

## RECORDS OF BIRDS SEEN AT BRINDANA GORGE, IN THE NORTH FLINDERS RANGES, SOUTH AUSTRALIA

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### SUMMARY

This paper presents records of observations of birds seen at Brindana Gorge, in the North Flinders Ranges of South Australia. A total of 85 species was observed in the 10-year period to the end of 1994. Comparisons of recorded observations and rainfall at the nearby Moolawatana Station Homestead have been made. Good years, in terms of increased rainfall, leading to more water in the area, did not necessarily equate to equivalent changes in bird presence, suggesting that the relationships between the two are far from simple.

### INTRODUCTION

The aim of this paper is to present records of observations, mainly for the 10-year period to the end of 1994, of birds seen at Brindana Gorge (29°58'S, 139°25'E). The Gorge is located on the Hamilton Creek, where it flows through the Mount Fitton Station lease, at the northern extremity of the Flinders Ranges of South Australia.

In September 1980, a small research unit was built at Brindana Gorge to study the relatively large population of Yellow-footed Rock-wallabies *Petrogale xanthopus* found there. It was erected at the top of a 100 m high cliff overlooking the normally virtually dry bed of the creek. Bird observations initially were spasmodic, and all observations have been confined to a very discrete area, namely what could be seen from the research unit, and along the bed of the Hamilton Creek from Brindana Springs to the downstream end of Brindana Gorge (Figure 1). The nearby open plains were not surveyed, and thus this paper does not give an accurate indication of the regional abundance for species which sparingly use the creek-line or gorge. For example, the Cinnamon Quail-thrush *Cinclosoma cinnamomeum* is common in the region but was recorded infrequently in the nominated area.

McGilp (1923) reported on the birds of the Lake Frome District, which covered about 6000 square miles (15 540 sq. km) and a wide diversity of habitats. This study area was approximately 1.5 sq. km, with the habitat comprising the creek-line with a few river red gums *Eucalyptus*

*camaldulensis* var. *obtusa* and some dense thickets of inland paper-bark *Melaleuca glomerata*. Despite these differences, some comparisons between the two surveys have been made.

An endeavour also has been made to correlate the incidence of birds in the area to the prevailing conditions, particularly rainfall. Rainfall data for the immediate vicinity were not available, but a reasonable indication can be derived from records kept at the nearby Moolawatana Homestead, 11 km ENE of the research unit. An extract of records that are relevant to this paper (covering the periods 1915-1923 and 1980-1994) is shown in Table 1. However, in this area of low average rainfall, with evaporation far exceeding precipitation, the nature of the rainfall could sometimes be more significant than the amount. For example, in 1984, 200 mm of rainfall was recorded in January; while the total for the year was 208 mm. Thus, for most of the year, the region effectively was in drought despite rainfall nearly 28% above the annual average of 163.3 mm.

Furthermore, the presence of water in the gorge could be misleading since, especially at the height of the summer, the water is particularly saline, reaching a salinity of approximately 25 000 ppm (compared with sea water which is about 35 000 ppm). However, there also were springs within the creek-bed which provided considerably less saline water. These patches, marked by bulrushes *Typha* sp., were exploited by feral goats, and some birds. For instance, in dry times Zebra Finches *Taeniopygia guttata* all would water at a discrete site.

The Hamilton Creek, in the vicinity of Brindana Springs, was used as a bird-banding site on seven occasions over the six years 1988-1993. Each visit lasted three days. The banding records include bird species that were not observed in the present study. These have not been incorporated in this report because part of the banding station was outside the main study area; however details of the banding records are appended.

## METHODS

Bird observations were made during 19 visits between December 1983 and December 1994. Visits usually lasted for seven to ten days.

For the most part, opportunistic observations were made from the research unit, which restricted the data to records of either larger birds,

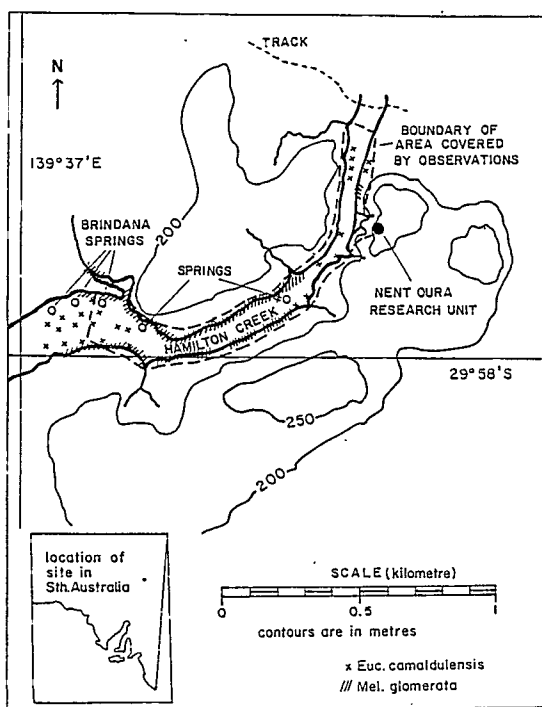


Figure 1. Map of research site.

