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THE SUNBIRD

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RESULTS OF THE QOS GARDEN BIRD SURVEY, 1979-80, WITH PARTICULAR REFERENCE TO SOUTH-EAST QUEENSLAND

PETER F. WOODALL

ABSTRACT

A garden bird survey conducted by the QOS in 1979/80 produced records for 100 gardens with 20 of these having records for more than 50 weeks. A total of 257 species was recorded, with an average of 31 species per garden. It took 8 weeks for records to reach 50% of the annual number of species recorded. Native species were the most widely distributed over all gardens, but the House Sparrow was the most frequently recorded from gardens on a weekly basis and had the highest mean maximum numbers, followed by the Silvereye. House Sparrows were absent from many of these gardens in the western suburbs of Brisbane, possibly excluded by Noisy Miners. Significantly higher mean maximum numbers of birds were recorded from gardens in autumn-winter than in spring-summer, but there were no significant seasonal differences in the mean numbers of species. Some individual species showed clear seasonal differences. Environmental features of the gardens are presented. The number of species recorded from these Brisbane gardens was positively correlated with the size of garden but negatively correlated with the frequency of Noisy Miner records.

INTRODUCTION

As humans establish settlements and plant gardens around their residences, they modify the natural habitats and create new types of habitat. Some species of birds are either preadapted or can adapt to take advantage of the modified conditions. These will prosper in suburban or urban conditions while other species are unable to cope with the changes and will decline. Another topic of interest is the interaction between native species, with little previous exposure to human settlement, and introduced species, which often have a long history of co-existence with humans in Europe or Asia. In a country such as Australia, with a relatively short history of settlement, there is an excellent opportunity to investigate these changes to the avifauna, and several studies in different parts of the country have taken advantage of this situation (Jones 1981, 1983; Green

1984, 1986; Mason 1985; Catterall, Green & Jones 1989; Lenz 1990). Some of these studies have been relatively limited in terms of the number of sites surveyed or the time span of the investigation.

In 1979/80, members of the Queensland Ornithological Society conducted a survey of garden birds from sites located throughout the state, although concentrated in the south-east around Brisbane. This paper outlines the nature and extent of the survey and gives information on the bird species and seasonal and regional variation in their numbers and some environmental features of the gardens.

METHODS

Members of the Queensland Ornithological Society (QOS) were invited to undertake a survey of garden birds in 1979; and from May 1979, for just over a year, each monthly newsletter sent to all members also contained a recording form for the garden bird survey. The members were asked to keep records on a weekly basis and to record the maximum number for each species seen at any one time during the week. These records were further subdivided into species recorded in the garden (IN); those recorded in the next garden or on adjacent land (NG); and those seen flying over the garden (FO). These additional categories were used to avoid the possible tendency to inflate the garden records with species seen nearby. In this analysis only those species listed as being IN are considered but complete totals are given in Appendix I. Species names follow Blakers *et al.* (1984) and this reference should be consulted for scientific names, which have not been included in the interests of conserving space.

These data provide two types of information.

(i) Percentage Frequency - the number of times a species was recorded as a percentage of the total number of records (eg. if it was seen on every occasion the percentage frequency would be 100%). This provides a measure of how "common" the species is. Percentage frequency was calculated in two ways, (a) using each week.garden as the unit of observation (n = 2826), or, (b) combining all records for each garden, and using the garden as the unit of observation (n = 100).

(ii) Mean maximum numbers - a mean of the maximum numbers recorded for each species each week. This reflects the abundance of each species and can be considered a measure of maximum flock size but is not directly comparable with estimates of density.

At the end of the survey an additional form was distributed to all members requesting information on various environmental factors relating to the garden, such as size, age, numbers and types of large trees, domestic pets, bird feeders, etc.. These data were summarised and an attempt was made to relate species numbers to some relevant environmental variables.

RESULTS

The Survey

There was a very good response to this project with nearly 100 members contributing records (see Appendix I for details). As expected, the majority of records were from Brisbane suburbs, but there were also some valuable records provided from the Gold Coast, scattered coastal sites north to North Queensland, and some inland areas. One of these gardens, in Toowoomba, was surveyed for a further five years and its records have been analysed in detail (McKilligan & McKilligan 1987).

Dealing solely with records from in the gardens, there were 2 826 lists of species (gardens x weeks = all records), giving a total of 136 388 individuals of 257 species. This gives an exceptionally large and valuable database on garden birds and also provides a baseline for future studies on changes in the suburban avifauna.

Climate

Records from Brisbane have been used to investigate weather patterns during the time of the survey. In general, rainfall for Brisbane was below average, with 640 mm recorded between May 1979 and April 1980 compared with a long-term mean of 1152 mm. However, there was exceptionally high rainfall in May 1980 (Fig. 1) which would have brought the total to normal levels. Late spring and summer rainfall was at normal levels but May, August and September 1979 and March - April 1980 were much drier than normal (Fig. 1). Below average rainfall

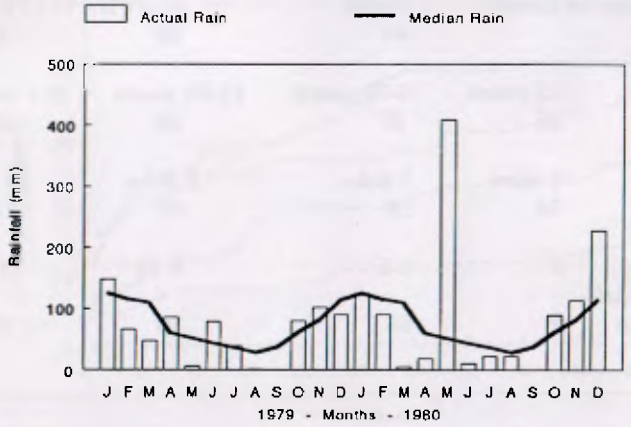

Fig. 1. Rainfall data over the study period.

was recorded in Brisbane for 1977 and 1978, as well as for 1979, but 1980 was near to normal. Apart from the north, other parts of Queensland also experienced below average rainfall over this period.

The Garden Environment

The questionnaire requesting information on the nature of the gardens produced 59 responses and the main results are summarised in Table 1. Most gardens provided water for birds and a quarter provided food for birds. The presence of cats and dogs was common at least "sometimes" in most gardens. Most gardens had less than 70% of the area as open space, and nearly half of the gardens had bushland on one or more sides. Potential nectar producing plants such as *Banksia, Grevillea* and *Callistemon* were present in nearly all the gardens. The age of the gardens ranged from less than 5 years old to more than 20 years old.

