-spring (Ns). As the number of team-hours expended in both seasons was similar (1193.1 vs 1266.2), the seasonal abundance ratio Na/Ns (or Ns/Na) provides an indication of the relative abundance of species in late autumn and mid-spring. Migrant species that are present at the end of October and absent at the end of May or vice versa provide high seasonal ratios. Throughout this report, species were defined as migratory if: (1) the seasonal abundance ratio was greater than 10 (irrespective of the number of individuals counted) or (2) the seasonal abundance ratio was greater than 5 and the number of individuals counted was greater than 500. Using this criterion, only the resident Pilotbird *Pycnoptilus floccosus* (Ns/Na = 37.5, n = 77) qualified erroneously as a migrant species (see Smith *et al.* 1989).

RESULTS

From 1988 to 1991, 92 observers counted a total of 254 886 individuals of 243 species. For each year, the number of individuals counted in autumn (32 592–41 943 individuals) was greater than the number counted in spring (25 452–29 758 individuals) (Table 2). Conversely, the number of species recorded in spring (187–201 species) was consistently greater than the corresponding number recorded in autumn (157–175 species). Raw data on observation effort and number of individuals of all species in all sub-areas are available from the author.

When data for 1988–91 were combined with data from the first counts (1982–87), there was a total of 167 landbird species. Abundance of 125 species, each with more than 50 individuals in total is mapped in the

TABLE 1

Environmental chacteristics of each physiographic region and total sampling effort from 1982–1991.
A = late autumn, S = mid-spring.

Region	1	2	3	4	5	6
General name	Northern shale	Central sandstone	Southern sandstone	Berry escarpments	Wollongong escarpments	North-eastern forests, woodlands and heath
Primary geology	Wianamatta shale	Hawkesbury sandstone	Wianamatta shale, Hawkesbury sandstone and Robertson basalt	Shoalhaven volcanics	Illawarra coal measures and quarternary alluvium	Hawkesbury sandstone and Narrabeen sandstone
Approximate area[1]	1 150 km^2	950 km^2	1 350 km^2	850 km^2	400 km^2	400 km^2
Altitude (asl)	100–300 m	300–500 m	500–800 m	0–600 m	0–500 m	100–300 m
Human population[2]	13 120	16 570	16 650	24 750	203 980	16 050
Survey period	1988–91	1988–91	1988–91	1988–91	1982–87	1982–87
Total team-hours[3] (A)	62.8	186	180	330.5	248.8	185
(S)	63.8	224.5	211.8	300.3	258.8	207
Annual rainfall (mm)	700–900	700–1 000	700–1 800	1 000–1 800	1 000–1 600	1 000–1 400
Vegetation and land use (area %)						
Rainforest	0	0	1.5	3	1	1
Wet sclerophyll forest	11	8	25	36	27	30
Dry sclerophyll forest	68	75	37	35	20	40
Pinus radiata forest	0	0	3	0	0	0
Open woodland[4]	20	15	30	19	12	0
Heath and scrub woodland	0	0	0.5	2	0	20
Wetland	0	0	1.5	2	9	5
Urban	1	2	1.5	3	31	4

[1]No surveys were conducted in the water catchment area (*c.* 450 km^2, see Fig. 1a).
[2]Australian Bureau of Statistics, 1991.
[3]Calculated as the cumulative sum of all hours worked by all teams.
[4]Mainly pastoral land.

TABLE 2

Overall summary of results for physiographic regions 1–4 in the County of Camden from 1988–1991.
A = late autumn, S = mid-spring.

		1988	1989	1990	1991	4-yr mean	SE	% increase in seasonal means
Number of teams	(A)	15	37	23	22	24.3	4.6	
	(S)	35	28	22	22	26.8	3.1	10
Team hours[1]	(A)	196.5	246.5	163.8	152.5	189.8	18.2	
	(S)	261.3	201.5	168	169.6	200.1	18.9	5
Team km[2]	(A)	1 767	1 691	1 429	1 225	1 528	108	
	(S)	2 150	1 627	1 294	1 353	1 606	169	5
Species[3]	(A)	166	175	157	166	166	3.2	
	(S)	201	199	187	193	195	2.7	17
Individuals[4]	(A)	34 982	41 943	35 359	32 592	36 219	1 735	
	(S)	28 778	25 452	26 034	29 758	27 506	904	32

[1]Calculated as the cumulative sum of all hours worked by all teams.
[2]Calculated as the cumulative sum of all kilometres travelled by all teams.
[3]Total species observed in all regions.
[4]Total number of individuals of all species in all regions.

six physiographic regions (Appendix 1). Abundance and distribution of the remaining 42 species are tabulated in Appendix 2.

Very few species were evenly distributed. Indeed, only two species provided a ratio Xmin/Xmax greater than 60 per cent (Spotted Pardalote *Pardalotus punctatus* 73% and Fan-tailed Cuckoo *Cacomantis flabelliformis* 68%). Although 83 species (66%) were recorded in all six regions at some time from 1982 to 1991 (Table 3), six species (White-headed Pigeon *Columba leucomela*, Rainbow Lorikeet *Trichoglossus haematodus*, Red-rumped Parrot *Psephotus haematonotus*, White-throated Needletail *Hirundapus caudacutus*, Bell Miner *Manorina melanophrys* and White-fronted Chat *Epthianura albifrons*) were recorded in only two regions. Musk Lorikeet *Glossopsitta concinna*, Tawny-crowned Honeyeater *Phylidonyris melanops* and Chestnut-breasted Mannikin *Lonchura castaneothorax* were seen in only one of the six regions. Numerous species showed preference for either the inland regions 1–3 or the coastal regions 4–6. Gang-gang Cockatoo *Callocephalon fimbriatum*, Crested Pigeon *Ocyphaps lophotes*, Common Bronzewing *Phaps calcoptera*, White-eared Honeyeater *Lichenostomus leucotis*, Rufous Whistler *Pachycephala rufiventris*, Common Blackbird *Turdus merula*, Rufous Songlark *Cincloramphus mathewsi* and White-winged Chough *Corcorax melanoramphos* occurred mainly west of the escarpment whereas Brown Cuckoo-Dove *Macropygia ambionensis*, Topknot Pigeon *Lopholaimus antarcticus*, Wonga Pigeon *Leucosarcia melanoleuca*, Little Wattlebird *Anthochaera chrysoptera*, New Holland Honeyeater *Phylidonyris novaehollandiae*, Lewin's Honeyeater *Meliphaga lewinii*, Golden Whistler *Pachycephala pectoralis* and Brown Gerygone *Gerygone mouki* were most common in coastal habitats. Southern Emu-wren *Stipiturus malachurus*, Little Wattlebird, Chestnut-rumped Heathwren *Hylacola pyrrhopygia* Tawny-crowned Honeyeater and Dusky Woodswallow *Artarmus cyanopterus* were species of the heathland and woodland in region 6. Within particular genera, some species were more specialised in their habitat preferences than others. For example, in the Scrubwrens, Yellow-throated Scrubwren *Sericornis citreogularis* and Large-billed Scrubwren *Sericornis magnirostris* showed affinity for escarpment forests whereas the White-browed Scrubwren *Sericornis frontalis* was more evenly distributed. In the Thornbills, Buff-rumped Thornbill *Acanthiza reguloides*, Yellow-rumped Thornbill *Acanthiza chrysorrhoa* and Striated Thornbill *Acanthiza lineata* were clearly most abundant in inland regions whereas Yellow Thornbills *Acanthiza nana* and Brown Thornbills *Acanthiza pusilla* were encountered at appreciable rates (birds/team hour) in most of the six regions. The following species were strongly linked to Northern shale habitats: Weebill *Smicrornis brevirostris*, White-throated Gerygone *Gerygone olivacea*, Yellow-tufted Honeyeater *Lichenostomus melanops*, Fuscous Honeyeater *Lichenostomus fuscus*, Restless Flycatcher *Myiagra inquieta* and Double-barred Finch *Taeniopygia bichenovii*.

TABLE 3

Occurrence of 125 regularly observed landbird species in the six physiographic regions of the County of Camdem from 1982 to 1991.

Number of species recorded	Number of regions in which species was recorded
83	6
10	5
16	4
7	3
6	2
3	1

Numerically, the Common Starling *Sturnus vulgaris* was predominant with 53 033 individuals overall, almost four times the number of Australian Magpies *Gymnorhina tibichen* (14 661 individuals). Other species that were abundant were: House Sparrow *Passer domesticus* (11 713 individuals), Welcome Swallow *Hirundo neoxena* (11 030), Superb Fairy-wren *Malurus splendens* (9 600), Common Myna

Acridotheres tristis (8 775), Crimson Rosella *Platycercus elegans* (8 214), Silvereye *Zosterops lateralis* (8 040), Red-browed Finch *Neochmia temporalis* (7 023) and Australian Raven *Corvus coronoides* (6 745). Three of these abundant species are introduced.