Table 1. Rainfall recorded at Moolawatana Station Homestead, for the periods 1915-1923 and 1980-1994. (Rainfall is shown in mm; rainfall above 1 mm is recorded to the nearest whole millimetre.)

Year	Month												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1915	-	-	-	9	41	4	6	4	37	0.8	2	-	104
1916	-	-	10	-	17	4	79	-	13	91	8	-	222
1917	59	62	-	-	-	7	16	20	29	-	14	16	223
1918	124	-	4	9	49	2	-	41	8	2	-	-	239
1919	-	17	-	35	33	-	-	6	-	-	-	-	91
1920	19	-	-	-	-	33	-	31	47	7	101	20	258
1921	10	44	8	-	38	22	-	-	-	-	15	-	137
1922	-	2	3	5	14	-	-	-	-	16	-	19	59
1923	-	3	11	28	34	65	7	-	-	-	-	-	148
1980	23	-	-	52	-	8	-	20	-	-	-	-	103
1981	18	3	-	-	109	-	42	-	16	7	9	8	212
1982	7	1	-	-	1	1	-	-	11	-	-	6	27
1983	12	-	11	25	-	-	5	15	-	-	-	9	77
1984	200	-	4	4	-	-	-	-	-	-	-	-	208
1985	-	8	4	-	23	4	-	17	-	9	82	11	158
1986	-	-	-	-	17	-	9	12	2	32	6	30	108
1987	14	136	-	-	-	27	-	12	-	5	5	21	220
1988	-	-	55	-	33	7	37	7	-	-	-	111	250
1989	-	-	125	24	10	9	7	-	-	5	-	27	207
1990	98	-	5	13	40	-	16	-	-	-	-	-	172
1991	-	-	-	-	-	54	9	-	-	-	2	-	65
1992	-	31	-	5	20	-	4	31	12	15	23	34	175
1993	26	4	19	-	30	-	52	6	22	32	11	-	202
1994	2	40	-	-	4	11	2	-	-	-	4	-	63

or small birds which came near the unit. Observations were made daily in the creek-bed below the unit; and along the creek-bed towards Brindana Springs at least once during each visit.

Details of the birds seen have been included in Table 2. When an accurate count was not obtained, the presence of a species was recorded as either C, common; S, several; F, few; or otherwise P, present. Where adults were seen feeding young this has been shown as '+y', or by the number of young, if known, e.g. '+2'. Alternatively, it can refer to a situation where adults are accompanied by birds in immature plumage.

## RESULTS

Between December 1983 and December 1994, a total of 85 bird species was recorded (Table 2). Earlier, two additional species were recorded, namely two adult and four immature Black-

winged Stilts *Himantopus himantopus* in November 1981, and a Dollarbird *Eurystomus orientalis* in February 1982 (Hornsby 1982).

Two features stood out from the results; bird species often would be observed only on one or two occasions during a visit. Secondly, numbers and species of birds seen varied according to the quality of the season, regardless of time of year.

Of the species recorded, 11 could be regarded as resident, though some were never present in large numbers. Those residents are the following:

White-faced Heron *Egretta novaehollandiae*: observed on all but one of the visits, usually with only one or two seen. One nesting event was recorded, in November 1984 in the skeletal remains of a river red gum, when only 8 mm of rainfall had been recorded over the preceding nine months (although standing water still was present from the exceptional 200 mm recorded in January 1984).

Wedge-tailed Eagle *Aquila audax*: observed during every visit, except in November 1984. Numbers varied from very few to a maximum of 20 in December 1990.

Nankeen Kestrel *Falco cenchroides*: regularly recorded in small numbers. Four were observed in May 1987; and in October 1990, two adults plus two young were seen. Of the five visits made during the breeding season of late August to early October (Marchant and Higgins 1993), the kestrels definitely were nesting on three occasions, and almost certainly so on two others. They also bred in 1980 and 1982. The regular nest is in a sheer cliff overlooking the gorge.

Black-fronted Dotterel *Elsayornis melanops*: recorded during every visit, but generally in small numbers with three or four present. Six were observed in May 1987 and 9 in October 1991. Their numbers were not correlated with rainfall.

Galah *Cacatua roseicapilla*: seen on every visit, with a large variability in numbers present, ranging from 12 in July 1990 to 150 in June 1994. There was no determinable correlation between the numbers present and rainfall or time of year.

Variegated Fairy-wren *Malurus lamberti*: recorded on all visits except one; in low numbers, and typically as small groups of three or four.