TABLE 1. A summary of some environmental variables relating to 59 Queensland gardens.

	Percentage Response		
	Never	Sometimes	Regularly
Provision of water	36	7	58
Provision of food for birds	56	19	25
Presence of cat(s) in garden	14	47	38
Presence of dog(s) in garden	19	47	34
Cage birds providing food	75	4	21

Open areas (lawn or grass)	0-40%	41-70%	71-100%
	44	39	18

Age of garden	<5 years	6-10 years	11-20 years	21+ years
	15	27	29	29

Bushland on...	0 sides	1 side	2 sides	3+ sides
	54	15	20	10

No. of *Banksia, Grevillea* or *Callistemon* spp. in garden	0	1-5	6-10	11+
	2	55	19	25

The size of the gardens varied from 250 to 14 164 m^2 with the median size being 835 m^2 (mean = 1 968 m^2). Gardens in the Brisbane suburbs were slightly

smaller, with a median size of 800 m^2. The mean number of large trees (> 3 m in height) in each garden was 22, with a range of 0 to 248.

Numbers of Species

Overall, an average of 31 species was recorded from each garden, with a mean total of 40 when species in the next garden or flying over were included (Appendix I).

The number of species recorded from a garden will depend upon both the characteristics of the habitat (to be considered later) and the period of observation. This is clearly shown when the cumulative total of species recorded is plotted against time. In Fig. 2, the cumulative species totals for four gardens with differing final numbers of species are shown. Two of the gardens (108 & 111) showed fairly marked increases between 15 and 25 weeks of observation, which may reflect the arrival of some summer migrants into the area.

To quantify this trend of increasing numbers of species, gardens with at least 50 weeks of records were identified (n = 20) and their cumulative species totals were analysed. On average it took 8.2 weeks (standard error = 0.94) to reach 50% of the annual total, and 29.1 (s.e. = 1.8) and 39.1 (s.e. = 2.0) weeks to reach 80% and 90%, respectively. There is no indication that a plateau had been reached in any of the four representative gardens (Fig. 2), and the species totals could be expected to continue to rise slowly.

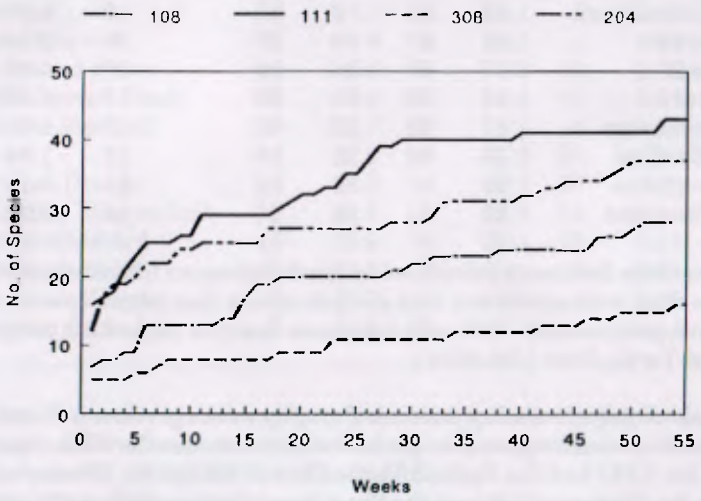

Fig. 2. Cumulative species totals for selected gardens.

The common garden species

The common garden species have been identified using two criteria: (a) those recorded most frequently (percentage frequency); and, (b) the most (numerically) abundant species. These differences are shown in Table 2.

TABLE 2. The "common" garden birds recorded during the survey.

Species	Percentage Frequency				Maximum abundance	
	By garden		By all records		By all records	
	Rank	%	Rank	%	Rank	Max
Willie Wagtail	1	85	4	46	19	0.77
Black-faced Cuckoo-shrike	2	84	3	48	7	1.29
Australian Magpie-lark	3	79	5	44	13	1.01
Laughing Kookaburra	4	77	11	33	22	0.71
Silvereye	5	76	2	51	2	3.82
Australian Magpie	6	74	7	41	6	1.31
Torresian Crow	7	71	8	37	11	1.07
House Sparrow	8	69	1	53	1	6.63
Spangled Drongo	9	66	17	23	31	0.43
Pale-headed Rosella	10	66	9	34	18	0.87
Pied Butcherbird	11	63	13	29	24	0.64
Figbird	12	61	15	27	4	1.48
Spotted Turtle-Dove	13	60	6	42	9	1.18
Noisy Friarbird	14	57	14	27	21	0.74
Grey Fantail	15	57	26	16	39	0.27
Noisy Miner	16	56	10	33	3	1.93
Brown Honeyeater	17	52	12	30	17	0.91
Welcome Swallow	18	52	21	18	12	1.04
Sacred Kingfisher	19	51	30	12	51	0.16
Striated Pardalote	20	51	25	17	43	0.26

Using percentage frequency calculated by garden gives an indication of which species are most widespread and this analysis shows that native species filled the top seven positions (85 - 71%) with the House Sparrow ranked 8th (69%) and the Spotted Turtle-Dove 13th (60%).

However, percentage frequency data calculated by weeks.gardens indicate how regularly each species frequents the gardens, and in this case the House Sparrow is ranked 1st (53%) and the Spotted Turtle-Dove is 6th (42%). The top native species are the Silvereye (51%) and the Black-faced Cuckoo-shrike (48%), which are also widespread. In spite of these differences, the two percentage frequency calculations produce similar lists of the top 20 species (Table 2).

TABLE 3. Seasonal variation in the species of garden birds recorded during the survey.