Twenty-two species were considered migratory, arriving before mid-spring and departing before late autumn. Fourteen had seasonal abundance ratios greater than 50, eight of which were counted only in spring: Common Koel *Eudynamys scolopacea*, Rainbow Bee-eater *Merops ornatus*, Dollarbird *Eurystomus orientalis*, Leaden Flycatcher *Myiagra rubecula*, Rufous Fantail *Rhipidura rufifrons*, White-winged Triller *Lalage sueurii*, White-browed Woodswallow *Artamus superciliosus* and Rufous Songlark. Migratory Scarlet Honeyeaters *Myzomela sanguinolenta* (Na/Ns = 29.5, n = 122) were well-represented in every spring count in regions 1–4 (n = 116) whereas only three birds were counted in autumn in these regions. They were however, poorly represented in both seasons in coastal regions five and 6 (n = 3). Only two species, defined as migrants, had seasonal abundance ratios greater than 5 but less than 10. These species were the Fan-tailed Cuckoo (Ns/Na = 5.8, n = 910) and the Tree Martin *Hirundo nigricans* (Ns/Na = 6.4, n = 1234). In every year, the number of Fan-tailed Cuckoos counted in spring was more than the number counted in autumn (seasonal ratio range 2.5–64.5, mean 5.7, n = 10).

Of the 42 species in Appendix 2, nine were represented by only one individual and a further 10 were seen in only one region. The remaining 23 species were either more common or more evenly distributed. Four of these 23 species (Peaceful Dove *Geopelia striata*, Brown Treecreeper *Climacteris picumnus*, Speckled Warbler *Chthonicola sagittata* and Hooded Robin *Melanodryas culcullata*) were restricted to the inland regions 1–3 whereas Emerald Doves *Chalcophaps indica* and Spangled Drongos *Dicrurus bracteatus* were found only in coastal regions 4–6. Channel-billed Cuckoos *Scythrops novaehollandiae*, White-plumed Honeyeaters *Lichenostomus penicillatus*, Cicadabirds *Coracina tenuirostris* and Long-billed Corellas *Cacatua tenuirostris* were the most abundant and most evenly distributed species in Appendix 2.

DISCUSSION

This large community effort (2 459 team-hours, Table 1) is the first attempt to quantify distribution and abundance of landbirds within the County of Camden. For 125 species, distribution maps are presented to enable abundance comparisons between physiographic regions and between late autumn and mid-spring. These data update current references that are important for wildlife managers, ecologists and consultants. Species such as the Little Lorikeet *Glossopsitta pusilla* (52 birds overall), Horsefield's Bronze Cuckoo *Chryscoccyx basilis* (84), Rock Warbler *Origma solitaria* (95) and Rufous Fantail (59) were certainly not 'moderately common' in the present study (see Smith *et al.* 1989). Moreover, new evidence has been presented to suggest that the Fan-tailed Cuckoo and the Scarlet Honeyeater are migratory rather than nomadic (see Smith *et al.* 1989). If Fan-tailed Cuckoos are summer migrants near Wollongong and Wangaratta (Cheney 1915) and winter migrants near Brisbane (Slater 1995), the movements of this Cuckoo might mirror those of the Brush Cuckoo *Cacomantis variolosus* and Pallid Cuckoo *Culculus pallidus*.

Abundance and distribution of the 42 species that were recorded in small numbers are quantified in Appendix 2. Smith *et al.* (1989) previously assessed that 27 of these species were not 'rare' but either 'uncommon' or 'scarce'. Twenty-four additional landbird species that have been recorded in the past (see Smith *et al.* 1989) were not counted in this study. The residency status of these 24 species should now be examined to determine whether small numbers of individuals are present in remote habitats (e.g. King Quail *Coturnix chinensis*, Turquoise Parrot *Neophema pulchella*, White-backed Swallow *Cheramoeca leucosternus*, Regent Honeyeater *Xanthomyza phrygia* and Black-chinned Honeyeater *Melithreptus gularis*) or whether these species are represented by only vagrant individuals (e.g. Little Button-quail *Turnix velox*, Oriental Cuckoo *Cuculus saturatus*, Olive Whistler *Pachycephala olivacea*, Brown Honeyeater *Lichmera indistincta* and Spectacled Monarch *Monarcha trivirgatus*).

Some aspects of the study impact on the interpretation of results. First, drought was experienced from April 1982 to April 1983 (Wood and Simcock 1993) and also during 1991 (Fig. 2). These periods of rainfall deficiency almost certainly influenced the abundance of Swift Parrots *Lathamus discolor*, White-browed Woodswallows, Masked Woodswallows *Artamus personatus* and Black-faced Woodswallows *Artamus cinereus* (Wood and Simcock 1993, Wood 1994).

Second, the number of individuals counted in autumn was greater each year than the corresponding number counted in spring (Table 2). As in the 1982–87 counts, this phenomenon is attributed to the formation of mixed and single-species flocks in autumn (see Wood and Simcock 1993). Among the landbirds, the Common Starling alone accounted for 17 773 more individuals in autumn than spring (35 383 vs 17 650). Zebra Finches *Taeniopygia guttata*, Double-barred Finches and Red-browed Finches were censused with much higher numbers in autumn than spring probably due to larger flocks in autumn, comprising adults and first-year birds that fledged following breeding after the spring counts.

Third, the small team effort and high counting efficiency in region 1 (Table 1) compared with other regions probably inflated the relative abundance of species such as Australian King-Parrot *Alisterus scapularis*, Yellow Thornbill and Grey Butcherbird *Cracticus torquatus* in the Northern shale. Had this

region been sampled more extensively, for example by more teams with a range of counting efficiencies, it seems likely that the abundance of these species, calculated as birds per team-hour, would have been less than presented herein.

Fourth, it cannot be assumed that distribution was uniform within a region, as some species occurred in habitat pockets. For example, the largest numbers of Red-whiskered Bulbuls *Pycnonotus jocosus* and House Sparrows were encountered in the north of region 4 while the largest numbers of Pilotbirds and Eastern Bristlebirds *Dasyornis brachypterus* were in the east of region 3. Moreover, large but irregular counts of some species tended to bias their perceived distribution in favour of the region in which those large numbers were counted. Such large counts were: 572 Sulphur-crested Cockatoos *Cacatua galerita* (region 1, May 89), 100 Little Corellas *Cacatua sanguinea* (region 1, May 89), 150 Yellow-tailed Black-Cockatoos *Calyptorhynchus funerus* (region 3, May 90), 150 Yellow-tailed Black-Cockatoos (region 2, May 91), 51 Pilotbirds (region 3, May 89), 500 House Sparrows (region 4, May 91), 127 Little Ravens *Corvus mellori* (region 4, October 90). These irregular large counts also provided large seasonal abundance ratios, sometimes falsely giving the impression of migration. For example, Little Raven (Ns/Na = 9.3) and White-headed Pigeon (Na/Ns = 6.5) showed high seasonal ratios whereas both species are probably nomadic (Smith *et al.* 1989).

Lastly, as cryptic species were identified mostly by call, their seasonal abundance was biased towards the season in which they called most. Seasonal abundance ratios for these species were indicative of comparative calling rates in the breeding and non-breeding seasons rather than migration. The following cryptic species are breeding residents yet their seasonal ratios were greater than 4: Pilotbird, Skylark *Alauda arvensis* and Common Blackbird. All the above impacts demonstrate the need for caution in interpretation of the results.

Avian assemblages consist of specialists that occupy ecological niches, and generalists that are more versatile in their habitat requirements (Catterall *et al.* 1991, Barrett *et al.* 1994). This study has enabled specialists and generalists to be broadly identified within the County. Rainforest specialists such as Brown Cuckoo-Dove, Emerald Dove, Topknot Pigeon, Black-faced Monarch *Monarcha melanopsis*, Rufous Fantail, and Green Catbird *Ailuroedus crassirostris* were present in regions 3, 4, 5 and 6, where rainforest occurs, and absent from region 1 in which there is no rainforest. Species usually considered rainforest specialists (see Smith 1991, Mills and Jakeman 1995) but found in all regions were Wonga Pigeon, Superb Lyrebird *Menura novarhollandiae*, Pilotbird, Eastern Whipbird *Psophodes olivaceus* and Satin Bowerbird *Ptilonorhynchus violaceus*. These five species may not be as closely linked to rainforest as previously thought. Five species were heathland specialists (Tawny-crowned Honeyeater, Dusky Woodswallow, Chestnut-rumped Heathwren, Little Wattlebird and Beautiful Firetail *Stagonopleura bella*) while Rainbow and Musk Lorikeets were virtually restricted to region 4. Inland shale and sandstone specialists included Yellow-tufted Honeyeater (183 birds overall), Pallid Cuckoo (172), Scarlet Honeyeater (122), Common Bronzewing (112), Restless Flycatcher (95), Zebra Finch (66), Fuscous Honeyeater (62), Weebill (54), Rufous Songlark (53), Rainbow Bee-eater (51), Peaceful Dove (32), Speckled Warbler (15), Hooded Robin (14), Brown Treecreeper (7), Southern Whiteface *Aphelocephala leucopsis* (2), Red-capped Robin *Petroica goodenovii* (2) and Nutmeg Mannikin *Lonchura punctulata* (2). Many of these shale specialist species, including the migrants, are at risk of local extinction because their populations are small (<200 birds counted in 8 surveys). Most shale species were present in region 1, yet absent from region 3, the only other region in which Wianamatta shale is dominant (Table 1). Absence of shale species from region 3 is probably due to clearing of almost all vegetation from shale landscapes around Moss Vale and Robertson.

