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THE SUNBIRD

Volume 29 No. 2 August 1999

THE BIRDS OF ARCHERFIELD AIRPORT, BRISBANE AND THEIR RESPONSE TO RAINFALL

PETER F. WOODALL

ABSTRACT

Thirty-two species of birds were recorded from Archerfield Airport during monthly counts from 1995-98. Several uncommon species including migrant waders and the Banded Lapwing were noted. The most numerous species were Australian Magpie, Common Starling and Magpie-lark. Masked Lapwings had low numbers from January-April, increased to a maximum from May-August and then decreased to 7-8 breeding pairs from September-December. The numbers of Straw-necked Ibis and Torresian Crow showed significant positive correlations with rainfall in the previous week. Magpie-larks showed a bimodal peak in numbers, suggesting regular seasonal movements.

INTRODUCTION

Archerfield Airport is located 12 km south of the centre of Brisbane. It is the sixth busiest airport in Australia, with 253 000 aircraft movements in 1996 compared with 153 000 at Brisbane Airport (CASA 1998). Today it handles mainly light aircraft, but in the 1930's and 1940's it was Brisbane's main airport servicing military and civil aircraft, including QANTAS and AOA/ANA (Marks 1994).

This study investigated the avifauna of the airport over a three-year period and is significant from two aspects. Firstly, birds on airfields present a potential hazard to the aircraft, and a better understanding of the species present, their numbers and seasonal changes may allow for better management to reduce this hazard. Secondly, the airfield provides a large and distinctive habitat for birds and several uncommon species have been recorded from Archerfield (Roberts 1979). The present study has provided a better understanding of the importance of the airfield for both the common and uncommon species.

STUDY AREA AND METHODS

Observations at Archerfield Aerodrome were made once a month from 1995 to 1998. They were conducted on a Saturday or Sunday morning near the end of the month, one to two hours after sunrise (0600 to 0800 depending on season). A Kowa TSN4 telescope (20x70) was used to count the birds. Nine observation sites (reduced in 1997 to eight with the loss of #6 due to peripheral development) (Fig. 1), were located on the boundary fence and these allowed an almost complete coverage of the airfield. At each observation site, boundaries were established to avoid counting the same birds twice. The total count took approximately one hour and any major movements of birds within the area were noted to avoid duplication. The total area of Archerfield Airport is 250 ha but, excluding the terminal buildings and hangers and the increasing area of peripheral development, the area available for most birds was ca. 200 ha.

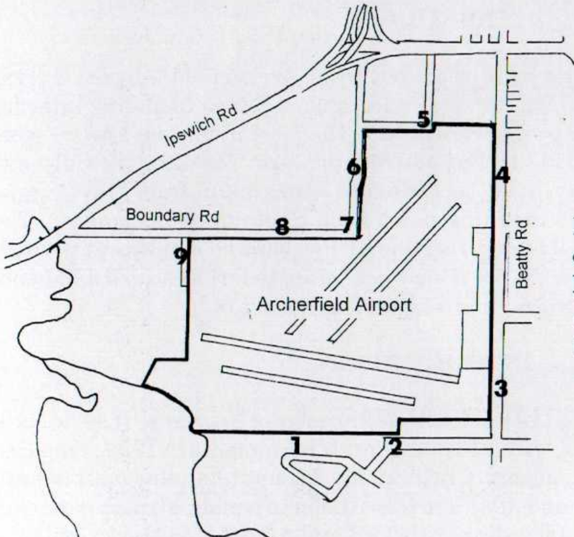

Fig. 1. The location of Archerfield Airfield. Numbers indicate the location of observation points on the boundary fence.

Daily rainfall data for Archerfield Airfield were obtained from the Bureau of Meteorology in Brisbane. Rainfall data from Brisbane Airport were substituted for a few cases of missing data. The total annual rainfall, July-June, was 1365 mm in 1995/96, 778 mm in 1996/97 and 863 mm in 1997/98. The average annual total for the Moreton District is 1161 mm, so two out of three years were well below average. This would have also been the case in 1995/96 had it not been for exceptionally heavy rainfall in May 1996 (510 mm, cf. 86 mm on average) which caused widespread flooding.