Species	Percentage freq. by week				Mean Max. No.			
	Spring-Summer		Autumn-Winter		Spring-Summer		Autumn-Winter	
	Rank	%	Rank	%	Rank	No.	Rank	No.
Spotted Turtle-Dove	4	42.9	7	41.3	9	1.08	8	1.26
Crested Pigeon	19	22.7	19	22.9	18	0.88	13	0.98
Galah	44	5.5	52	4.9	13	0.99	25	0.59
Rainbow Lorikeet	22	16.9	23	19.0	7	1.18	7	1.27
Scaly-breasted Lorikeet	21	17.9	26	16.2	8	1.11	11	1.16
Pale-headed Rosella	9	33.9	10	33.6	19	0.84	16	0.88
Laughing Kookaburra	11	31.3	9	33.9	23	0.65	20	0.75
Welcome Swallow	20	20.7	25	16.6	6	1.18	14	0.93
Black-faced Cuckoo-shrike	3	45.1	2	49.6	12	0.99	5	1.53
Rufous Whistler	29	10.7	20	22.3	51	0.15	40	0.35
Grey Fantail	43	5.5	17	25.1	72	0.09	32	0.42
Willie Wagtail	8	36.2	1	54.5	24	0.65	17	0.87
Noisy Friarbird	12	30.9	18	24.1	21	0.73	21	0.75
Little Friarbird	18	22.9	22	20.9	26	0.59	24	0.59
Noisy Miner	10	33.6	11	33.1	3	1.87	4	1.99
Brown Honeyeater	13	29.6	13	31.1	14	0.97	18	0.86
White-cheeked H'eater[1]	66	3.3	83	2.2	11	0.99	43	0.28
Silvereye	2	53.8	4	48.4	2	2.97	2	5.52
House Sparrow	1	57.9	3	48.5	1	6.74	1	6.54
Red-browed Finch	39	6.8	39	8.2	10	1.02	19	0.84
Double-barred Finch	35	9.0	38	8.8	17	0.91	15	0.93
Common Starling	15	25.7	27	14.2	4	1.64	9	1.18
Figbird	14	27.0	15	27.2	20	0.82	3	2.01
Spangled Drongo	23	16.5	14	28.8	37	0.31	29	0.52
Australian Magpie-lark	5	42.8	5	44.9	16	0.94	12	1.07
Grey Butcherbird	16	23.9	16	27.1	25	0.64	23	0.70
Pied Butcherbird	17	23.8	12	32.4	27	0.54	22	0.73
Australian Magpie	6	38.7	6	43.3	5	1.25	6	1.36
Torresian Crow	7	36.7	8	37.2	15	0.94	10	1.17

The top 20 species in each category have been included in the Table and since there are differences in ranking between some categories, data for some lower ranked species are also included in each column.

[1] White-cheeked Honeyeater.

The figures for maximum abundance (mean maximum numbers) are similar to those for percentage frequency by weeks, with the House Sparrow clearly first and the Silvereye second. Species which tend to flock are ranked high in this category, and the Noisy Miner, Figbird and Common Starling fill the next three positions. The next introduced species is the Spotted Turtle-dove at 9th. This indicates that the introduced species may not be as widely distributed as some of the native species, but where they are found, they occur regularly and in high numbers.

Seasonal Variation

To investigate seasonal variation in the avifauna of the gardens, the data were divided into two groups: those from spring-summer (September 1979 to February 1980); and those from autumn-winter (May to August 1979, March to August 1980).

The results for individual species (Table 3) show that the main difference in percentage frequency was a marked increase in records for the Willie Wagtail in autumn-winter (34 to 54%) and a smaller reduction in records for the Noisy Friarbird (30.9 to 24.1%). For most other species there were relatively minor changes in the ranking and percentages. Additional species in the top 20 for autumn-winter were the Spangled Drongo, Grey Fantail and Rufous Whistler, replacing the Welcome Swallow, Little Friarbird and Common Starling. In terms of the mean maximum numbers (maximum flock size), there was a marked increase in autumn-winter for the Figbird, with smaller increases for Black-faced Cuckoo-shrike and Crested Pigeon and decreases for the Welcome Swallow and Common Starling.

Combining all species, and only including gardens which had a minimum of eight weeks of records for both spring-summer and autumn-winter ($n = 48$), there were no significant differences in the numbers of species between the seasons but a highly significant increase in the mean maximum number of individuals in autumn-winter (Table 4).

TABLE 4. Seasonal variation in the mean number of species and the mean abundance of birds in 48 gardens in Queensland.

	Spring-Summer	Autumn-Winter	Significance*
Mean no. of Species	29.9	30.7	$p>0.05$
Mean Max. Nos. (all species per week)	44.7	54.9	$p<0.001$
Sample Size (mean no. weeks)	22.0	22.5	

*Significance tested with paired t-test.

Regional Variation

Most surveyed gardens in Brisbane and the Gold Coast had a similar representation of common garden birds (Table 5a) and there were only minor differences between the means of regions 2, 3 and 4 (north, south and east, respectively). However, gardens in the western suburbs had much higher frequencies of Noisy Miners than elsewhere and small birds both native (Silvereye, Willie Wagtail) and introduced (House Sparrow) were not common. This was the only region in which the House Sparrow was not in the top 10 ranking of percentage frequency by weeks.gardens. The Gold Coast gardens (region 5) also showed some differences with the Brown Honeyeater and Noisy Friarbird being reported more frequently from there than elsewhere.

TABLE 5a. Regional variation in garden birds recorded during the survey. Brisbane and Gold Coast.

Species	Rank/Percentage Frequency by week Area*					
	1	2	3	4	5	Total 1-9
Spotted Turtle-Dove		2/62	2/54	4/60	6/51	6/42
Crested Pigeon	9/47					
Pale-headed Rosella	4/60	7/41	10/33			9/34
Laughing Kookaburra	6/53		7/37	10/33		
Black-faced Cuckoo-shrike	2/67	4/45	4/44	5/58	7/49	3/48
Willie Wagtail		5/45	5/41	3/71		4/46
Noisy Friarbird					4/53	
Little Friarbird	5/53					
Noisy Miner	1/75					10/33
Brown Honeyeater		10/34		9/41	2/60	
Silvereye		3/62	1/56	1/80	3/55	2/51
House Sparrow		1/65	3/47	2/72	1/75	1/53
Common Starling				8/42		
Figbird	10/45				8/49	
Spangled Drongo					9/47	
Australian Magpie-lark	8/48	8/36	6/40	6/56		5/44
Grey Butcherbird	7/48		9/33		10/46	
Australian Magpie	3/61	9/36			5/51	7/41
Torresian Crow		6/42	8/34	7/43		8/37

*The areas, 1-5, refer to regional groups of gardens as given in Appendix 1. For each area, data for only the top 10 species are given.

Moving further afield from Brisbane, there were obvious changes in the assemblages of garden birds (Table 5b): the North Coast (region 6) had high frequencies of the Brown Honeyeater, Spangled Drongo, Mistletoebird, Varied Triller and Yellow-bellied Sunbird; the West (region 7) had characteristic species such as White-plumed Honeyeaters, Spotted Bowerbirds and Galahs coming to the gardens; Ipswich and the Darling Downs were similar to Brisbane,

TABLE 5b. Regional variation in garden birds of Queensland. North, west and southern Queensland.