Although 83 species could be broadly considered generalist species (Table 3), only six were encountered at almost the same number of birds per team hour in all six regions. These generalist species were: Fan-tailed Cuckoo, Laughing Kookaburra *Dacelo novaeguinea*, Spotted Pardalote, Eastern Spinebill *Acanthorhynchus tenuirostris*, Grey Fantail *Rhipidura fuliginosa* and Pied Currawong *Strepera graculina*. Three introduced species deserve special mention because they were among the ten most abundant landbirds. Common Starling (53 033 birds overall), House Sparrow (11 713) and Common Myna (8 775) all recorded the highest number of birds per team hour in the Northern shale. The impact of these exotic species on the survival of native populations has yet to be determined, but it is well known that Common Starlings and Common Mynas compete with native birds for food and nest sites (see Wood 1995, Pell and Tidemann 1997). Sheer numbers of exotic birds in shale regions may account for the low abundance of shale specialist species.

Throughout a number of regions in Australia, there is a continuing decline in species richness, often leading to local extinctions (Recher and Lim 1990). Species loss is rarely attributed to a single cause but Recher and Lim (1990) predicted an acceleration in extinctions unless clearing of habitats was controlled. In the woodlands of western Sydney, Hoskin (1991) and Keast (1995) showed that six shale-specialist species (Black-eared Cuckoo *Chrysococcyx osculans*, Brown Treecreeper, Speckled Warbler, Southern Whiteface, Hooded Robin and Redcapped Robin) are virtually extinct. Keast (1995) discussed the process of extinction over the last 50 years and demonstrated that loss of prime habitat was the most significant factor in the demise of these species. In the County of Camden, at least four, probably five landbirds (Australian Brush-turkey *Alectura lathami*, Bush Stone-curlew *Burhinus grallarius*, Woompoo Pigeon *Ptilinopus magnificus*, Australian Ringneck *Barnardius*

zonarius and Black-eared Cuckoo) are already extinct (King 1893, Gibson 1977, Smith *et al.* 1989) and many others, including those that have been eliminated from western Sydney, are now threatened. As Recher (1993) pointed out, ground-foraging species are most endangered because they are most restricted in their ecological requirements and most exposed to predation and disturbance. It is hoped data presented in this report and knowledge gained from past extinctions are used effectively in conserving the remaining species in the County of Camden.

ACKNOWLEDGMENTS

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APPENDIX 1

Distribution and abundance of 125 species of landbirds with a total of more than 50 individuals observed during bi-annual counts in the County of Camden from 1982 to 1991.

Observation effort was 1 193.1 team-hours in late autumn and 1 266.2 team-hours in mid-spring.

For each species, the number of birds per team-hour in each of the six physiographic regions (both seasons combined) is in proportion to the circle diameter. The largest circle represents the highest number of birds per team-hour (Xmax). The total number of individuals counted in late autumn and mid-spring is shown as Na and Ns respectively.

Abundance of any species in any region can be calculated as follows:

(1) measure the diameter of the circle corresponding to the region in question,

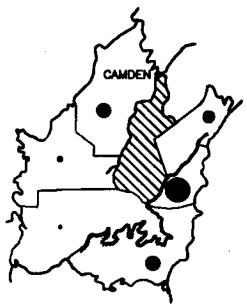
(2) measure the diameter of the largest circle,

(3) calculate the ratio of the smaller to larger diameter as a percentage,

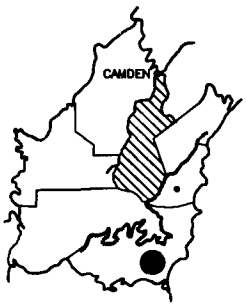
(4) multiply the calculated percentage by Xmax.

For example, Xmax for the Rock Dove is 2.1 birds per team-hour in region 5. The abundance of Rock Doves in regions 1, 2 and 3 is therefore approximately 50, 20 and 10 per cent of 2.1 birds per team-hour respectively.

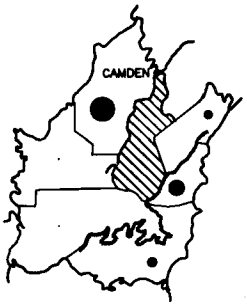
For summer migrant species (SM), the total number of individuals counted in mid-spring was at least five times the total number counted in late autumn (see methods).



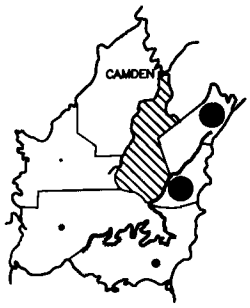
Rock Dove
Columba livia
Xmax = 2.1 birds/team hr
Na = 2085 Ns = 505



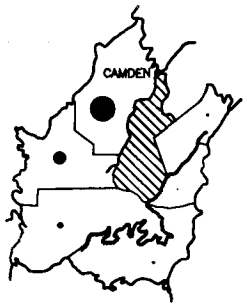
White-headed Pigeon
Columba leucomela
Xmax = 0.14 birds/team hr
Na = 85 Ns = 13



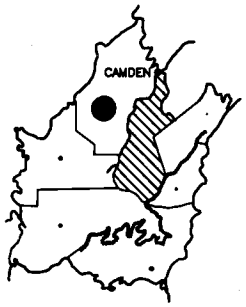
Spotted Turtle-Dove
Streptopelia senegalensis
Xmax = 2.2 birds/team hr
Na = 1034 Ns = 757



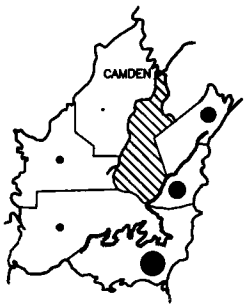
Brown Cuckoo-Dove
Macropygia amboinensis
Xmax = 0.24 birds/team hr
Na = 90 Ns = 198



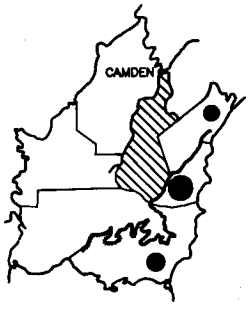
Common Bronzewing
Phaps chalcoptera
Xmax = 0.24 birds/team hr
Na = 37 Ns = 75



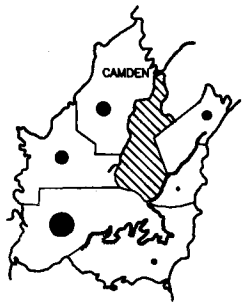
Crested Pigeon
Ocyphaps lophotes
Xmax = 2.3 birds/team hr
Na = 640 Ns = 251



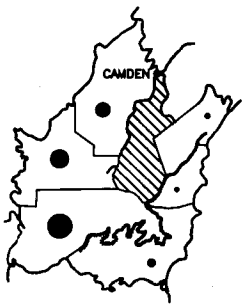
Wonga Pigeon
Leucosarcia melanoleuca
Xmax = 0.29 birds/team hr
Na = 122 Ns = 275



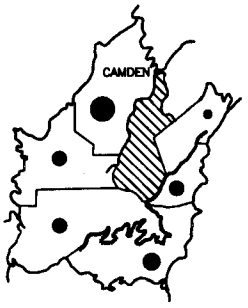
Topknot Pigeon
Lopholaimus antarcticus
Xmax = 1.1 birds/team hr
Na = 512 Ns = 839



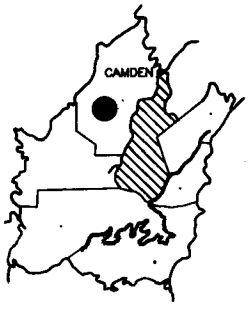
Yellow-tailed Black-Cockatoo
Calyptorhynchus funereus
Xmax = 2.0 birds/team hr
Na = 1577 Ns = 391



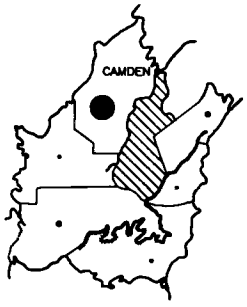
Gang-gang Cockatoo
Callocephalon fimbriatum
Xmax = 0.41 birds/team hr
Na = 255 Ns = 209



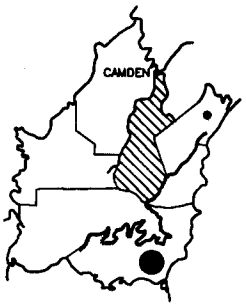
Galah
Cacatua roseicapilla
Xmax = 3.2 birds/team hr
Na = 2384 Ns = 2120



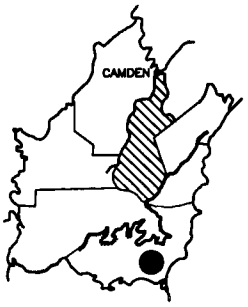
Little Corella
Cacatua sanguinea
Xmax = 0.85 birds/team hr
Na = 112 Ns = 35



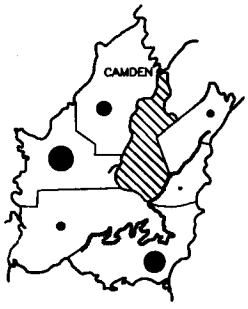
Sulphur-crested Cockatoo
Cacatua galerita
Xmax = 7.3 birds/team hr
Na = 1881 Ns = 1117



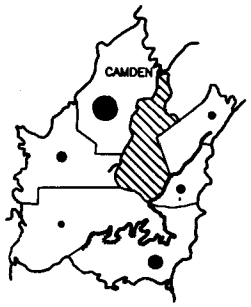
Rainbow Lorikeet
Trichoglossus haematodus
Xmax = 0.71 birds/team hr
Na = 387 Ns = 137