RESULTS

A total of thirty-two species was recorded from Archerfield during the three years of observations (Table 1). Many of these were recorded on less than 10%

TABLE 1. Species recorded at Archerfield Airport during 36 monthly surveys, 1995-1998.

Species	Total number counted (all surveys)	Maximum number counted (on one survey)	Percentage frequency of sightings
White-faced Heron	1	1	2.8
Cattle Egret	4	2	8.3
Australian White Ibis	107	77	16.7
Straw-necked Ibis	644	163	50
White-bellied Sea-Eagle	1	1	2.8
Swamp Harrier	1	1	2.8
Wedge-tailed Eagle	2	2	2.8
Nankeen Kestrel	30	4	47.2
Australian Hobby	1	1	2.8
Little Curlew	2	2	2.8
Pacific Golden Plover	32	19	8.3
Banded Lapwing	90	9	50
Masked Lapwing	647	46	94.4
Rock Dove	22	10	13.9
Spotted Turtle-Dove	1	1	2.8
Crested Pigeon	16	7	13.9
Galah	362	66	61.1
Sulphur-crested Cockatoo	1	1	2.8
Fork-tailed Swift	3	3	2.8
Magpie-lark	790	63	94.4
Willie Wagtail	16	3	27.8
Black-faced Cuckoo-shrike	2	2	2.8
Pied Butcherbird	3	3	2.8
Australian Magpie	1663	106	100
Torresian Crow	548	92	100
Richard's Pipit	412	40	100
House Sparrow	3	3	2.8
Welcome Swallow	85	23	22.2
Fairy Martin	216	31	36.1
Golden-headed Cisticola	27	3	44.4
Common Starling	1468	251	80.6
Common Myna	1	1	2.8

of visits and only fourteen species were recorded on more than 20% of visits. The most numerous species was the Australian Magpie *Gymnorhina tibicen*, followed by the Common Starling *Sturnus vulgaris* and Magpie-lark *Grallina cyanoleuca*. Only two species, Masked *Vanellus miles* and Banded Lapwings *V. tricolor*, were recorded breeding although it is likely that those nesting among the buildings (House Sparrow *Passer domesticus*, Common Starling) and the more cryptic nesters (e.g. Richard's Pipit *Anthus novaeseelandiae*) were overlooked.

Raptors were well represented at Archerfield but most species were recorded on only one occasion (White-bellied Sea-Eagle *Haliaeetus leucogaster*, Swamp Harrier *Circus approximans*, Wedge-tailed Eagle *Aquila audax* and Australian Hobby *Falco longipennis*). The Nankeen Kestrel *F. cenchroides* was the only regular species and small numbers were recorded on 47% of visits. It was recorded in greatest numbers in late summer (Table 2).

The Masked Lapwing showed a clear seasonal pattern of abundance (Fig. 2). Low numbers were recorded in late summer, January to April, then numbers increased to a peak in June, July and August; but over the breeding season, September to December, numbers were relatively stable at between 14 -16 adults. The Banded Lapwing showed a similar pattern (Table 2), being absent from January to May 1996, and December 1996 to June 1997, but in 1998 this pattern changed with a small group being present in January, February and April. Breeding (observations of juvenile birds) in this species was recorded between September and January.