Species	Rank/Percentage Frequency Area*				
	6	7	8	9	Total 1-9
Spotted Turtle-Dove					6/42
Crested Pigeon		10/45		10/63	
Galah		6/50			
Black-faced Cuckoo-shrike			5/56		3/48
Varied Triller	6/36				
Jacky Winter				9/68	
Willie Wagtail	9/34	2/66	3/59	1/99	4/46
Superb Fairy-wren				3/95	
Yellow-rumped Thornbill				2/97	
Noisy Friarbird	8/34				
Yellow-throated Miner		9/47			
White-plumed Honeyeater		1/76		8/68	
Brown Honeyeater	1/56				
Yellow-bellied Sunbird	7/36				
Mistletoebird	3/47				
Silvereye	5/41		6/54		2/51
House Sparrow	4/41	5/57	1/77	7/69	1/53
Double-barred Finch				4/94	
Red-browed Finch				6/77	
Common Starling			10/43		
Common Myna			7/52		
Spangled Drongo	2/52				
Spotted Bowerbird		3/64			
Australian Magpie-lark		4/59	2/66		5/44
Pied Butcherbird		7/50	9/51		
Australian Magpie		8/47	4/56	5/88	7/41
Torresian Crow			8/52		8/37

*The areas, 6-9, refer to regional groups of gardens as given in Appendix 1. For each area, data for only the top 10 species are given.

but with higher frequencies of Common Mynahs and Pied Butcherbirds; and the Southern Border (region 9) had higher frequencies of Yellow-rumped Thornbills, Superb Fairy-wrens, Double-barred Finches and Red-browed Finches. It must be recognised that the sample size for some regions is small and the gardens surveyed may not be fully representative of the region.

Environmental Factors

I attempted to use some of these environmental factors to "explain" the number of species recorded from gardens. The analysis was restricted to gardens that had more than 30 weeks of records ($n = 38$) so that there would be no bias due to under-reporting. The age of the garden and the density of large trees showed no significant correlations with species totals from the gardens. However, the size of the garden was significantly correlated with the number of species recorded from Brisbane gardens ($r = 0.44$, $P < 0.05$, $n = 22$), but not with gardens overall ($r = 0.16$, $P > 0.1$, $n = 38$). The percentage frequency of Noisy Miner records showed no significant correlation with the species totals overall, but for Brisbane gardens these variables were negatively correlated (approaching the 5% significance level, $r = -0.36$, $0.05<P<0.1$).

DISCUSSION

Some differences in methods mean that the results obtained from this survey are not directly comparable with other studies conducted in Australia and elsewhere. Examples of these differences are that these surveys were largely conducted by observers living on the site, and the use of a week as the sampling period means that the observations were far more extensive than they were in other surveys where observers visit a site for a few hours at a time. In addition, for many gardens, the long, continuous period of observation meant that the mean number of species per garden and the overall number of species recorded were much higher than in other studies. Fig. 2 shows how the number of species recorded increased with time and, for 20 gardens, an average of 8 weeks of observations was required to reach only 50% of the annual total of species.

In cities surveyed in New South Wales and North Queensland respectively, a total of 27 species from 9 sites (Wagga Wagga: Jones 1981) and 48 species from 13 sites (Townsville: Jones 1983) were recorded. This compares with a mean of 31 species from each site in this survey but it is difficult to know how much this reflects differences in location and habitat rather than differences in survey method.

Since most observers in this survey had no previous experience with the theory or practice of censusing techniques, it was considered that the best and simplest method of obtaining an indication of the numerical abundance of each species

was to ask them to record the maximum numbers of each species seen at any one time over the week. This cannot lead to an estimate of the density of the species, as other more sophisticated censusing methods allow, but it does provide an index of the abundance of each species. It shows that the House Sparrow had the highest mean maximum of numbers, followed by the Silvereye and then by the Noisy Miner, Figbird and Common Starling. The latter three species are all commonly found in flocks and this technique will be biased towards flocking species. After these top five species, there is a large number of species, all with relatively similar mean maximum numbers (Table 2).

Many previous surveys in Australia have found that introduced species dominate the suburban avifauna, and this is partially supported by the present study which showed that the House Sparrow was ranked first in terms of both percentage frequency by week.garden and mean maximum numbers. The five other introduced species reported in this survey were all of much less significance in the avifauna as defined by their ranking in both percentage frequency by all records and mean maximum numbers respectively: Spotted Turtle-Dove (6th, 9th); Common Starling (20th, 5th); Common Myna (49th, 33rd); Feral Pigeon (53rd, 40th); Nutmeg Mannikin (59th, 32nd).

In terms of percentage frequency by garden, reflecting the breadth of distribution (Table 2), the introduced species were poorly represented, with the House Sparrow 8th, the Spotted Turtle-Dove 13th, and the Common Starling 27th. These results are similar to those for Queensland reported by Catterall *et al.* (1989) and Jones (1983), with two or three introduced species in the top ten. But they contrast with results from Melbourne (Green 1984) where there were five introduced species in the top seven by relative frequency.

An interesting aspect revealed by the regional analysis was the fact that the House Sparrow was not the dominant species in the western suburbs of Brisbane nor in a number of other gardens, and it seemed likely that the high numbers and frequency of the Noisy Miner (Dow 1977, Low 1994) and possibly other large aggressive native species may have excluded it. This aspect will be considered more fully in a future paper.

Huhtala & Jarvinen (1977) defined a dominant species as one which made up more than 5% of the total population and this criterion has been used in several subsequent studies of garden birds. In the present study, only the House Sparrow (13.7%) and Silvereye (7.9%) could be termed dominant in these terms, followed by the Noisy Miner (4.0%), and Figbird (3.1%). These results are not strictly comparable with others, however, for they are based on mean maximum numbers rather than mean estimates of density. As such, they will tend to favour flocking species.

Lenz (1990) indicated the need for surveys to consider seasonal changes in garden bird populations. The present survey found that, overall, there was no significant seasonal difference in the number of species frequenting gardens but there was a significant increase in the mean maximum numbers in autumn-winter. McKilligan & McKilligan (1987) found an increase in both the number of species and the mean maximum numbers of birds in their Toowoomba garden in winter. The data presented by Jones (1983) for Townsville gardens showed no significant differences in either the number of species or the number of individuals between the wet and dry seasons.