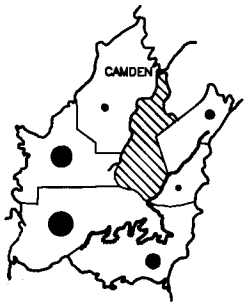
Musk Lorikeet
Glossopsitta concinna
Xmax = 0.11 birds/team hr
Na = 49 Ns = 23



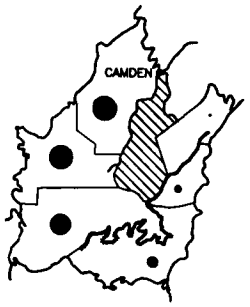
Little Lorikeet
Glossopsitta pusilla
Xmax = 0.04 birds/team hr
Na = 40 Ns = 12



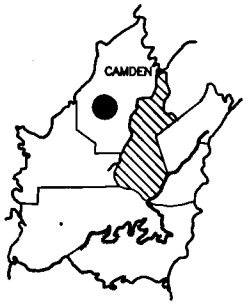
Australian King–Parrot
Alisterus scapularis
Xmax = 1.1 birds/team hr
Na = 732 Ns = 360



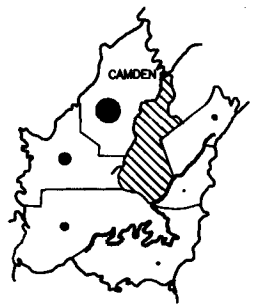
Crimson Rosella
Platycercus elegans
Xmax = 5.8 birds/team hr
Na = 5577 Ns = 2637



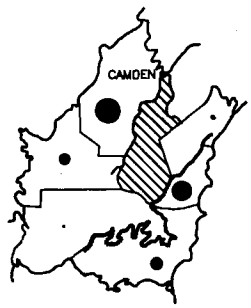
Eastern Rosella
Platycercus eximius
Xmax = 3.9 birds/team hr
Na = 3209 Ns = 1768



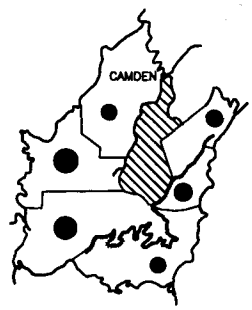
Red–rumped Parrot
Psephotus haematonotus
Xmax = 1.6 birds/team hr
Na = 178 Ns = 52



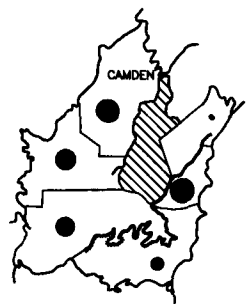
Pallid Cuckoo
Cuculus pallidus (SM)
Xmax = 0.28 birds/team hr
Na = 1 Ns = 171



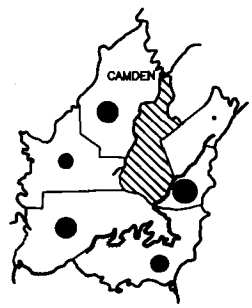
Brush Cuckoo
Cacomantis variolosus (SM)
Xmax = 0.09 birds/team hr
Na = 3 Ns = 101



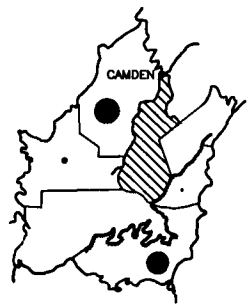
Fan–tailed Cuckoo
Cacomantis flabelliformis (SM)
Xmax = 0.47 birds/team hr
Na = 134 Ns = 776



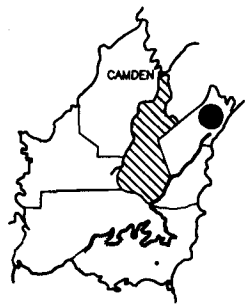
Horsfield's Bronze–Cuckoo
Chryscoccyx basilis (SM)
Xmax = 0.05 birds/team hr
Na = 7 Ns = 77



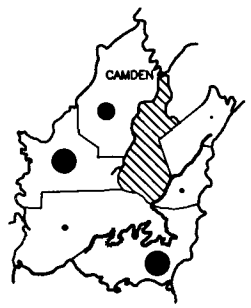
Shining Bronze–Cuckoo
Chryscoccyx lucidus (SM)
Xmax = 0.10 birds/team hr
Na = 8 Ns = 164



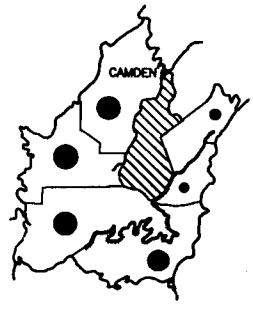
Common Koel
Eudynamys scolopacea (SM)
Xmax = 0.06 birds/team hr
Na = 0 Ns = 51



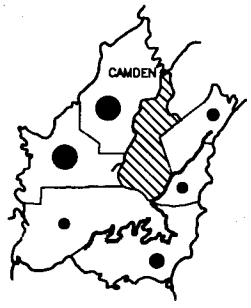
White–throated Needletail
Hirundapus caudacutus (SM)
Xmax = 0.21 birds/team hr
Na = 3 Ns = 91



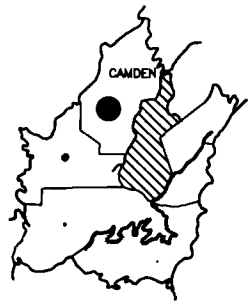
Azure Kingfisher
Alcedo azurea
Xmax = 0.05 birds/team hr
Na = 34 Ns = 26



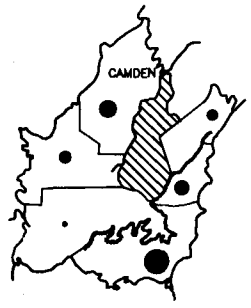
Laughing Kookaburra
Dacelo novaeguinea
Xmax = 1.7 birds/team hr
Na = 1416 Ns = 1772



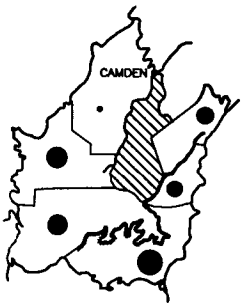
Sacred Kingfisher
Todiramphus sanctus (SM)
Xmax = 0.26 birds/team hr
Na = 4 Ns = 385



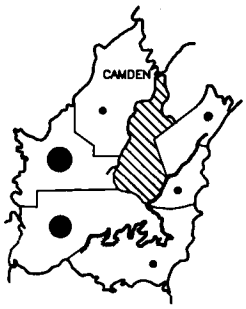
Rainbow Bee–eater
Merops ornatus (SM)
Xmax = 0.20 birds/team hr
Na = 0 Ns = 51



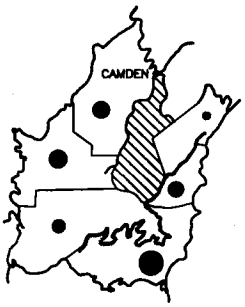
Dollarbird
Eurystomus orientalis (SM)
Xmax = 0.22 birds/team hr
Na = 0 Ns = 317



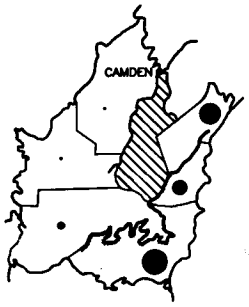
Superb Lyrebird
Menura novaehollandiae
Xmax = 0.39 birds/team hr
Na = 464 Ns = 288



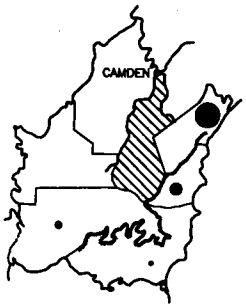
White-throated Treecreeper
Cormobates leucophaeus
Xmax = 1.2 birds/team hr
Na = 690 Ns = 806



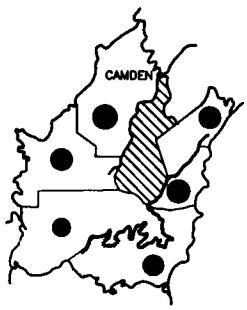
Superb Fairy-wren
Malurus splendens
Xmax = 5.7 birds/team hr
Na = 4669 Ns = 4931



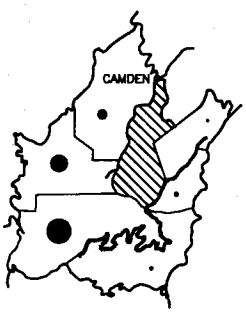
Variegated Fairy-wren
Malurus lamberti
Xmax = 0.34 birds/team hr
Na = 259 Ns = 225



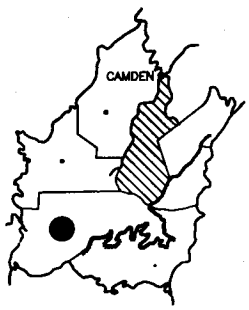
Southern Emu-wren
Stipiturus malachurus
Xmax = 0.14 birds/team hr
Na = 54 Ns = 60