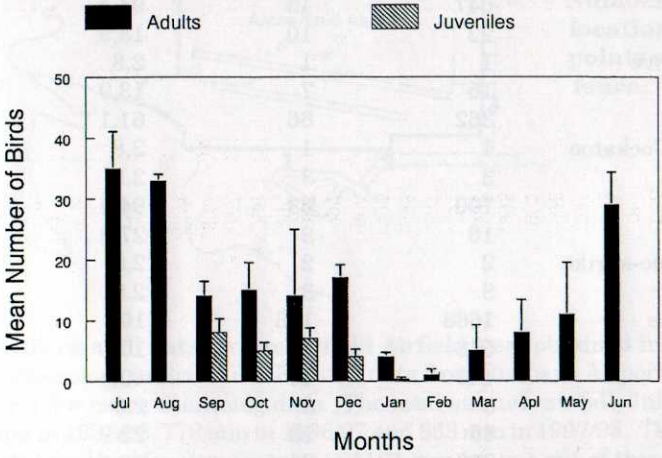

Fig. 2. Seasonal changes in the mean number of Masked Lapwing counted at Archerfield Airfield, (n=3 for each month). Solid columns represent adults, shaded columns pulli and juveniles. Error bars show 1 standard error.

TABLE 2. Seasonal changes in bird numbers at Archerfield Airport, 1995-1998.

Species	Year	J	F	M	A	M	J	J	A	S	O	N	D
		Numbers Counted Each Month											
Straw-necked Ibis	1995								15	1	0	0	0
	1996	0	0	0	0	5	6	42	22	0	0	0	0
	1997	81	0	0	1	58	33	26	5	5	0	37	0
	1998	0	163	0	141	2	0	1					
Nankeen Kestrel	1995								0	0	1	0	2
	1996	2	2	4	1	2	0	1	0	1	0	0	0
	1997	2	3	2	1	0	0	0	0	0	0	1	1
	1998	2	0	0	0	0	0	2					
Banded Lapwing	1995								4	2	8	6	5
	1996	0	0	0	0	0	2	0	7	4	5	0	0
	1997	0	0	0	0	0	0	6	4	5	3	5	0
	1998	9	7	0	6	0	0	2					
Masked Lapwing	1995								43	22	18	31	43
	1996	5	0	6	16	14	20	25	16	22	17	20	7
	1997	4	7	9	3	18	62	43	33	27	27	13	15
	1998	3	8	3	4	0	23	38					
Galah	1995								4	2	2	9	6
	1996	0	0	0	2	0	0	0	6	11	50	66	13
	1997	29	0	17	0	0	0	8	29	15	35	12	6
	1998	15	4	0	0	0	0	9					
Magpie-lark	1995								50	33	0	9	18
	1996	0	2	3	5	14	8	19	16	34	5	7	14
	1997	2	13	33	21	44	18	56	60	36	38	18	30
	1998	9	21	9	63	51	14	29					
Willie Wagtail	1995								0	0	0	0	0
	1996	1	0	0	1	2	0	3	1	0	0	0	0
	1997	1	0	0	0	0	0	1	2	0	1	0	0
	1998	0	0	0	3	0	0	0					

Table 2 cont.

Australian Magpie	1995								26	39	24	21	18
	1996	1	54	19	92	35	35	49	52	70	44	91	46
	1997	20	45	82	106	52	30	19	68	42	48	45	48
	1998	47	34	77	80	28	35	41					
Torresian Crow	1995								33	24	9	26	7
	1996	17	20	3	6	6	9	29	11	9	4	4	4
	1997	92	8	8	5	68	12	6	17	2	20	14	10
	1998	9	33	5	4	4	6	4					
Richard's Pipit	1995								23	26	40	15	12
	1996	13	11	12	34	18	9	22	16	23	8	5	8
	1997	1	3	14	11	4	0	8	8	6	5	5	7
	1998	3	4	5	1	10	5	17					
Welcome Swallow	1995								0	2	0	0	0
	1996	0	0	0	0	0	5	8	0	0	0	0	0
	1997	0	0	0	0	0	0	0	0	0	0	0	15
	1998	20	0	0	23	6	6	0					
Fairy Martin	1995								6	31	20	17	0
	1996	0	30	0	0	0	0	25	0	0	0	0	5
	1997	0	0	0	0	0	0	0	30	5	12	15	10
	1998	10	0	0	0	0	0	0					
Golden-headed Cisticola	1995								0	0	0	0	1
	1996	0	2	2	0	0	0	0	0	0	1	0	3
	1997	2	0	0	0	0	0	0	0	1	1	3	0
	1998	1	2	2	2	1	2	1					
Common Starling	1995								212	18	8	46	1
	1996	0	0	0	1	25	8	59	251	21	17	56	33
	1997	0	32	2	11	0	200	75	85	4	21	18	30
	1998	20	0	0	77	89	10	41					