Some of these seasonal differences in garden avifaunas are linked with the formation of winter flocks (Figbird) and the arrival of some winter migrants in the gardens (Willie Wagtail, Grey Fantail, Rufous Whistler), while some summer species departed (Welcome Swallow and, surprisingly, Common Starling). However, overall there did not seem to be very marked seasonal changes in the species composition of garden avifaunas.

The lack of significant correlations between species totals and various environmental variables is not unexpected. This was an essentially heterogeneous data set and it is likely that a wide range of variables determined the number of species recorded in a garden. Restricting the data to Brisbane gardens reduced the heterogeneity somewhat, and here there was a significant correlation with the size of the garden, which is to be expected. The negative correlation of species totals with the frequency of Noisy Miners supports the suggestion that this species may exclude others from its territory, even in a suburban setting.

This garden bird survey was the first survey of its type organised by the QOS. It was very well supported and produced a large quantity of useful information. The main limitation on its use to date has been the time and resources required to analyse the quantity of information generated. It is hoped that these results can be used as a baseline to monitor future changes in the garden birds of Queensland but it must be realised that they reflect the gardens of those who participated in the survey and they may not be a typical sample of all Queensland gardens. To achieve a random sample of Queensland (or Brisbane) gardens would require a much more elaborate sampling design. However, future surveys conducted by the QOSI are likely to use a similar group of observers (with similar gardens) and thus be comparable with this one.

ACKNOWLEDGEMENTS

I am grateful to the many members of the QOS who watched, counted and recorded the birds coming to their gardens and thus made the most significant contribution to this project. In particular, I must thank Bill and Helen Horton who assisted with the inclusion of the survey forms with the QOS newsletter in

spite of the additional problems it must have caused; and Leith Woodall for her help with the often tedious analysis. The Editor and two anonymous referees provided valuable comments on the MS.

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Moving further afield from Brisbane, there were obvious changes in the assemblages of garden birds (Table 5b): the North Coast (region 6) had high frequencies of the Brown Honeyeater, Spangled Drongo, Mistletoebird, Varied Triller and Yellow-bellied Sunbird; the West (region 7) had characteristic species such as White-plumed Honeyeaters, Spotted Bowerbirds and Galahs coming to the gardens; Ipswich and the Darling Downs were similar to Brisbane,

TABLE 5b. Regional variation in garden birds of Queensland. North, west and southern Queensland.

Species	Rank/Percentage Frequency Area*				
	6	7	8	9	Total 1-9
Spotted Turtle-Dove					6/42
Crested Pigeon		10/45		10/63	
Galah		6/50			
Black-faced Cuckoo-shrike			5/56		3/48
Varied Triller	6/36				
Jacky Winter				9/68	
Willie Wagtail	9/34	2/66	3/59	1/99	4/46
Superb Fairy-wren				3/95	
Yellow-rumped Thornbill				2/97	
Noisy Friarbird	8/34				
Yellow-throated Miner		9/47			
White-plumed Honeyeater		1/76		8/68	
Brown Honeyeater	1/56				
Yellow-bellied Sunbird	7/36				
Mistletoebird	3/47				
Silvereye	5/41		6/54		2/51
House Sparrow	4/41	5/57	1/77	7/69	1/53
Double-barred Finch				4/94	
Red-browed Finch				6/77	
Common Starling			10/43		
Common Myna			7/52		
Spangled Drongo	2/52				
Spotted Bowerbird		3/64			
Australian Magpie-lark		4/59	2/66		5/44
Pied Butcherbird		7/50	9/51		
Australian Magpie		8/47	4/56	5/88	7/41
Torresian Crow			8/52		8/37

*The areas, 6-9, refer to regional groups of gardens as given in Appendix 1. For each area, data for only the top 10 species are given.

APPENDIX 1 cont.

207	Wavell Heights	Hopkins, N.	47	21	32
208	Boondall	Silver, L. & K.	65	34	49
209	New Farm	Edwards, R. & J.	5	11	15
210	New Farm	Madden-Holmes, J.	24	21	28
211	New Market	Veacock, J.	18	27	39
212	Red Hill	Bischoff, T.	10	4	20
213	Banyo	Logan, K.	9	11	18
214	Windsor	Madden-Holmes, J.	20	29	32
215	Stafford Heights	Porter, A.	18	24	34
216	Bribie Island	Belson, R.D.	5	19	19
217	Deception Bay	Blaber, T.	5	26	26
218	Deception Bay	Jahnke, B.R. & M.J.	1	6	15
219	Scarborough	Higgs, M.	53	32	52
3	**Brisbane - South**				
301	Annerley	Tanner, D. & N.	25	23	34
302	Corinda	Niland, D. & M.	24	23	44
303	Corinda	Walters, I.	42	21	33
304	Holland Park	Lillingstone, T. & J.	44	19	22
315	Holland Park	Barling, M.	9	12	19
305	Mt Gravatt	Harvey, B.J.	4	14	15
316	Mt Gravatt	Dickenson, C.W.	1	11	11
306	Moorooka	Tanner, D. & N.	29	10	15
307	Sherwood	Thomson, R. & R.	53	32	46
308	Tarragindi	Woodall, P. & L.	57	16	28
309	Yerongpilly	Bourne, J.	60	30	41
310	Daisy Hill	Barry, D.H.	51	47	57
311	Doolandella	Griffiths, P.	5	12	28
312	Logan Reserve	Dawson, P. & D.	55	75	98
313	Logan Reserve	Reynolds, I.	11	60	72
314	Tanah Merah	Bond, C.	5	41	52
317	Rochedale	Thompson, J. & P.	6	34	40
4	**Brisbane - East**				
405	Carina	Wheeler, J.	40	33	44
406	Chandler	Morgan, J.	24	87	94
407	Coorparoo	Veerman, P.	5	17	21
408	Coorparoo	Webb, A.F.	30	47	55
409	Manly	Watson, P.	14	32	33
410	Meeandah	Liddy, J.	53	31	31
411	Morningside	Ryan, B.J.	34	19	31
412	Wynnum	Ryan, B.J.	40	22	36
413	Seven Hills	Felgenhauer, J.	5	18	20
414	Capalaba	Forster, I.	5	28	32

APPENDIX 1 cont.