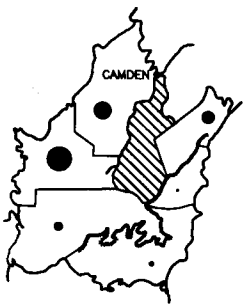
Spotted Pardalote
Pardalotus punctatus
Xmax = 1.03 birds/team hr
Na = 1138 Ns = 1088



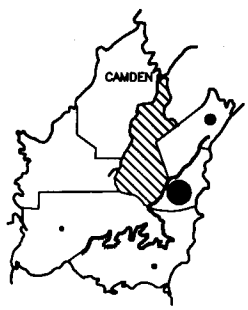
Striated Pardalote
Pardalotus striatus
Xmax = 0.74 birds/team hr
Na = 134 Ns = 527



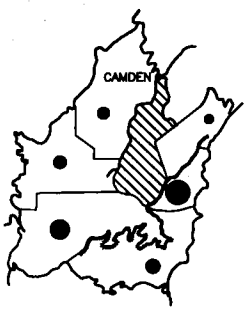
Pilotbird
Pycnoptilus floccosus
Xmax = 0.16 birds/team hr
Na = 2 Ns = 75



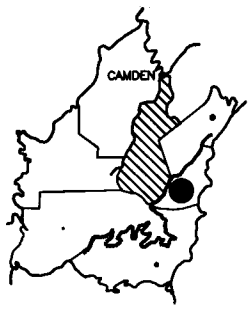
Rockwarbler
Origma solitaria
Xmax = 0.10 birds/team hr
Na = 64 Ns = 31



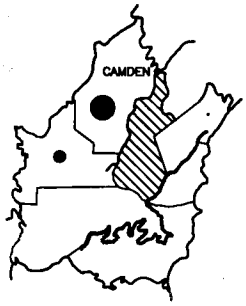
Yellow-throated Scrubwren
Sericornis citreogularis
Xmax = 0.38 birds/team hr
Na = 135 Ns = 196



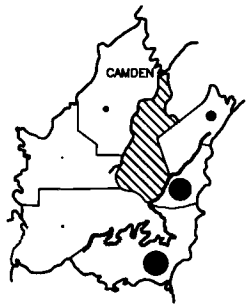
White-browed Scrubwren
Sericornis frontalis
Xmax = 1.8 birds/team hr
Na = 1334 Ns = 1605



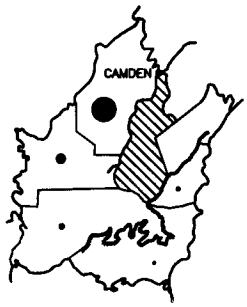
Large-billed Scrubwren
Sericornis magnirostris
Xmax = 0.17 birds/team hr
Na = 72 Ns = 50



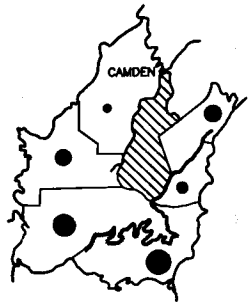
Weebill
Smicrornis brevirostris
Xmax = 0.15 birds/team hr
Na = 33 Ns = 21



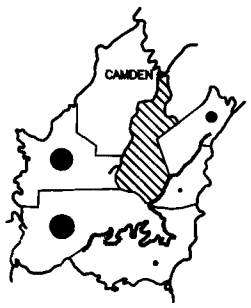
Brown Gerygone
Gerygone mouki
Xmax = 2.4 birds/team hr
Na = 1836 Ns = 1251



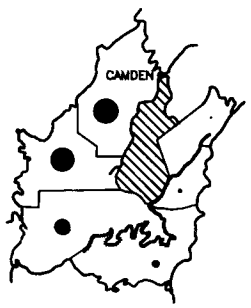
White-throated Gerygone
Gerygone olivacea (SM)
Xmax = 0.66 birds/team hr
Na = 5 Ns = 323



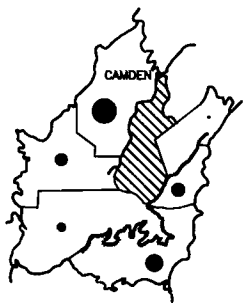
Brown Thornbill
Acanthiza pusilla
Xmax = 1.8 birds/team hr
Na = 1723 Ns = 1528



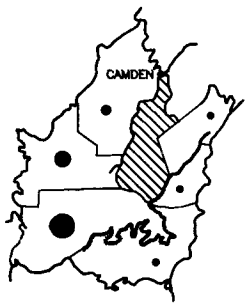
Buff–rumped Thornbill
Acanthiza reguloides
Xmax = 0.82 birds/team hr
Na = 622 Ns = 255



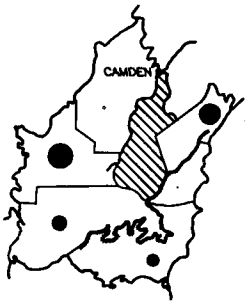
Yellow–rumped Thornbill
Acanthiza chrysorrhoa
Xmax = 2.8 birds/team hr
Na = 1778 Ns = 963



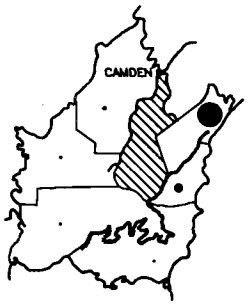
Yellow Thornbill
Acanthiza nana
Xmax = 1.90 birds/team hr
Na = 1357 Ns = 940



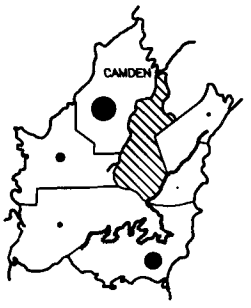
Striated Thornbill
Acanthiza lineata
Xmax = 3.6 birds/team hr
Na = 2272 Ns = 1692



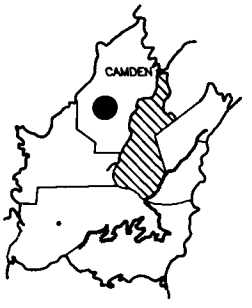
Red Wattlebird
Anthochaera carunculata
Xmax = 1.4 birds/team hr
Na = 1019 Ns = 773



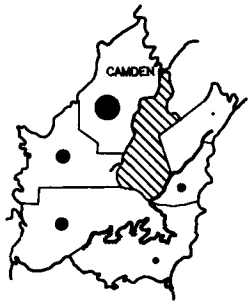
Little Wattlebird
Anthochaera chrysoptera
Xmax = 1.2 birds/team hr
Na = 344 Ns = 419



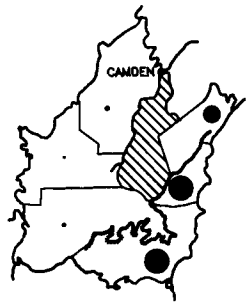
Noisy Friarbird
Philemon corniculatus
Xmax = 1.2 birds/team hr
Na = 454 Ns = 517



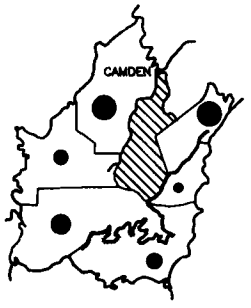
Bell Miner
Manorina melanophrys
Xmax = 4.6 birds/team hr
Na = 399 Ns = 374



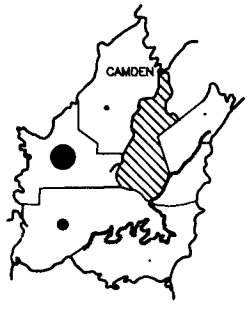
Noisy Miner
Manorina melanocephala
Xmax = 5.4 birds/team hr
Na = 1952 Ns = 2522



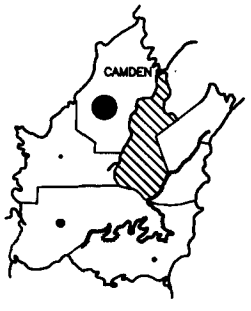
Lewin's Honeyeater
Meliphaga lewinii
Xmax = 2.3 birds/team hr
Na = 1878 Ns = 1534



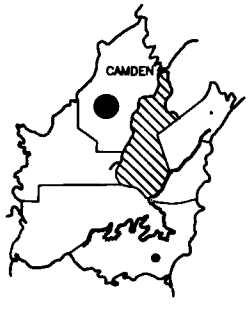
Yellow–faced Honeyeater
Lichenostomus chrysops
Xmax = 3.7 birds/team hr
Na = 4078 Ns = 2203



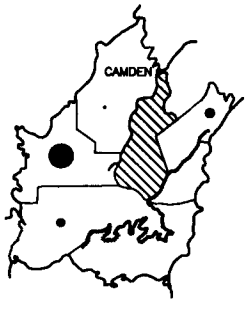
White–eared Honeyeater
Lichenostomus leucotis
Xmax = 1.4 birds/team hr
Na = 462 Ns = 437



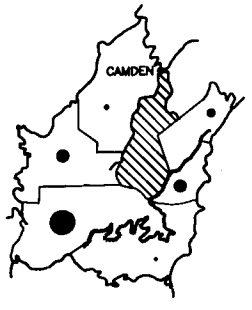
Yellow–tufted Honeyeater
Lichenostomus melanops
Xmax = 0.48 birds/team hr
Na = 122 Ns = 61