White-plumed Honeyeater *Lichenostomus penicillatus*: recorded on all visits except three, and numbers were not correlated with rainfall. Young were recorded in May, September, October, and December. Banding data (Appendix 1) also included White-plumed Honeyeaters on every visit, with birds regularly being retrapped.

Willie Wagtail *Rhipidura leucophrys*: small numbers seen on every visit.

Australian Magpie *Gymnorhina tibicen*: observed on every visit except in March 1985 and June 1994. Usually only one or two were seen, but there were periodic irruptions in winter months, with 32 being seen together in May 1989. This coincided with a very wet period, with 260 mm of rain in the preceding five months. A similar wet period occurred in the five months before December 1985, but there was no corresponding increase in magpie numbers during the summer months.

Australian Raven *Corvus coronoides*: present during every visit, usually in small groups. Six to ten birds were reported on six of the 19 visits.

Zebra Finch: observed on every visit except June 1991, which was one of only two occasions where no rainfall had been recorded during the

preceding five months. Similarly, in December 1990, 'few' Zebra Finches were observed and no rainfall had been recorded in the preceding four months, but 16 mm fell in July 1990. 1984 was the exceptional year with 200 mm of rain in January, and only 8 mm subsequently and, paradoxically, in November Zebra Finches were 'present' and nesting. Banding data (Appendix) also included Zebra Finches on every visit except in June 1993. Often they occurred in large numbers, but seldom were retrapped.

## DISCUSSION

The large number of infrequently recorded species suggests that the gorge is part of a transit corridor. This could be because the creek-bed has permanent water which would be visible from the air, and in dry times there are few alternative water sources in the area. McGilp (1923), referring to the Lake Frome District, which technically includes this area, stated that: "with the exception of a few rock springs and a small area of mud (i.e. mound) springs in the Flinders Range, the whole district is devoid of permanent natural waters." In this regard, he underestimated the significance of Brindana Gorge, but his records actually referred more to the plains to the east than to the ranges.

Eleven species were recorded as resident in the study area. These include four of the 10 birds most widely reported throughout Australia in Blakers *et al.* (1984), i.e. Wedge-tailed Eagle, Nankeen Kestrel, Galah, and Willie Wagtail; while another two from this list were seen during a majority of the visits, i.e. Magpie-lark *Grallina cyanoleuca* and Black-faced Cuckoo-shrike *Coracina novaehollandiae*. Given their widespread distribution, coupled with a suitable habitat, it is not surprising they have occurred here. Several other species recorded were those with a general occurrence in the Flinders Ranges region, while a third group included species seen but not continuously present due to seasonal or itinerant movements.

This overall picture was borne out by the records included in McGilp (1923). His data were congruent for 10 of the 11 species classed as resident in this study, and for all of them if his corvid *C. ceciliae* is equivalent to *C. coronoides*, as seems likely.

The Little Corella *Cacatua sanguinea* showed the largest variation in numbers recorded; ranging

Table 2. Birds recorded at Brindana Gorge over the period January 1983 to December 1994, showing the number of birds seen on each occasion (P = present, F = few, S = several, C = common, +y = +young, pr = pair, H = heard only, and n = nesting). TR = number of times recorded in 19 visits.