5	**Gold Coast**				
501	Southport	Acton, D.	37	40	89
502	Southport	Lander, P.	10	12	20
503	Southport	Robertson, B.	47	38	59
504	Southport	Robinson, T.A.	49	29	48
505	Surfers' Paradise	Moore, M.	53	43	57
506	Palm Beach	Walton, A.	48	57	63
507	Tweed Heads	Johnson, M.	26	48	62
508	Numinbah	Flenady, W. & I.	5	12	17
6	**Qld - North Coast**				
601	Cairns	Cowan, I.	15	24	30
613	Cairns - Smithfield	Morris, F.T.	55	65	95
602	Townsville	Headlam, T.	30	45	55
603	Mackay	Gregory, P.A.	5	25	26
604	Gladstone	McLean, H.	41	31	44
605	Maryborough	Peddie, H.H.	5	27	28
606	Maryborough	Sutton, P.H.	45	55	74
607	Gympie	Darbishire, L.	43	66	72
608	Gympie	Parr, G.	10	13	19
609	Nambour	Nunn, K.	5	18	19
610	Eumundi	Lake, R.L. & J.E.	20	24	35
611	Bundaberg	Hill,	5	22	43
612	Nanango	Templeton, M.T.	2	31	44
7	**Qld. - West**				
701	Mt Isa	Glass, G.J.	31	34	40
702	Barcaldine	Chandler, J.	30	33	47
703	Charleville	McConnel, J.	10	18	30
704	Longreach	Templeton, M.T.	5	12	18
706	Julia Creek	Bell, J.	1	21	29
8	**Ipswich - Darling Downs**				
801	Pittsworth	Walter, J. & R.	56	53	74
802	Toowoomba	McKilligen, H.	59	35	35
803	Toowoomba	Temple-Watts, B.	45	37	46
804	Ipswich	Williams, K.A.W.	36	51	58
805	Riverview	Hadley, R.J.	55	34	39
9	**Qld - S. Border**				
901	Stanthorpe	Aiken, C.S.	55	83	83
902	Stanthorpe	Finlay, E.M.	35	48	48
903	Inverell	Baldwin, M.	49	62	63

THE DIET AND BEHAVIOUR OF THE BLACK-BREASTED BUTTON-QUAIL *TURNIX MELANOGASTER*

P.McCONNELL and R.HOBSON

ABSTRACT

Information is presented on the ecology of the Black-breasted Button-quail *Turnix melanogaster* in southeast Queensland. Observations date from 1977 to 1993. The paper provides a detailed description of the diet, data on foraging behaviour, what we believe to be the first description of roosting behaviour, and a method of distinguishing the presence of Black-breasted Button-quail and Painted Button-quail *T. varia* in the field by the shape of their faecal pellets. This last piece of information has significant implications for future work on the population distribution of the Black-breasted Button-quail.

INTRODUCTION

The distribution of the Black-breasted Button-quail *Turnix melanogaster* extends from Rockhampton in Queensland to the Northern Rivers and Tablelands of New South Wales (Marchant & Higgins 1993). Their preferred habitat is dry rainforest and possibly brigalow, and there has been some adaptation to Hoop Pine *Araucaria cunninghamii* plantations and exotic Lantana *Lantana camara* (Olsen, Crome & Olsen 1993). Very little information has been obtained on breeding and most data on social behaviour are derived from captive birds. The foraging behaviour described by Hughes & Hughes (1991) includes the strategies of scratching the leaf litter from under the body while turning around and pecking at the litter while walking. The first strategy produces "soup-plate" depressions called platelets. Specific information on the diet of the Black-breasted Button-quail is scant. Marchant & Higgins (1993) reported a diet of seeds and insects whereas Barker & Vestjens (1989) stated that the diet was unknown.

Much information is still to be obtained on the ecology of the Black-breasted Button-quail. It is hoped that this paper will fill in some of the gaps in that knowledge. In particular, it is hoped that it will encourage more work on faecal pellet shape as a quick method of determining the presence of Black-breasted Button-quail and therefore aid in population distribution studies of this vulnerable species.

STUDY SITES AND METHODS

Three study sites in southeast Queensland were visited. These were Jimna State Forest (26°39'S, 152°27'E), Redwood Park (Toowoomba) (27°35'S, 151°59'E) and Ravensbourne National Park (27°22'S, 152°11'E). The vegetation at the first

site is Lantana thicket beneath planted Hoop Pines. The other sites, where the majority of the work was done, are areas of raingreen, mixed vine forest merging into open forest with patches of Lantana. Sporadic observations date from 30 December 1977 to March 1991. More detailed observation continued until 26 June 1993 and included field work on foraging behaviour, diet and faecal pellet shape.

Foraging behaviour in Black-breasted Button-quail was observed on nine occasions. The birds were watched at close quarters with binoculars until such time as they moved into dense cover and were lost from sight. Observations sometimes continued for up to 15 minutes, but most lasted for less than 5 minutes. At Ravensbourne National Park, several areas of the forest floor showed extensive platelet formation on 14 April 1993. A 5m^2 section showing the heaviest activity was counted for freshly completed platelets.

Over 300 fresh Painted Button-quail *T. varia* faecal pellets and 50 fresh Black-breasted Button-quail faecal pellets were collected from platelets. All were collected soon after the birds moved to another foraging location. This was done between September 1992 and May 1993 at the Helidon Livestock Dip (27°32'S, 152°06'E), Ravensbourne National Park and Redwood Park. Twelve fresh faecal pellets of Black-breasted Button-quail were collected for dietary analysis during the period 16 May to 19 May 1993 at Redwood Park. These were transferred to solution, sieved and examined microscopically. The remains were compared with leaf litter invertebrates collected from the same area on 20 May 1993.

RESULTS AND DISCUSSION

ANALYSIS OF DIET

Prey items found in fresh faecal pellets included spiders, ants, centipedes, millipedes, beetles (including weevils) and the land snail *Nitor pudibundus*. Hard parts of beetles and ants were dominant in the samples. The hard parts of spiders were also common, while those of centipedes, millipedes and snails were scarce. It is unlikely that soft bodied invertebrate prey would be detected by this method due to their breakdown in the gizzard and by digestion. The hard parts of spiders recovered included one head with chelicera attached. These remains resembled those of a jumping spider (Salticidae). Another fragment appeared to be from the Brown Trapdoor *Arbanitis variabilis*, and comparison with specimens in the University of Southern Queensland collection indicated that it was probably a 1.5-2.0 cm individual which was presumably too large for the bird to swallow whole.