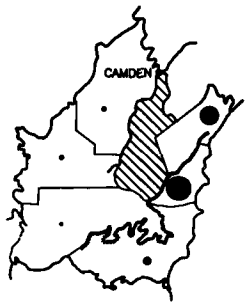
Fuscous Honeyeater
Lichenostomus fuscus
Xmax = 0.17 birds/team hr
Na = 40 Ns = 22



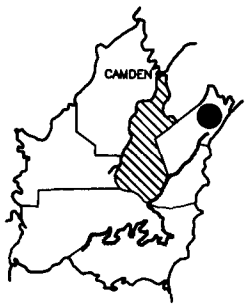
Brown–headed Honeyeater
Melithreptus brevirostris
Xmax = 0.40 birds/team hr
Na = 174 Ns = 96



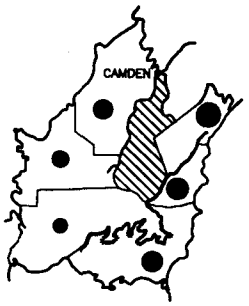
White–naped Honeyeater
Melithreptus lunatus
Xmax = 0.67 birds/team hr
Na = 546 Ns = 157



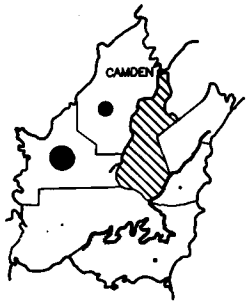
New Holland Honeyeater
Phylidonyris novaehollandiae
Xmax = 2.4 birds/team hr
Na = 1614 Ns = 971



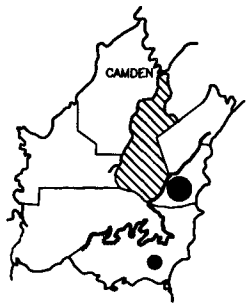
Tawny-crowned Honeyeater
Phylidonyris melanops
Xmax = 0.57 birds/team hr
Na = 154 Ns = 72



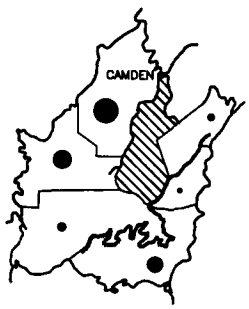
Eastern Spinebill
Acanthorhynchus tenuirostris
Xmax = 1.4 birds/team hr
Na = 1237 Ns = 1630



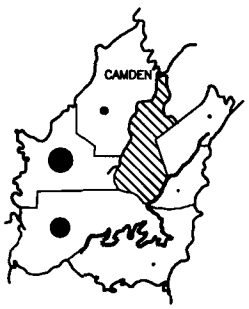
Scarlet Honeyeater
Myzomela sanguinolenta (SM)
Xmax = 0.22 birds/team hr
Na = 4 Ns = 118



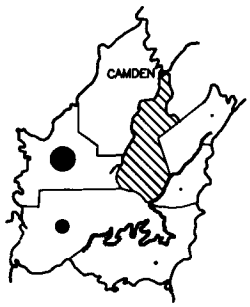
White-fronted Chat
Epthianura albifrons
Xmax = 0.14 birds/team hr
Na = 37 Ns = 89



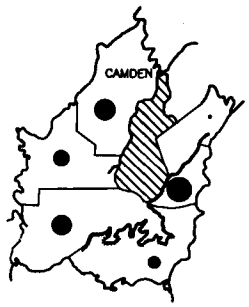
Jacky Winter
Microeca fascinans
Xmax = 0.28 birds/team hr
Na = 229 Ns = 105



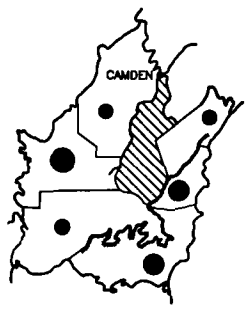
Scarlet Robin
Petroica multicolor
Xmax = 0.49 birds/team hr
Na = 347 Ns = 74



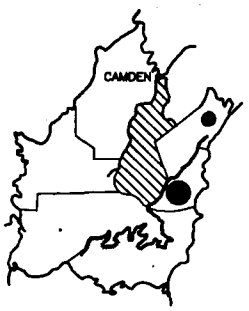
Flame Robin
Petroica phoenicea
Xmax = 0.10 birds/team hr
Na = 47 Ns = 25



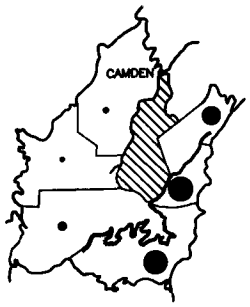
Rose Robin
Petroica rosea
Xmax = 0.05 birds/team hr
Na = 47 Ns = 23



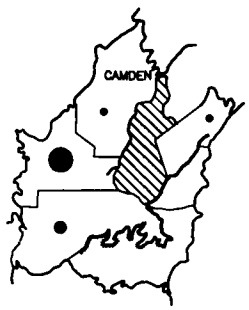
Eastern Yellow Robin
Eopsaltria australis
Xmax = 0.73 birds/team hr
Na = 645 Ns = 765



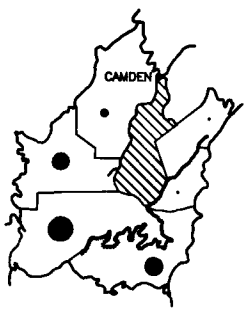
Logrunner
Orthonyx temminckii
Xmax = 0.14 birds/team hr
Na = 52 Ns = 58



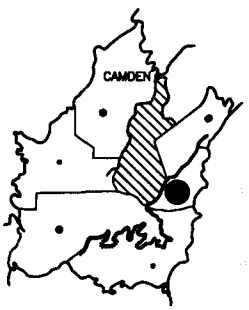
Eastern Whipbird
Psophodes olivaceus
Xmax = 1.4 birds/team hr
Na = 778 Ns = 1562



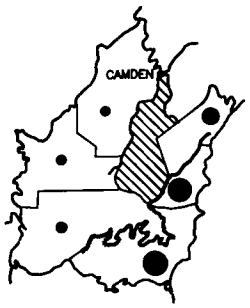
Spotted Quail-thrush
Cinclosoma punctatum
Xmax = 0.10 birds/team hr
Na = 40 Ns = 29



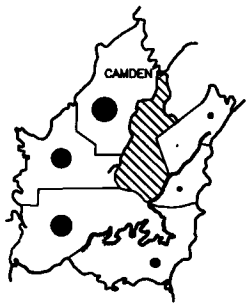
Varried Sittella
Daphoenositta chrysoptera
Xmax = 0.17 birds/team hr
Na = 151 Ns = 59



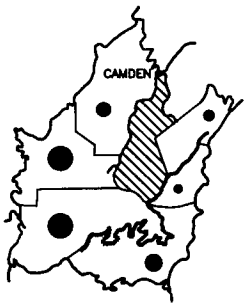
Crested Shrike-tit
Falcunculus frontatus
Xmax = 0.13 birds/team hr
Na = 68 Ns = 47



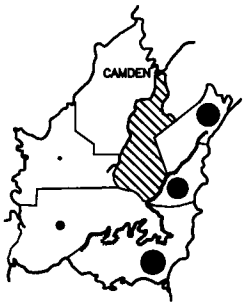
Golden Whistler
Pachycephala pectoralis
Xmax = 0.62 birds/team hr
Na = 487 Ns = 622



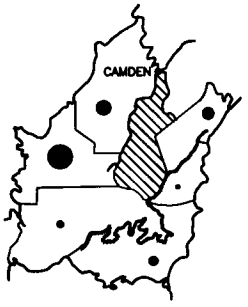
Rufous Whistler
Pachycephala rufiventris (SM)
Xmax = 1.5 birds/team hr
Na = 19 Ns = 1806



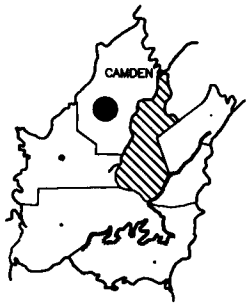
Grey Shrike–thrush
Colluricincla harmonica
Xmax = 1.2 birds/team hr
Na = 882 Ns = 1059



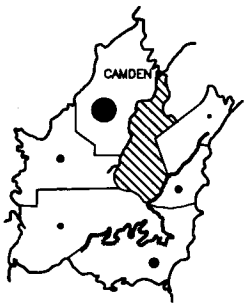
Black–faced Monarch
Monarcha melanopsis (SM)
Xmax = 0.28 birds/team hr
Na = 1 Ns = 447



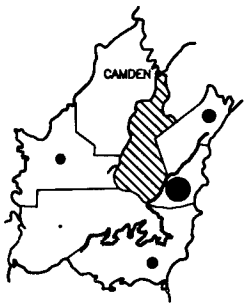
Leaden Flycatcher
Myiagra rubecula (SM)
Xmax = 0.10 birds/team hr
Na = 0 Ns = 107



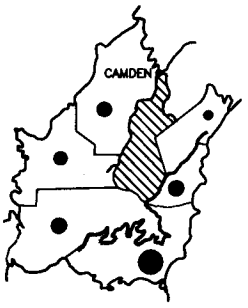
Restless Flycatcher
Myiagra inquieta
Xmax = 0.39 birds/team hr
Na = 41 Ns = 54