The Straw-necked Ibis *Threskiornis spinicollis* and Australian White Ibis *T. molucca* were present in highly variable numbers that showed no clear seasonal pattern. However, when their numbers were compared with previous rainfall totals it was clear that they were generally found at Archerfield during or following a month of heavy rainfall. Although the Torresian Crow was present on every survey, its numbers were quite variable, with a peak in January, and its peak numbers were also correlated with past rainfall (see below).

Australian Magpies had a peak of numbers in March and April, possibly the result of young birds moving in from their natal territories. Magpie-larks showed two peaks, one in April-May and another in July-September. The Common Starling was recorded throughout the year but with peaks of numbers in winter (June to August) with flocks of up to 250. Willie Wagtails *Rhipidura leucophrys* were also recorded mainly in winter.

Richard's Pipit numbers were reasonably constant throughout the year with a slight peak in October. Golden-headed Cisticolas *Cisticola exilis* also showed little seasonal variation, with a slight reduction in winter. Welcome Swallow *Hirundo neoxena* numbers were variable with peaks in December-January and April-July. Fairy Martins *H. ariel* were fairly regular from July-February with none being recorded from March-June.

The effect of rainfall

The numbers of some species seemed to be related to rainfall and this relationship was tested for the seven species with an overall percentage frequency of over 50%, and also for Straw-necked and Australian White Ibis because of their suspected association with rainfall. Total rainfall for 7, 14 and 21 days preceding the count were used as an index of past rainfall. No significant correlations ($P > 0.05$) were found between the three rainfall indices and monthly counts of Masked Lapwing, Galah *Cacatua roseicapilla*, Magpie-lark, Australian Magpie, Richard's Pipit or Common Starling. However, significant positive correlations were found in the analyses of Australian White and Straw-necked Ibis and Torresian Crow (Table 3). In all three species the highest correlation was between numbers and rainfall over the previous 7 days, but both ibises also showed some significant correlations over the previous 14 and 21 days.

There were a number of outliers for the plot of Straw-necked Ibis numbers vs. total rainfall over the preceding 7 days (identified by numbers in Fig. 3a) that can be explained with further information. In February 1997 (Fig. 3a-1), 81 Straw-necked Ibis were counted after only 11 mm of rain, but the week before that had 35 mm of rain. June and July 1997 (Fig. 3a-3 & 4) also have high numbers of Straw-necked Ibis (33 and 26 respectively) after comparatively little rainfall (6 and 3 mm) but these represent declining numbers from a flock of 58 recorded in May 1997 (Fig. 3a-2), after higher rainfall in the preceding week (37