Species	Year:																		TR	
	84	84	85	85	86	86	87	88	89	89	90	90	90	91	91	93	93	94		'94
Month:	6	11	3	12	3	7	5	9	5	10	7	10	12	6	10	6	9-10	6	12	
Emu	-	-	-	-	3	1	-	P	-	-	-	2+5	3	-	2	-	2	-	5	8
Australian Wood Duck	-	-	-	pr	-	-	P	-	-	-	-	-	-	-	-	-	-	8	-	3
Pacific Black Duck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	1	2
Grey Teal	P	P	26	3	P	-	-	3	-	P+y	4	S+y	10	10	30	12	9	2	12	16
Hardhead	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Australasian Grebe	-	-	5	-	-	-	-	-	-	-	-	-	-	-	1	1	1	-	-	4
Little Pied Cormorant	-	P	-	-	1	-	-	1	-	-	-	-	-	-	-	-	2	1	-	5
Pied Cormorant	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1
Little Black Cormorant	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	2	-	3	3
Great Cormorant	-	-	3	-	-	-	-	P	-	-	4	-	-	-	-	-	-	-	-	3
White-faced Heron	P	Pn	P	-	1	1	P	3	1	1	1	2	1	2	2	2	2	2	2	18
White-necked Heron	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1+1	-	-	2
Square-tailed Kite	-	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	1	-	3
Black Kite	-	-	P	-	-	-	P	P	1	P	6	2	1	-	-	-	-	18	2	10
Whistling Kite	P	-	-	-	-	-	-	-	P	2	-	-	-	-	-	-	-	-	1	4
Brown Goshawk	-	-	-	-	1	-	1	P	1	-	-	-	-	-	-	-	-	1	-	5
Collared Sparrowhawk	-	-	-	-	-	-	-	-	-	P	-	-	1	-	-	-	-	-	-	2
Wedge-tailed Eagle	P	-	P	1	4	6	P	P	P	P	8	5	20	3	3	5	4	11	2	18
Little Eagle	-	-	-	-	-	-	P	-	-	-	1	-	-	1	-	-	1+2	-	-	4
Brown Falcon	-	-	-	-	-	-	1	1	-	1	-	1	-	-	-	-	2	-	-	5
Black Falcon	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Peregrine Falcon	P	-	P	-	-	-	-	-	-	-	1	-	-	1	-	-	1	-	1	6
Nankeen Kestrel	P	P	P	1	1	1	4	Pn	2	2	2	2+2	2	1	2	pr	2+1	1	1	19
Eurasian Coot	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1
Black-fronted Dotterel	P	P	P	2	1	2	6	S	S	S	S	S	F	S	9	2	C	S	C	19
Common Bronzewing	-	-	-	-	-	-	-	P	pr	-	-	2	-	-	-	2	pr	-	1	6
Crested Pigeon	-	P	-	P	-	1	P	P	6	-	16	10	S	S	30	F	F	-	S	14
Diamond Dove	P	P	-	2	-	P	P	P	-	-	-	-	-	-	-	-	2	-	-	7
Peaceful Dove	-	-	-	P	P	2	-	P	S	S	P	F	F	S	F	4	P	2	-	14
Galah	P	Pn	C	P	40	60	P	P	C	P	12	20	F	40	30	30	C	150	S	19
Little Corella	-	18	20	22	-	25	P	C	1600	P	1000	100	F	50	5	30	C	150	-	16
Cockatiel	-	P	-	-	-	-	-	P	-	-	-	-	-	-	-	-	-	-	-	2
Australian Ringneck	-	-	-	-	-	-	-	P	-	-	-	-	-	-	-	-	-	-	3	2
Mulga Parrot	-	-	-	-	-	pr	-	P	-	P	pr	2	2	pr	-	2	H	pr	-	10
Budgerigar	-	10	-	-	-	-	P	P	20	P	-	P	P	-	-	-	C	-	-	8
Tawny Frogmouth	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	H	-	-	1
Spotted Nightjar	-	-	-	-	-	-	-	P	H	-	-	-	-	-	H	-	-	-	-	3
Australian Owllet-nightjar	-	-	-	-	-	-	-	1	-	-	-	-	P	-	-	H	-	-	-	3
Red-backed Kingfisher	-	-	-	-	-	-	-	P	P	F	-	P	P	-	-	-	1	-	-	6
Rainbow Bee-eater	-	-	-	-	-	-	-	-	-	-	-	2	-	-	2	-	2	-	-	3
Variiegated Fairy-wren	-	P	P	1	P	P	P	P	P	P	S	S	F	P	F	S	P	S	S	18
Striated Pardalote	-	-	-	-	-	P	P	P	-	-	P	-	-	-	1	S	P	2	-	8