FAECAL PELLET SHAPE

The faecal pellets of the Black-breasted Button-quail, although variable in form,

were always strongly hooked. They included a globular section topped with uric acid. However, those of the Painted Button-quail were usually cylindrical, linear and truncated at both ends with the uric acid content capping one end (Fig.1). The somewhat hooked pellet of the Painted Button-quail has undergone some physical damage and must be considered atypical. The consistency of fresh faecal pellets of Painted Button-quail was usually firmer than those of Black-breasted Button-quail, and pellet shape is significantly different. We propose that the shape of the faecal pellets found in the platelets is a diagnostic character that can be used to determine the presence of these species in the field.

FORAGING BEHAVIOUR

On all occasions, Black-breasted Button-quail were observed to be foraging in raingreen, mixed vine forest, or the transitional zone (with Lantana) between vine and open forest. On one occasion, in Jimna State Forest, the species was observed in Lantana thicket beneath planted Hoop Pines. On many occasions foraging birds were observed to form saucer-shaped and shallow depressions in the leaf litter, called platelets. These platelets were formed by a bird scratching with alternate feet, and pivoting in a circular fashion, either clockwise or counterclockwise, sometimes turning through several complete circles. More often, birds completed a partial circle before moving to a new location. The time taken to make platelets varied from several seconds to a few minutes. Continual pecking during platelet formation clearly indicated feeding. At Ravensbourne National Park, a male Black-breasted Button-quail was noted to mantle the platelet with its wings bowed away from its body (R.H. pers. obs., G.Kirstjens, pers. comm.).

In their study, Hughes & Hughes (1991) reported only the female Black-breasted Button-quail making platelets. On five occasions we observed males making platelets. Other observers have also commented on this behaviour in males (M.Atzeni, L.Beaton, C.Dollery, A.Smyth, pers. comm.). In all instances, there appeared to be no discernible difference in the formation and structure of platelets made by male or female birds. The only interaction noticed between male and female birds was that the male birds kept fairly close contact with the female/s. Black-breasted Button-quail platelets measured approximately 20 cm in diameter and were of variable depth. On one occasion, in April 1993, the density of fresh platelets on the forest floor measured 250+ per 5 m^2 (P.McC. pers. obs., A.Young pers. comm.).

In Redwood Park, Painted Button-quail penetrate the edge of the vine scrub when foraging, forming platelets which do not differ noticeably from those of Black-breasted Button-quail. Hughes & Hughes (1991) observed that Painted Button-quail platelets have a less definite construction involving movement of the leaf litter but not the soil. They also reported that the platelets of this species,

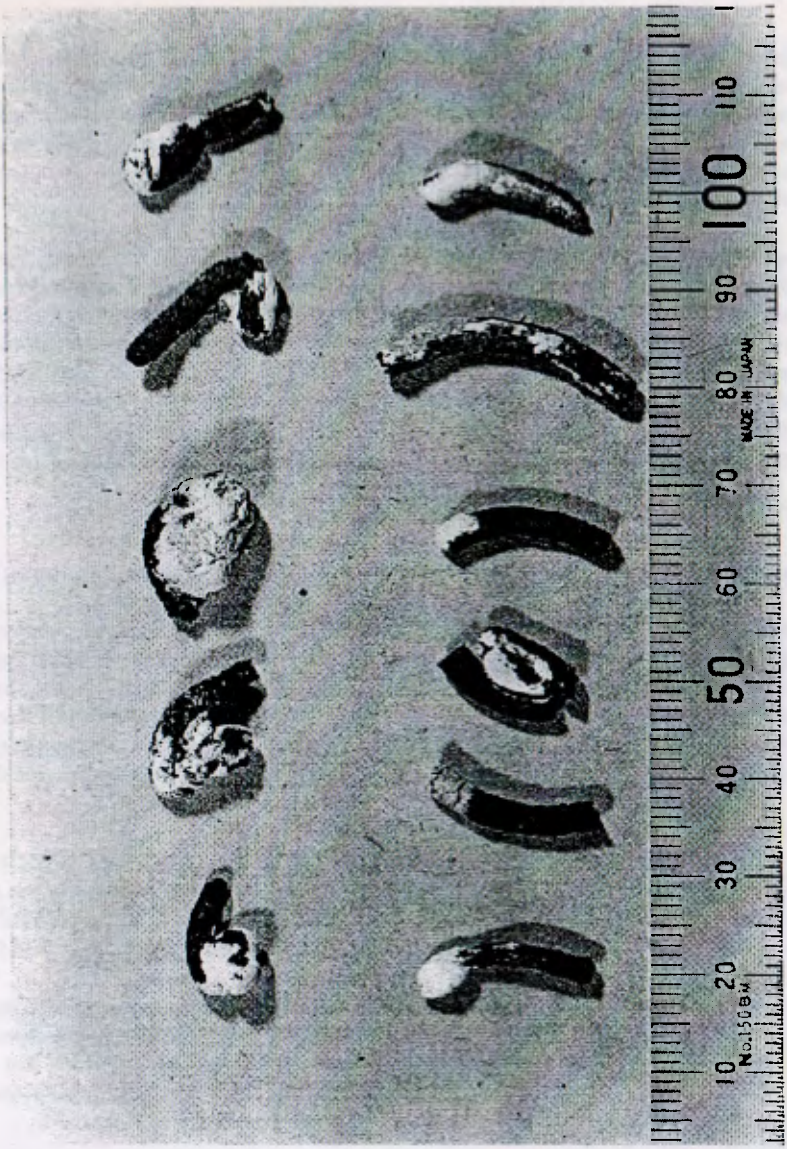

Fig.1. Faecal pellet shape in button-quails. The left column shows some of the variation in faecal pellet shape which can be found in Black-breasted Button-quail. The right column demonstrates the same for Painted Button-quail. The faecal pellet third from the bottom in the right column is atypical for Painted Button-quail. (Photograph by P. McConnell and A. Young).

although deeper than those of Black-breasted Button-quail, do not have a clearly-defined structure. In our observations, Painted Button-quail were seen to create definite platelets, some to a depth of 9 cm, in friable litter and soil. On one occasion a female was observed to almost bury herself when feeding in an area of friable soil. There was no discernible difference in the structure of platelets between the two species.

Hughes & Hughes (1991) also state that Black-breasted Button-quail feed by walking and pecking. Although we have never recorded this behaviour, Painted Button-quail have been seen by other observers feeding in this manner (L.Beaton pers. comm.). Of 23 sightings of Black-breasted Button-quail, eight observations were of two males and a single female, five of a female and a male, three of one male, two of two males, one of two females, one of a single female and two of lone birds of undetermined sex. On one occasion in late February an adult male was observed foraging with two young in Ravensbourne National Park.