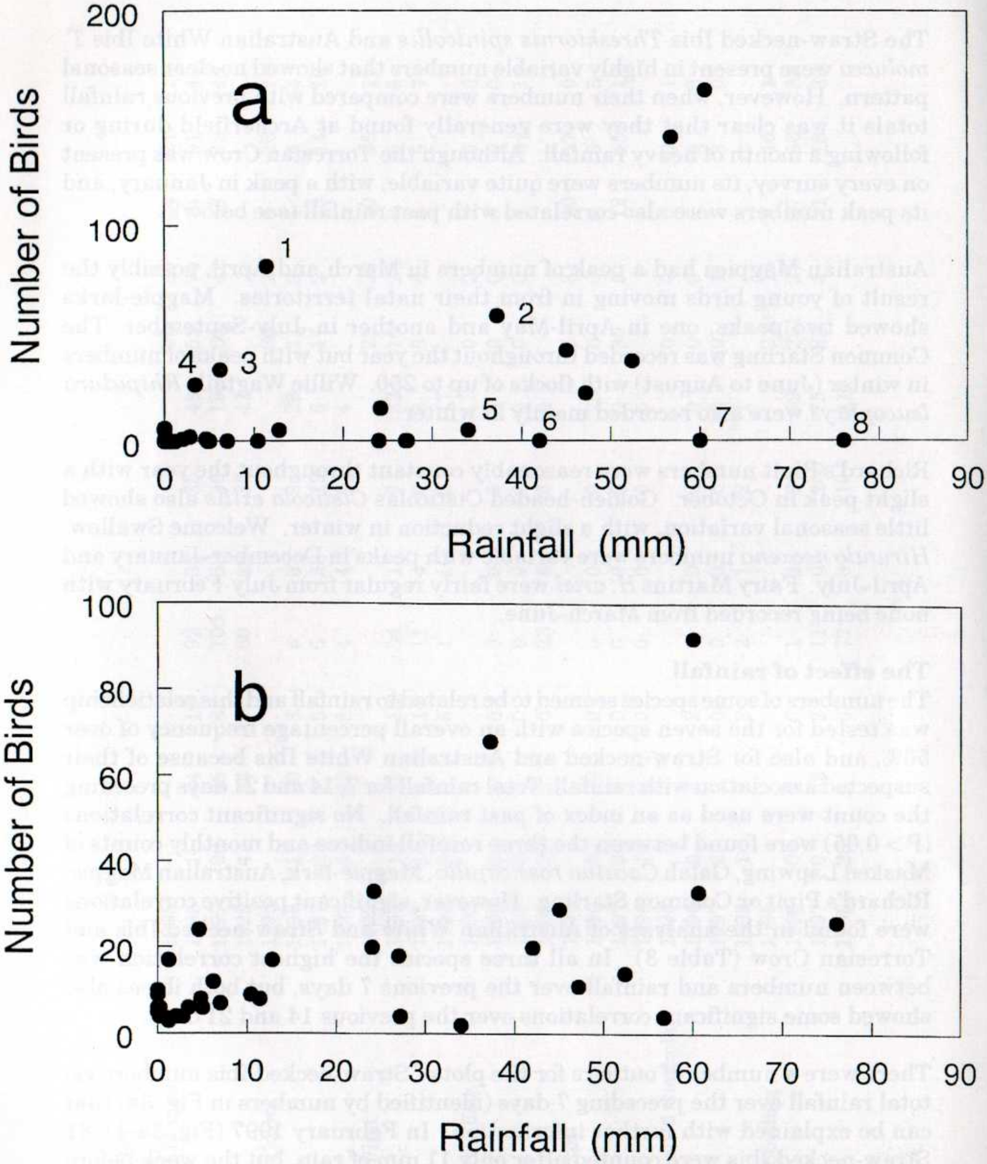

Fig. 3. The relationship between the number of birds counted for (a) Straw-necked Ibis and (b) Torresian Crow and rainfall (mm) recorded over the preceding week. Numbers in the graph are referred to in the text.

TABLE 3. Correlations between rainfall totals and monthly counts for three species of birds at Archerfield, 1995-1998.

	Correlation Coefficient (n=36)		
Species	Total Rainfall 7 days before count	Total Rainfall 14 days before count	Total Rainfall 21 days before count
Australian White Ibis	0.415*	0.208	0.402*
Straw-necked Ibis	0.483**	0.409*	0.461**
Torresian Crow	0.537**	0.249	0.247

Statistical significance: *=P<0.05, **=P<0.01

mm), and even more rainfall earlier in the month. There are also several cases (Fig. 3a-5,6,7 & 8) of no response by Straw-necked Ibis to high totals of rainfall in the preceding 7 days. These were all in summer (September to January) when they are breeding (Marchant & Higgins 1990). Straw-necked Ibis numbers are generally very low during this period, and a flock of 37 recorded in November 1997, following 52 mm of rain in the previous week, was an exception. If data for the summer months (September-January) are excluded, then the correlation between the previous week's rainfall and Straw-necked Ibis numbers is increased ($r = 0.770$, $n = 21$, $P < 0.01$).