Table 2 continued

Species	Year:	84	84	85	85	86	86	87	88	89	89	90	90	90	91	91	93	93	94	94	TR
Month:	6	11	3	12	3	7	5	9	5	10	7	10	12	6	10	6	9-10	6	12		
Weebill	-	-	-	-	-	-	-	P	-	-	6	-	-	2	-	-	-	-	-	-	3
Inland Thornbill	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	F	-	F	-	-	3
Chestnut-rumped Thornbill	-	-	-	-	-	P	-	-	-	-	P	4	-	-	-	F	-	-	-	-	4
Yellow-rumped Thornbill	-	-	-	-	-	-	-	P	-	-	P	-	-	-	-	-	-	-	-	F	3
Southern Whiteface	-	-	-	-	-	-	-	-	-	-	-	-	P	2	-	-	-	-	-	-	2
Spiny-cheeked Honeyeater	-	-	-	-	P	S	-	P	S+y	P	S	S	2	C	P	S	F	S	S	S	14
Yellow-throated Miner	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Singing Honeyeater	-	-	-	P	P	P	P	P	P	P	F	-	2	3	-	S	F	F	F	F	14
Grey-headed Honeyeater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	1
Grey-fronted Honeyeater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	-	-	-	-	1
White-plumed Honeyeater	-	-	P	P	-	S	P	P	S+y	S	P	S+y	S+y	S	S+y	C	C+y	C	F		16
Crimson Chat	-	-	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Jacky Winter	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Red-capped Robin	-	P	-	P	-	P	P	P	P	P	P	-	-	P	P	F	-	S	F		13
Hooded Robin	-	P	-	P	P	-	P	P	-	-	pr	P	P	-	1	F	-	3	-	-	11
White-browed Babbler	-	-	-	-	-	4	P	P	S	S	S	-	F	3	2	S	C	12	F		13
Cinnamon Quail-thrush	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2		2
Crested Bellbird	-	-	-	-	-	-	-	P	-	-	-	-	-	P	-	P	P	P	-		5
Gilbert's Whistler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1
Rufous Whistler	-	-	-	P	-	P	-	P	-	P	1	1	1	-	-	2	-	-	P		9
Grey Shrike-thrush	-	P	-	-	-	P	-	P	P+y	6	F	F	2	P	2	2	2	2	1		14
Magpie-lark	-	-	P	-	-	1	-	P	-	1	2	2	-	-	-	4	pr	pr	3		10
Willie Wagtail	P	P	P	1	1	1	P	P	S	S	S	S	F	P	F	F	S	F	2		19
Black-faced Cuckoo-shrike	-	P	-	P	-	-	3	-	-	P	2	1	-	-	P	-	4	1	1		10
White-winged Triller	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	pr	-	-		1
Black-faced Woodswallow	-	-	2	P	6	-	P	P	-	P	-	-	-	2	-	2	-	F	-		9
Little Woodswallow	-	S	P	2	-	-	-	S	-	6	-	2	F	-	F	-	8	-	F		10
Australian Magpie	P	P	-	P	2	2	P	P	32	P	2	2	2	2	5	9	2	-	1		17
Australian Raven	P	P	P	P	P	10	P	P	P	P	6	8	F	4	7	8	2	6	F		19
Little Crow	-	P	-	P	P	P	P	P	P	P	-	-	S	-	-	30	40	40	F		13
Singing Bushlark	-	-	-	-	-	-	-	P	-	-	2	1	-	-	-	-	1	-	-		4
Skylark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1		1
Richard's Pipit	P	-	-	-	-	-	-	P	-	-	-	-	-	1	-	-	-	-	-		3
Zebra Finch	P	Pn	P	S	S	C	P	C	P	C	F	S+y	F	-	C	F	C	C	C		18
Painted Finch	-	-	-	prn	-	-	-	-	pr	-	-	-	-	-	-	-	-	-	-		2
Mistletoebird	-	-	-	-	-	S	-	P	-	-	S	1	1	C	-	C	2	C	-		9
Welcome Swallow	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-		1
Tree Martin	-	-	-	-	-	12	-	P	-	P	4	12	-	-	S	25	2	C	F		10
Fairy Martin	-	P	P	-	-	-	-	-	-	-	-	-	-	-	-	-	Cn	-	-		3
Clamorous Reed-warbler	-	P	-	-	-	-	-	P	-	S	-	-	-	-	1	-	2	-	1		6
Rufous Songlark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	S+y	-	-		1
Silvereye	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-		1
<i>Overall total = 85 species</i>																					
Species recorded per visit	15	24	22	25	20	30	30	50	28	35	36	35	32	30	31	36	51	37	34		

from zero, on three occasions, to 1600 in May 1989. McGilp (1923) recorded that the Little Corella occurred "in greater numbers than the Galah," but the Galah also was observed "in countless numbers." Rainfall did have some influence on corella presence. Large numbers of corellas usually, but not inevitably, were recorded following high rainfall in the current month plus the two or three preceding months, but not if high rainfall occurred only in the current and immediately preceding month.

One group with irregular occurrence was ducks. Up to 30 Grey Teal *Anas gracilis* were recorded, with occasional breeding. This, together with variations in the number of birds seen during the course of a visit, reflects what Frith referred to as the species' susceptibility to population fluctuation and nomadism (Frith *et al.* 1969). On seven of 20 visits (including a brief visit in August 1984), 10 or more Grey Teal were present. Six of these occurred when conditions were very dry, with less than 10 mm of rainfall during the previous three months. Conversely, when greater than 75 mm of rain fell in the previous three months (four occasions), there were three instances when three or less Grey Teal were seen. The paucity of Grey Teal when conditions were good strongly suggests the gorge was a 'non-preferred' area. Frith (1982a) reported that large flooded billabongs and lagoons were preferred habitats so a possible explanation is that, when these were available, they were occupied in preference to the gorge, with its restricted channel.

The Pacific Black Duck *A. superciliosa* was an infrequent visitor, with records of two in September/October 1993, when conditions were good, and of one in December 1994, when it was very dry. Frith (1982a) also reported that the preferred habitat for Black Duck was deep, permanent vegetated swamps, and that it was a less adaptable feeder than the Grey Teal (Frith *et al.* 1969). A similar explanation could apply to the Hardhead *Aythya australis*, which was seen once only. These records contrast with those of McGilp (1923) who found the Black Duck to be generally resident, though this is hard to reconcile with his earlier remark about the whole district being "devoid of permanent natural waters." That Black Duck were "common in good seasons" is much easier to accept. He also found that a

number of duck species first occurred in May 1918, near the end of a three-year period of above-average rainfall. No similar pattern in ducks was seen at Brindana as a consequence of the record rains in early 1989, which also was a climax of three above-average years.