OTHER BEHAVIOUR

Roosting

Roosting birds were sighted on two occasions during spotlight searches for the Sooty Owl *Tyto tenebricosa* in March and May 1991. One involved a female roosting on leaf litter in the open, with two males roosting under small shrubs nearby. The other involved a female and two males roosting under small shrubs. Both sightings occurred at the edge of the narrow unsealed road which traverses Ravensbourne National Park. The leaf litter in both cases was substantial.

Calling

The Black-breasted Button-quail was heard calling on five occasions. The only call heard is rendered "ak-ak". On 16 May 1993, a male bird was noted calling from a walking track in Redwood Park. It had been inadvertently separated from a female and another bird by the observers (L.Beaton and P.McC.). The separated bird was observed foraging for 15 minutes, during which time it called frequently. The call could be best described as a high pitched "ak-ak-ak" repeated 2-14 times, but most often 5-6 times. The volume varied but the pitch did not. Eventually the group of birds was reunited whereupon calling ceased. At no instance did the pair of birds respond vocally to the single calling bird.

Flight

Flying was observed on three separate occasions. During the two spotlighting expeditions mentioned above, birds were observed to fly on both occasions. Flushed birds ascended at a very steep angle (about 70°) to a height of about 3m

before dropping to the ground nearby and running away. During the day, a single male under observation beside a road in Ravensbourne National Park was startled by a passing truck. On this occasion the angle of flight was much shallower, approximately 30°, and the bird flew for about 8m at a height of about 1.5m.

ACKNOWLEDGEMENTS

We would like to thank Allan Young for his assistance with some of the field work; Dr Mark Sutherland, Dr Ian Gynther and Anita Smyth for their comments on the manuscript; Dr Ron Atkinson for his help with the spider identifications; and Don Seaton, who first proposed that the difference in faecal pellet shape between Black-breasted Button-quail and Painted Button-quail was diagnostic. We would also like to thank Dr John Stanisic and Craig Eddie who identified the snail remains.

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EDITOR'S NOTICES

THE TAXONOMY AND SPECIES OF BIRDS OF AUSTRALIA AND ITS TERRITORIES

This recently published work by Leslie Christidis and Walter Boles, the second in the RAOU Monograph series, provides detailed reasons for changes to scientific names and revisions to recommended English names, and occupies 116 pages. Though the official list of the birds of Australia, it is far more than a mere list. It will be used for both nomenclature and English names in future issues of *The Sunbird*.

There are numerous taxonomic changes in this impressive work, driven by recent DNA - DNA hybridisation studies and earlier analyses of egg-white proteins. Nevertheless, the authors note that "our understanding of the relationships of many Australian birds is based on morphology, and, to a lesser extent, vocalisations and behaviour". The sequence of Orders and Families differs markedly from traditional sequences. Such changes include the placement of megapodes and quails between emus and ducks, while grebes, penguins and seabirds (Procellariiformes) follow ducks. It is planned to revise the list at least every three to four years.

Some of the comparatively few changes to English names will be applauded by many. Thus, White-faced Heron, Nankeen Night Heron, Nankeen Kestrel, Bush Stone-curlew, Beach Stone-curlew, Australian Spotted Crake, Major Mitchell's Cockatoo, Barred Cuckoo-shrike, Heathwren (rather than Hylacola) and Fieldwren (rather than Calamanthus) have been resurrected, Magpie-lark has lost the prefix "Australian", and Maned Duck is now Australian Wood Duck.

25th CELEBRATORY VOLUME OF *THE SUNBIRD*

The Silver Jubilee Dinner for the Queensland Ornithological Society was held on 9 September 1994 and *The Sunbird* is 25 years old in 1995. There will not be an extra issue in this jubilee year but we plan to publish a historical piece by the Founding President, J.D. Macdonald, in the June 1995 issue.

SOUTHERN HEMISPHERE ORNITHOLOGICAL CONGRESS: ALBANY 5-9 OCTOBER 1996

Professor Brian Collins has requested publicity for this important event. Ecology, conservation and management of Southern Hemisphere birds is the major theme, while sub-themes include breeding biology and mating systems of birds, plant-animal interactions and pollination, and foraging behaviour in terrestrial bird communities.

For additional information contact Prof. Brian Collins, School of Environmental Biology, Curtin University of Technology, GPO Box U 1987, Perth, WA 6001.

INSTRUCTIONS TO AUTHORS

The Sunbird is published quarterly by the Queensland Ornithological Society to further the knowledge of birds in Queensland and adjacent northern regions of Australia.

Papers are invited from non-members as well as members on all aspects of ornithology, e.g. life history, taxonomy, distribution, behaviour and ecology. Articles may take the form of major articles on specific birds, birds in specific areas or habitats, or short notes on either birds themselves or the literature on birds, such as reviews of books or comments on published articles.

Submission of a paper implies that the results reported have not been published and are not being considered for publication elsewhere. The editor reserves the right to submit records of rare birds to the Records Appraisal Committee of the Royal Australasian Ornithologists Union.

Manuscripts can be supplied on floppy disk (IBM or MACINTOSH systems in Wordperfect 5.1 or Word 4.0 format) or in typed form on paper. When typed, the manuscript should be double-spaced and two copies sent. Papers longer than four typed A4 pages should have a summary. If needed, help may be given to authors to find relevant literature. Common names, scientific names and order of names should follow 'The Taxonomy and Species of Birds of Australia and its Territories', Christidis, L. and Boles, W.E. 1994, RAOU Monograph 2. Intending authors should consult recent issues of *The Sunbird* to see acceptable forms of contributions.

References should be listed in alphabetical order at the end of papers in the following styles; titles of journals will be abbreviated as in the *World List of Scientific Periodicals:*

FLEAY, D.H. 1937. Nesting habits of the brush turkey. *Emu* 36: 153-163.

FRITH, H.J. (Ed.) 1976. Mallee fowl. In *Complete Book of Australian Birds*, pp. 136-137. Sydney: Reader's Digest.

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SLATER, P. 1970. *A Field Guide to Australian Birds. Non-Passerines.* Adelaide:Rigby.

Tables and Figures should be numbered with Arabic numerals. Drawings and diagrams should be in Indian Ink on cartridge paper or tracing paper. If authors cannot arrange suitable drawings, the editor may arrange the drawing of figures and diagrams. Authors may submit photographs (preferably black and white) with their manuscripts.

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