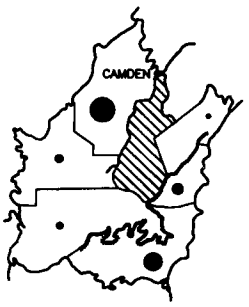
Magpie–lark
Grallina cyanoleuca
Xmax = 7.8 birds/team hr
Na = 3218 Ns = 2414



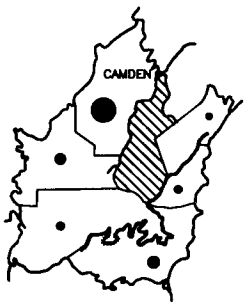
Rufous Fantail
Rhipidura rufifrons (SM)
Xmax = 0.05 birds/team hr
Na = 0 Ns = 59



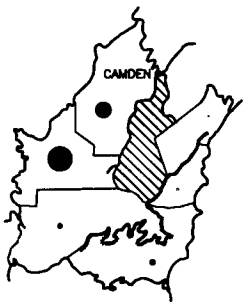
Grey Fantail
Rhipidura fuliginosa
Xmax = 2.3 birds/team hr
Na = 1374 Ns = 2429



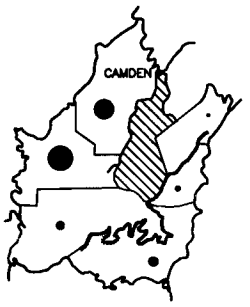
Willie Wagtail
Rhipidura leucophrys
Xmax = 2.4 birds/team hr
Na = 1194 Ns = 1400



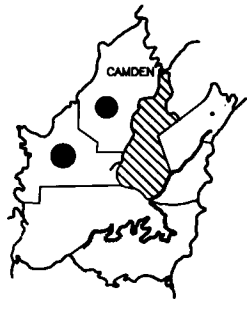
Black–faced Cuckoo–shrike
Coracina novaehollandiae
Xmax = 1.4 birds/team hr
Na = 349 Ns = 1107



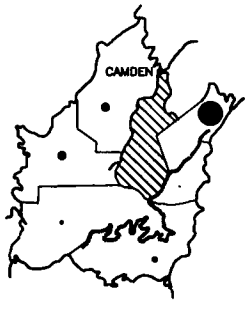
White–winged Triller
Lalage sueurii (SM)
Xmax = 0.15 birds/team hr
Na = 0 Ns = 107



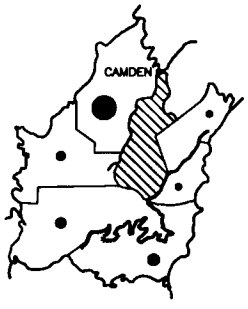
Olive–backed Oriole
Oriolus sagittatus
Xmax = 0.28 birds/team hr
Na = 45 Ns = 245



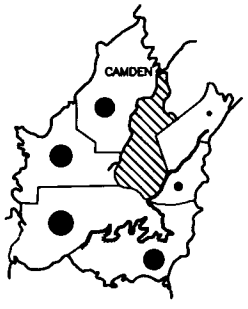
White–browed Woodswallow
Artamus superciliosus (SM)
Xmax = 0.75 birds/team hr
Na = 0 Ns = 425



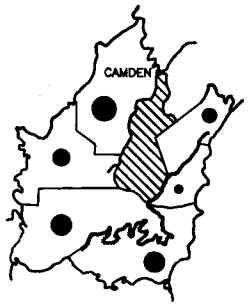
Dusky Woodswallow
Artamus cyanopterus
Xmax = 0.77 birds/team hr
Na = 166 Ns = 396



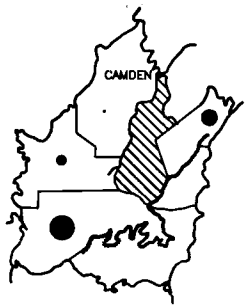
Grey Butcherbird
Cracticus torquatus
Xmax = 0.86 birds/team hr
Na = 434 Ns = 444



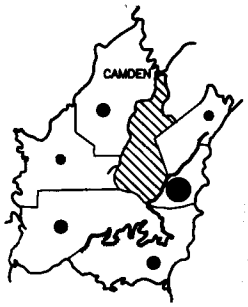
Australian Magpie
Gymnorhina tibicen
Xmax = 9.2 birds/team hr
Na = 8011 Ns = 6650



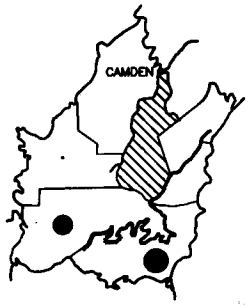
Pied Currawong
Strepera graculina
Xmax = 3.8 birds/team hr
Na = 4956 Ns = 1559



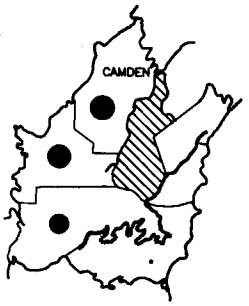
Grey Currawong
Strepera versicolor
Xmax = 0.14 birds/team hr
Na = 55 Ns = 60



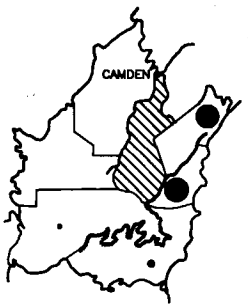
Australian Raven
Corvus coronoides
Xmax = 4.6 birds/team hr
Na = 3850 Ns = 2904



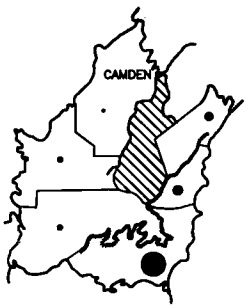
Little Raven
Corvus mellori
Xmax = 0.23 birds/team hr
Na = 21 Ns = 196



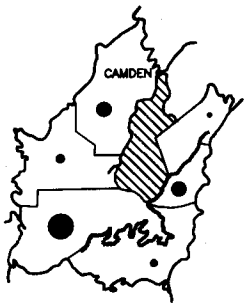
White–winged Chough
Corcorax melanorhamphos
Xmax = 0.64 birds/team hr
Na = 383 Ns = 204



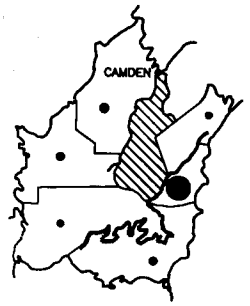
Green Catbird
Ailuroedus crassirostris
Xmax = 0.09 birds/team hr
Na = 33 Ns = 67



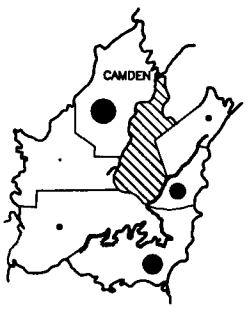
Satin Bowerbird
Ptilonorhynchus violaceus
Xmax = 1.9 birds/team hr
Na = 1062 Ns = 1038



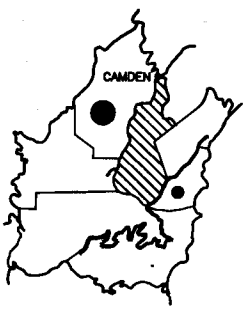
Skylark
Alauda arvensis
Xmax = 0.13 birds/team hr
Na = 30 Ns = 120



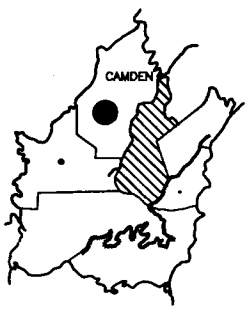
Richard's Pipit
Anthus novaeseelandiae
Xmax = 1.1 birds/team hr
Na = 542 Ns = 657



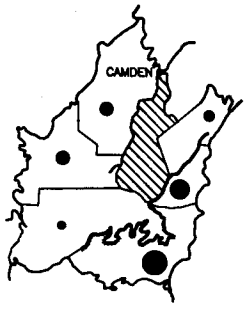
House Sparrow
Passer domesticus
Xmax = 10.5 birds/team hr
Na = 5214 Ns = 6499



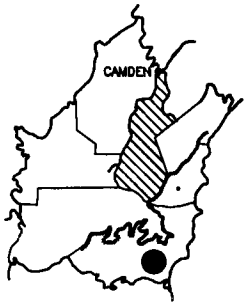
Zebra Finch
Taeniopygia guttata
Xmax = 0.15 birds/team hr
Na = 51 Ns = 15



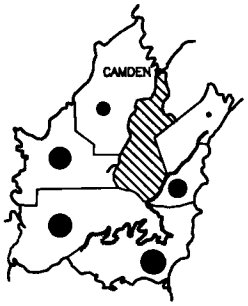
Double–barred Finch
Taeniopygia bichenovii
Xmax = 1.2 birds/team hr
Na = 238 Ns = 33



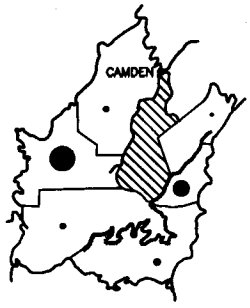
Red–browed Finch
Neochmia temporalis
Xmax = 4.4 birds/team hr
Na = 5050 Ns = 1973