Numbers of Torresian Crow were also significantly correlated with rainfall over the previous 7 days (Table 3, Fig. 3b), with the highest counts of 92 in January 1997 and 68 in May 1997 following 60 mm and 37mm of rain, respectively. Other counts over 25 were all associated with over 25 mm of rainfall. There was no indication of a clear seasonal change in their numbers and excluding the summer months produced little change in the still significant correlation ($r = 0.543$, $n = 21$, $P < 0.05$).

DISCUSSION

The Avifauna

The common species recorded from Archerfield are those that typically prefer open grassland/woodland habitats and many of these species are also common in surrounding suburban gardens, parks and sporting fields. However, the large expanse of short grass and the exclusion of dogs and most humans means that Archerfield Airport provides suitable habitat for some uncommon species in south-east Queensland. The Banded Lapwing, described by Roberts (1979) as "rare", has been shown to be a regular breeding visitor to the airfield.

Some migrant waders also make use of the airfield but this is generally not an important site for them. The Pacific Golden Plover *Pluvialis fulva* was recorded on three occasions in February and April 1996 and March 1998, and the Little Curlew *Numenius minutus*, described as "rare" by Roberts (1979), was recorded once, in October 1997. The Little Curlew has been previously recorded from Archerfield (Gynther *et al.* 1995) together with several other vagrants including Oriental Plover *Charadrius veredus* and Australian Pratincole *Stiltia isabella*. Gynther *et al.* (1995) suggested that the presence of the latter two species at Archerfield in November 1994 might be the result of the severe drought in much of Australia that year. This suggestion is supported by the fact that they were not recorded subsequently at Archerfield during this survey.

Population Changes of Masked Lapwing

The marked changes in the numbers of Masked Lapwing at Archerfield are surprising since it is considered a resident species (Marchant & Higgins 1993). They have been reported forming flocks in autumn and winter (the origin of the birds in the flocks is not known), with a dispersal to breed in late winter and early spring (Marchant & Higgins 1993). This corresponds with the situation observed at Archerfield with peak numbers from June to August followed by a lower but stable breeding population of 7 to 8 pairs from September to December. The breeding season (egg-laying) for southern Queensland is reported as mid-August to early December and also early March (Marchant & Higgins 1993), which largely agrees with these records. However, the dispersal of Masked Lapwings, including many of the breeding pairs, from the area from January to March seems unusual and not previously reported.

The density of breeding Masked Lapwings at Archerfield was 0.075 birds/ha (15/200 ha) which lies in between previous records of 0.02 birds/ha at Laverton (37°S, Victoria) and 1 bird/ha at Barilla Bay (42°S, Tasmania) (Blakers *et al.* 1984). The non-breeding flocks had a density of 0.16 birds/ha (32/200ha) which is lower than the density recorded at Laverton (0.38 birds/ha) (Blakers *et al.* 1984).

Seasonal Changes in Bird Populations

The relationship between rainfall and the numbers of Straw-necked Ibis and Torresian Crow is probably related to the availability of food. Numbers of Torresian Crows showed a statistically significant correlation only with rainfall totals over the previous 7 days and not with totals over the previous 14 or 21 days. This suggests that Torresian Crows have a short-term response to rainfall, probably feeding on insects immediately displaced by the rainfall. Numbers of ibis showed significant correlations with rainfall totals over 7, 14 and 21 days. This response to rainfall over a longer period is probably because the rain softens the ground, allowing the ibis to probe for some time before the ground dries out again. After breeding, the Straw-necked Ibis is considered locally nomadic (McKilligan 1975), and many of its movements seem to be related to rainfall and flooding (Marchant & Higgins 1990, Woodall 1985).

There is some evidence of seasonal movements in Magpie-larks with increased numbers in northern parts of Australia (Darwin, Cape York) in winter (Blakers *et al*. 1984). The variation in their numbers at Archerfield suggest that they might be moving through on passage, with birds flying north creating the peak in April-May and birds returning south creating the peak in July-September.