Brindana records for the Australian Wood Duck *Chenonetta jubata* showed it also to be an infrequent and unpredictable visitor, with no discernible seasonal movements.

Four cormorant species were recorded. Their occurrence usually was not related to rainfall but in November 1984, Little Pied Cormorants *Phalacrocorax melanoleucos* (the most frequently observed cormorant) were present although effectively no rain had fallen since the 200 mm in January, 10 months previously. Of the five occasions when they were observed, three were preceded by protracted dry spells. Generally cormorants were observed to be present for just part of a visit, emphasising the itinerancy of their behaviour. McGilp (1923) reported that both smaller species, *P. melanoleucos* and the Little Black Cormorant *P. sulcirostris*, were seen "throughout the year on stock tanks and bore streams and springs," while the two larger species were seen "in good seasons when the lakes were full." McGilp referred to these as *P. carbo* and the White-breasted Cormorant *P. fuscescens*. The latter almost certainly was a mis-identification of the Pied Cormorant *P. varius*, since *P. fuscescens* is a marine species never found inland (Condon 1968).

Records for raptors generally also were erratic, but for different reasons. Only the Wedge-tailed Eagle and the Nankeen Kestrel regularly were recorded. Other raptors recorded were occasional visitors to the site, possibly because it was within their greater home range. For example, Peregrine Falcon *Falco peregrinus* records consisted typically of a single pass down Brindana Gorge, and often they were seen only once or twice per visit. McGilp (1923) saw Peregrine Falcons only twice. McGilp (1934) noted that Peregrines were "seldom seen in the interior regions (of South Australia), and then only where there are rough ranges, in which it will be found where cliffs or deep ravines abound." The earlier lack of observations (McGilp 1923) could be interpreted as showing that in these arid parts, they prefer watercourses to open plains.

The only raptor to be in any way seasonal was the Black Kite *Milvus migrans*. McGilp (1923)

1. This apparent anomaly could be explained by the ducks' use of station dams - Eds.

recorded it as "appearing in great numbers about June or July, and usually leaving before the end of November." While birds occasionally were seen at Brindana at other times of the year, most were observed during the cooler months, with 18 recorded in spring 1993.

The banding records (Appendix 1) show the Peaceful Dove *Geopelia striata* to be more or less resident. They regularly could be found in small numbers but only in the tall dense vegetation close to good water in the creek, upstream from the research unit. This is typical arid country Peaceful Dove habitat (Frith 1982b). Diamond Doves *G. cuneata* usually were encountered in the more open areas, foraging along the creek-bed. They were occasional visitors, suggesting this specific location could have bordered their home ranges. Common Bronzewings *Phaps chalcoptera* were even more irregular in their occurrence and usually were seen in pairs.

According to Frith (1982b), Crested Pigeons *Ocyphaps lophotes* prefer "lightly-wooded country near water"; not surprisingly it was virtually a resident. Their numbers irrupted occasionally, with up to 30 birds seen, usually in a flock. McGilp (1923) found them "very numerous" and freely breeding, so the fluctuations could have been due to local nomadic movements.

Among the smaller parrots, the Budgerigar *Melopsittacus undulatus* was another species seen passing through the area. They seem to use Brindana Gorge as a corridor, since they always flew along the watercourse and never were observed at rest or feeding. They were common in good rainfall years and absent in the drier years; time of year appeared to have no bearing on their presence. McGilp (1923) was somewhat ambiguous, reporting that in good seasons their numbers were unlimited and they bred freely. However, he went on to say that "even in a good year (they) may not appear, and it is apparently only when driven by adverse conditions in the far interior that they favour us with a visit." This suggests that the region may be a non-preferred area for Budgerigars. By comparison with irruptions elsewhere, they never were seen in large numbers at Brindana. Night movements may occur since contact calls were recorded at 2140 h (about 3.5 hours after sunset) on 26 September 1993 as they flew overhead in bright moonlight.

Blakers *et al.* (1984) recorded the Cockatiel *Nymphicus hollandicus* as moving south in summer and north in winter, in both eastern and

western Australia. The two records here, in November 1984 and September 1988, suggest they could have been passing through on their southward journey. McGilp (1923) reported them as visiting "only in good years."