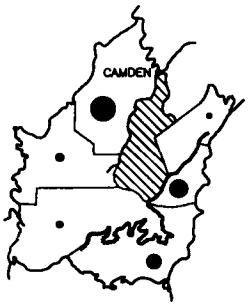
Chestnut–breasted Mannikin
Lonchura castaneothorax
Xmax = 0.16 birds/team hr
Na = 32 Ns = 77



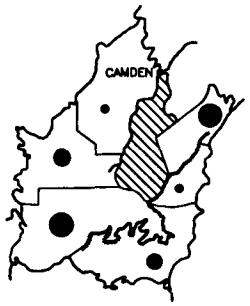
European Goldfinch
Carduelis carduelis
Xmax = 0.87 birds/team hr
Na = 826 Ns = 817



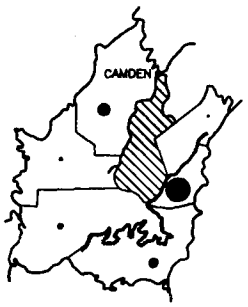
Mistletoebird
Dicaeum hirundinaceum
Xmax = 0.47 birds/team hr
Na = 197 Ns = 289



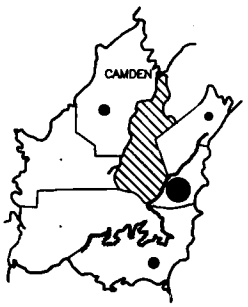
Welcome Swallow
Hirundo neoxena
Xmax = 9.2 birds/team hr
Na = 6282 Ns = 4748



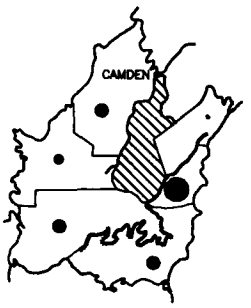
Tree Martin
Hirundo nigricans (SM)
Xmax = 0.73 birds/team hr
Na = 167 Ns = 1067



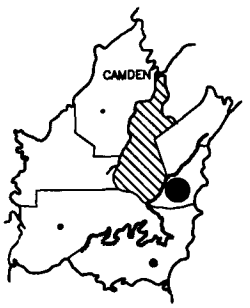
Fairy Martin
Hirundo ariel (SM)
Xmax = 1.6 birds/team hr
Na = 46 Ns = 1496



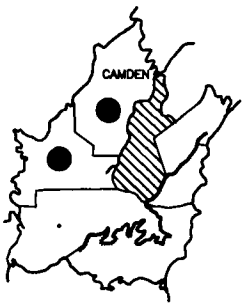
Red-whiskered Bulbul
Pycnonotus jocosus
Xmax = 2.0 birds/team hr
Na = 1159 Ns = 857



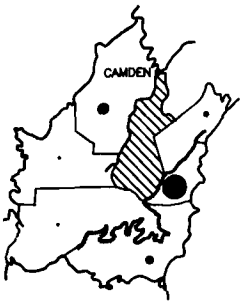
Clamorous Reed-Warbler
Acrocephalus stentoreus (SM)
Xmax = 0.41 birds/team hr
Na = 6 Ns = 539



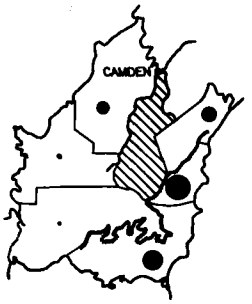
Little Grassbird
Megalurus gramineus
Xmax = 0.09 birds/team hr
Na = 22 Ns = 47



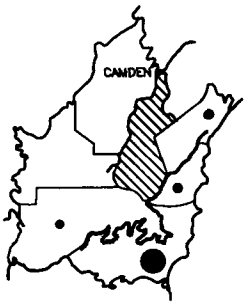
Rufous Songlark
Cincloramphus mathewsi (SM)
Xmax = 0.09 birds/team hr
Na = 0 Ns = 53



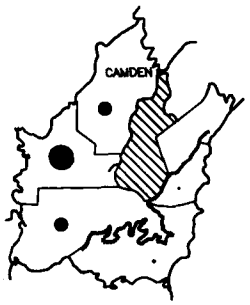
Golden-headed Cisticola
Cisticola exilis
Xmax = 1.1 birds/team hr
Na = 377 Ns = 562



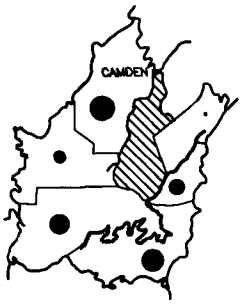
Silvereye
Zosterops lateralis
Xmax = 5.7 birds/team hr
Na = 4657 Ns = 3383



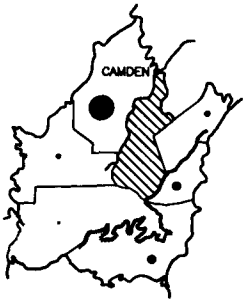
Bassian Thrush
Zoothera lunulata
Xmax = 0.07 birds/team hr
Na = 31 Ns = 47



Common Blackbird
Turdus merula
Xmax = 0.31 birds/team hr
Na = 46 Ns = 194



Common Starling
Sturnus vulgaris
Xmax = 32.8 birds/team hr
Na = 35383 Ns = 17650



Common Myna
Acridotheres tristis
Xmax = 12.6 birds/team hr
Na = 5020 Ns = 3755

APPENDIX 2

Results for 42 landbird species that were recorded with a total of less than 50 individuals during 10 bi-annual counts in the County of Camden from 1982 to 1991. The total number of species, and number of individuals of each species is shown for the six physiographic regions. I = introduced species, AE = aviary escapee.

Species	Region						
	1	2	3	4	5	6	Total
Australian Brush-turkey *Alectuta lathami* (AE)	0	0	0	0	1	0	1
Stubble Quail *Coturnix pectoralis*	0	5	2	5	0	0	12
Brown Quail *Coturnix ypsilophora*	0	5	0	2	9	0	16
Painted Button-quail *Turnix varia*	0	0	1	0	0	0	1
Emerald Dove *Chalcophaps indica*	0	0	0	1	10	0	11
Brush Bronzewing *Phaps elegans*	1	0	2	2	2	2	9
Peaceful Dove *Geopelia striata*	9	22	0	0	0	1	32
Bar-shouldered Dove *Geopelia humeralis*	0	0	0	1	0	0	1
Rose-crowned Fruit-Dove *Ptilinopus regina*	0	0	0	2	0	0	2
Glossy Black-Cockatoo *Calyptorhynchus lathami*	0	8	0	0	0	0	8
Long-billed Corella *Cacatua tenuirostris*	16	0	4	11	9	0	40
Major Mitchell's Cockatoo *Cacatua leadbeateri* (AE)	0	0	0	0	1	0	1
Cockatiel *Nymphicus hollandicus* (AE)	0	0	0	0	1	0	1
Scaly-breasted Lorikeet *Trichoglossus chlorolepidotus*	0	0	0	0	0	4	4
Australian Ringneck *Barnardius zonarius* (AE)	0	0	0	0	2	0	2
Swift Parrot *Lathamus discolor*	0	0	0	0	11	0	11
Ground Parrot *Pezoporus wallicus*	0	0	4	0	0	0	4
Channel-billed Cuckoo *Scythrops novaehollandiae*	13	9	1	12	7	1	43
Red-browed Treecreeper *Climacteris erythrops*	1	9	8	2	8	2	30
Brown Treecreeper *Climacteris picumnus*	0	3	4	0	0	0	7
Eastern Bristlebird *Dasyornis brachypterus*	0	0	29	0	0	0	29
Chestnut-rumped Heathwren *Hylacola pyrrhopygia*	0	9	1	5	0	17	32
Speckled Warbler *Chthonicola sagittata*	0	14	1	0	0	0	15
Southern Whiteface *Aphelocephala leucopsis*	0	2	0	0	0	0	2
White-plumed Honeyeater *Lichenostomus penicillatus*	6	12	2	4	22	0	46
Crescent Honeyeater *Phylidonyris pyrrhoptera*	0	0	9	2	0	0	11
White-cheeked Honeyeater *Phylidonyris nigra*	0	5	1	0	0	0	6
Red-capped Robin *Petroica goodenovii*	0	0	2	0	0	0	2
Hooded Robin *Melanodryas culcullata*	1	13	0	0	0	0	14
Satin Flycatcher *Myiagra cyanoleuca*	0	5	1	0	2	0	8
Spangled Drongo *Dicrurus bracteatus*	0	0	0	2	8	0	10
White-bellied Cuckoo-shrike *Coracina papuensis*	0	1	0	0	1	0	2
Cicadabird *Coracina tenuirostris*	0	12	10	6	5	3	36
Figbird *Sphecotheres viridis*	0	0	0	21	0	0	21
Masked Woodswallow *Artamus personatus*	2	3	0	0	0	2	7
Black-faced Woodswallow *Artamus cinereus*	0	0	0	0	0	1	1
Singing Bushlark *Mirafra javanica*	0	0	0	1	0	0	1
Diamond Firetail *Stagonopleura guttata*	6	27	0	0	1	1	35
Beautiful Firetail *Stagonopleura bella*	0	0	0	0	0	1	1
Nutmeg Mannikin *Lonchura punctulata* (I)	2	0	0	0	0	0	2
Tawny Grassbird *Megalurus timoriensis*	0	0	0	1	0	0	1
Brown Songlark *Cincloramphus cruralis*	0	0	1	0	2	0	3
Total number of species	10	18	18	17	18	11	42