Hazards to Aircraft

Most bird strikes occur in the first 60 m (200 feet) above ground, so aircraft taking off and landing at airfields are particularly vulnerable to this hazard. With higher takeoff and landing speeds, larger commercial aircraft are more likely to hit birds because the birds have less time to take evasive action. These aircraft are also more likely to suffer structural damage because the force of impact increases greatly with increased speed (Byron 1998). This is reflected in the much lower number of bird strikes reported from Archerfield compared with Brisbane Airport for the period 1993-95 (4 and 81 respectively)(Anon. 1996), despite the fact that Archerfield is a busier airport.

A CSIRO study (van Tets *et al*. 1977) investigated bird strikes at Australian airports and identified the birds most likely to be involved. They also made recommendations for reducing the problem, primarily by reducing the food and shelter available for birds, by regular mowing to keep the grass short, and drainage of wet areas. With their large size and flocking behaviour, ibis pose a significant threat to aircraft. The present study has confirmed, in a quantitative manner, the importance of high rainfall and the consequent flooding in attracting birds like Straw-necked and Australian White Ibis and Torresian Crows to Archerfield. Clearly the provision of good drainage, particularly in the non - breeding season, is very important in reducing their numbers.

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REFERENCES

ANON. 1996. *Reported bird strikes in Australia*. Canberra: Bureau of Air SafetyInvestigation.

BLAKERS, M., DAVIES, S.J.J.F, & REILLY, P.N. 1984. *The Atlas of Australian Birds*. Melbourne: RAOU and Melbourne Univ. Press.

BYRON, 1998. Bird Strike. *Asia-Pacific Air Safety* 17: 11-13.
CASA 1998. Civil Aviation Safety Authority, web page. http://www.casa.gov.au/index.htm
GYNTHER, I, STEWART, D. & TARRANT, T. 1995. A flock of Oriental Plovers *Charadrius veredus* in south-east Queensland. *Sunbird* 25: 93-96.
MARCHANT, S. & HIGGINS, P.J. .(Eds). 1990. *Handbook of Australian, New Zealand and Antarctic Birds. Vol. 1B. Pelican to Ducks*. Melbourne: Oxford University Press.
MARCHANT, S. & HIGGINS, P.J. .(Eds). 1993. *Handbook of Australian, New Zealand and Antarctic Birds. Vol. 2. Raptors to Lapwings*. Melbourne: Oxford University Press.
MARKS, R.R. 1994. *Queensland airfields WW2 - 50 years on*. Brisbane: R. & J. Marks.
McKILLIGAN, N.G. 1975. Breeding and movements of the Straw-necked Ibis in Australia. *Emu* 75: 199-212.
ROBERTS, G.J. 1979. *The birds of south-east Queensland*. Brisbane: Queensland Conservation Council.
WOODALL, P.F. 1985. Waterbird populations in the Brisbane region, 1972-83, and correlates with rainfall and water heights. *Aus. Wildl. Res.* 12: 495-506.
Van TETS, G.F., VESTJENS, W.J.M., D'ANDRIA, A.H. & BARKER, R. 1977. *Guide to the Recognition and Reduction of Aerodrome Bird Hazards*. Canberra: Australian Government Publ. Serv.

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HABITAT PREFERENCE OF GREY FANTAILS *RHIPIDURA FULIGINOSA* WINTERING IN CENTRAL QUEENSLAND

JOHN BECK and KEN CHAN

ABSTRACT

The Grey Fantail *Rhipidura fuliginosa* is an insectivore that migrates to the Rockhampton District, central Queensland for the winter. The present study investigated the species' winter habitat use in a range of dry forest/woodland habitats in the Rockhampton region, that varied in their structural and floristic composition. Correlations of habitat variables and bird abundance revealed that the species preferred areas containing dense stands of tall trees (*Eucalyptus* or *Melaleuca* spp.) and shrubs. The fantails were less likely to occur in areas devoid of a shrub layer, or those almost exclusively having an understorey. Thus, although being a generalist in a broad forest/woodland habitat, the species prefers areas that are continuously layered and relatively dense. Such intact habitats tended to occur in areas that were relatively unaffected by human influence.