Blakers *et al.* (1984) referred to the Tree Martin *Hirundo nigricans* as another species which tends to migrate north from southern Australia in winter. At Brindana Gorge up to 25 were recorded in a single visit, but only between June and October, except for an observation of 'few' in December 1994. Their absence during summer could indicate the birds have moved further south; possibly because of a relative lack of food during the hotter months. The aerial feeders which replaced them in summer, mainly the Little Woodswallow *Artamus minor*, and later the Black-faced Woodswallow *A. cinereus*, were present only in small numbers, and they also are species able to augment their food intake with nectar and ground insects (Blakers *et al.* 1984). These observations do not match McGilp's (1923) report that Tree Martins were resident, with a breeding season from August to January.

Fairy Martins *H. ariel* were far more irregular in their occurrence. They were most numerous in September 1993, when there was a noteworthy abundance of small flying insects which could have been due to exceptional-rainfall of 137 mm for the year to the end of August. They nested communally in a large cave on the southern side of the Hamilton Creek. Collection of mud from the creek-side was communal as well; there were cycles of building, feeding, then building again, with about 10 minutes devoted to each activity. Fairy Martins were not present in the even wetter years of 1988 and 1989. McGilp (1923) also found them to be irregular visitors, usually arriving in August, but unaffected by the quality of the season.

Six species of honeyeater were recorded from the study site. Of these, three were seen on nearly every visit, namely the White-plumed Honeyeater *Lichenostomus penicillatus*, Spiny-cheeked Honeyeater *Acanthagenys rufogularis*, and Singing Honeyeater *L. virescens*. Keast (1968) considered all three species to be sedentary in the more arid parts of Australia, but regarded the Spiny-cheeked Honeyeater as nomadic away from the better-watered parts of its range. The banding records (Appendix 1) showed trapping of White-plumed and Spiny-cheeked Honeyeaters on every visit. The data also included retrapping.



events, suggesting that at least some of the birds were resident. McGilp (1923) recorded *L. penicillatus* as resident, and implied the other two were.

At Brindana, Singing Honeyeaters typically were absent during October and November. Furthermore, on the three occasions when they were banded, including 26 in April 1990 and 14 in April 1991, there was no retrapping. This suggests that, contrary to the conclusions of Keast (1968), this species was not a resident.

The Yellow-throated Miner *Manorina flavigula*, Grey-headed Honeyeater *L. keartlandi* and Grey-fronted Honeyeater *L. plumulus* were seen only once. The Miner had a decided preference for the taller river red gums higher up the creek-line and rarely ventured into the observation area, thus it seldom was recorded. McGilp (1923) reported it as common. Keast (1968) regarded *M. flavigula* as sedentary, and *L. plumulus* as a species "in which nomadic habits were moderately well-developed," while McGilp (1923) reported *L. plumulus* as not common. The data here, together with the fact that *L. plumulus* was banded just once, suggest that *L. plumulus* is probably nomadic. Keast (1968) regarded *L. keartlandi* as locally nomadic, while McGilp (1923) failed to record it.

The Mistletoebird *Dicaeum hirundinaceum* was highly seasonal in its occurrence, being common from June to September, and largely absent for the remainder of the year. McGilp (1923) noted they were common when mistletoes were fruiting, and the birds tended to arrive about May, and depart in October or November. Keast (1958) described their behaviour as 'food nomadism' - "a highly developed nomadism based on the fruiting of mistletoes in different districts." Closely paralleling the occurrence of Mistletoebirds was the Striated Pardalote *Pardalotus striatus*. It mainly appeared during the late winter months, and normally only one or two birds were seen.

Six species were considered to be rare visitors. These included the Welcome Swallow *Hirundo neoxena* which was recorded just once, whereas McGilp (1923) recorded them as "not common, but appear to be residents." Three species were recorded once only, all during the same visit in October 1993. The first was a pair of White-winged Trillers *Lalage sueurii*. McGilp (1923) regarded them as migratory, arriving about the end of October, sometimes appearing in flocks, but

always at least a few of them. The other two were the Gilbert's Whistler *Pachycephala inornata* and Rufous Songlark *Cincloramphus mathewsi*, which was recorded with young. Blakers *et al.* (1984) described the Songlark as a spring-summer breeding visitor to southern Australia. McGilp (1923) recorded neither of these, nor the Painted Finch *Emblema picta*, which has been observed twice at Brindana. On the first occasion in December 1985, a pair was seen nesting at the base of a clump of spinifex *Triodia irritans* (Hornsby 1987). Finally, the Silvereve *Zosterops lateralis* was reported only in June 1994. However, they were banded twice, but only during the April visits, with no retrapping. McGilp's (1923) single record was in October 1920. He regarded them as "evidently migrating." It appears that Silvereves may be commoner in the area than previously believed, with the study site being near the northern limit of their movements.

In summary, the relationship between birds seen at Brindana Gorge and prevailing conditions, particularly rainfall, is complex. In part this could be attributed to the small size of the recording site, but other factors also must operate. Good years, in terms of appropriately increased rainfall, leading to more water in the area, and plenty of green-feed, have not necessarily been equated with equivalent increases in bird presence. Similarly, in dry conditions when water is scarce, there are a number of species, like Grey Teal and Little Pied Cormorants, which could be using the gorge as a refuge even though, at such times, the water is particularly saline. Thus the gorge could be interpreted as a non-preferred but 'reserve' area, to fall back upon when conditions elsewhere are bad.

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## REFERENCES

- Blakers, M., Davies, S.J.J.F. and Reilly, P.N. 1984. *The atlas of Australian birds*. RAOU and Melbourne University Press, Melbourne.
- Condon, H.T. 1968. *A handlist of the birds of South Australia*. Second edition. SAOA, Adelaide.
- Frith, H.J., Braithwaite, L.W. and McKean, J.L. 1969. Waterfowl in an inland swamp in New South Wales. II Food. *CSIRO Wildlife Research*, 14, 17- 64.
- Frith, H.J. 1982a. *Waterfowl in Australia*. Revised edition. Angus and Robertson, Sydney.
- Frith, H.J. 1982b. *Pigeons and Doves of Australia*. Rigby, Adelaide.
- Hornsby, P. 1982. A sighting of the Dollar Bird in the northern Flinders Ranges. *South Australian Ornithologist*, 29, 24-25.
- Hornsby, P. 1987. Nest-building by the Painted Firetail in the North Flinders Ranges. *South Australian Ornithologist*, 30, 83.
- Keast, A. 1958. The influence of ecology on variation in the Mistletoe-bird *Dicaeum hirundinaceum*. *Emu*, 58, 195-206.
- Keast, A. 1968. Seasonal movements in the Australian Honeyeaters (Meliphagidae) and their ecological significance. *Emu*, 67, 159-209.
- McGilp, J.N. 1923. Birds of Lake Frome District, South Australia. *Emu*, 22, 237- 243; 274-287.
- McGilp, J.N. 1934. The hawks of South Australia. *South Australian Ornithologist*, 12, 225-293.
- Marchant, S. and Higgins, P.J. 1993. *Handbook of Australian, New Zealand & Antarctic birds. Vol. 2: Raptors to Lapwings*. Oxford University Press, Melbourne.
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## APPENDIX

Details of birds banded at Hamilton Creek during the period September 1988 to June 1993. (Retrap data are shown in parentheses.)

Species	Month/Year: 9/88	10/89	4/90	7/90	10/90	4/91	6/93	Total Banded
Collared Sparrowhawk	-	1	-	-	-	-	-	1
Black-fronted Dotterel	-	-	-	2	1	-	-	3
Common Bronzewing	-	-	-	1	-	-	-	1
Diamond Dove	3	-	-	-	-	-	-	3
Peaceful Dove	2	4	2 (2)	-	2	(1)	-	10 (3)
Australian Ringneck	-	-	-	1	-	-	-	1
Mulga Parrot	-	-	-	2	-	-	-	2
Variiegated Fairy-wren	-	-	4	1	-	9	-	14
White-winged Fairy-wren	-	-	7	1	-	-	-	8
Weebill	-	-	-	2	-	-	-	2
Inland Thornbill	-	-	1	1	-	1 (1)	-	3 (1)
Chestnut-rumped Thornbill	-	4	(1)	-	-	2	-	6 (1)
Yellow-rumped Thornbill	-	-	1	-	-	-	-	1
Southern Whiteface	-	6	5 (1)	1 (1)	-	-	-	12 (2)
Spiny-cheeked Honeyeater	5	7	20 (1)	2 (1)	20	9 (4)	(1)	63 (7)
Singing Honeyeater	-	-	26	3	-	14	-	43
Grey-fronted Honeyeater	-	-	-	-	-	3	-	3
White-plumed Honeyeater	14	6 (3)	22 (2)	(3)	2	5 (3)	3 (1)	52 (12)
White-fronted Honeyeater	-	-	2	-	-	4	-	6
Red-capped Robin	-	-	1	-	-	-	-	1
White-browed Babbler	5	11 (1)	6	(3)	(3)	-	1	23 (7)
Rufous Whistler	2	1 (1)	5 (1)	(1)	3	(1)	1	12 (4)
Grey Shrike-thrush	2	-	1	-	-	-	1	4
Grey Fantail	-	-	1	-	-	-	-	1
Willie Wagtail	-	-	1	-	2	1	-	4
Zebra Finch	50	116 (1)	65 (1)	6	10 (1)	60	-	307 (3)
Mistletoebird	-	-	-	7	-	1	2	10
Tree Martin	-	-	-	-	5	-	2	7
Clamorous Reed-warbler	1	3	-	-	-	-	-	4
Silvereye	-	-	8	-	-	5	-	13
<i>Total Species = 30</i>								