INTRODUCTION

Migratory birds encounter a variety of habitats in their annual movement cycles. Many migrant landbirds are considered generalists, capable of occupying multiple habitat types (e.g. Lovei 1989). It has been suggested that their foraging versatility enables them to exploit a wide range of food resources which may be mostly untapped by resident guilds (Leisler 1992). As the population of many migrant species may be controlled by wintering-ground events (Rappole & McDonald 1994) it is not surprising that a current conservation issue is response of wintering migrants to habitat disturbance (e.g. Askins *et al*. 1992, Dolman & Sutherland 1994). However, most studies on migrant-habitat associations have occurred in the northern hemisphere, and findings and predictions may not be applicable to Australian conditions.

Australian eucalypt habitats have been particularly affected by human activities (e.g. Barrett *et al*. 1994). Within Australia, Catterall *et al*. (1998) found that most wintering migrant species were absent from cleared or developed areas, although they occurred in small forest remnants. Most work in Australia on the response of birds to habitat disturbance has been directed to whole community studies (e.g. Kavanagh *et al*. 1985, Loyn 1985, Smith 1985) with little mention of how such disturbance affects wintering migrant populations of individual species.

Central Queensland is a stopover and wintering area for many temperate migrant birds (e.g. Crawford 1993). A typical non-breeding migrant that winters in the region is the Grey Fantail *Rhipidura fuliginosa*. The species is frequently referred to as a habitat generalist, being widespread across a range of habitats, though particularly common in eucalypt habitats (Abbott 1975). For example, Cameron (1985) observed a regular occurrence of Grey Fantails in sites ranging from eucalypt forest/woodland to savanna grassland in north-eastern New South Wales. Kikkawa (1974) computed fidelity indices of bird species to predict their association with three vegetation formations (wet, tall semi-arid and low semi-arid) in eastern Australia, and found that the Grey Fantail was significantly associated with all formations, thereby scoring one of the lowest fidelity indices.

A number of studies have demonstrated a significant effect of habitat loss and fragmentation on Grey Fantails. Kavanagh *et al.* (1985), who compared bird populations in logged and unlogged forests of New South Wales, found that the Grey Fantail was one of the species most affected by logging. Evans *et al.* (1997), who examined the relative use of bushland remnants by several bird species in southern Brisbane, found that Grey Fantails were abundant in large ($\geq$ 500 ha) remnants but rare in extremely small remnants (1-2 ha) and urban areas.

In this study, we examine the extent to which the Grey Fantail occupies eucalypt habitats around Rockhampton which differ considerably in their structure and floristics. We are particularly interested in determining if the 'generalistic' Grey Fantail prefers specific habitat characteristics.

METHODS

Study area

Rockhampton (23° 20'S, 150° 33'E) is situated on the Tropic of Capricorn within a region where land has been cleared to varying degrees for cattle grazing. Ten sites were selected within 50 km of Rockhampton (Fig. 1). Much of central Queensland is naturally eucalypt or acacia forest/woodland. Dominant tree species in the overall study area were *Corymbia tessellaris*, *Eucalyptus crebra*, *E. platyphylla*, *E. populnea* and *E. tereticornis*. Dry creekbeds often contained *Casuarina cunninghamiana* and *Melaleuca leucadendron*. Common shrubs included *Acacia farnesiana*, *A. shirleyi*, *Alphitonia excelsa*, *Lantana camara*, *Ficus* spp. and *Eucalyptus* saplings.

General site descriptions

Sixteen habitat variables were measured in each site. The variables and their method of measurement are given in Table 1. Sites 1 and 2 (> 20 ha; 23° 20.07'S, 150° 32.91'E and 23° 19.75'S, 150° 33.05'E, respectively) were located at the foothills of the Berserker ranges and contained an ephemeral creek. Site 3 (10 ha; 23° 19.53'S, 150° 31.41'E) was part of an ecological reserve of Central Queensland University and comprised an immature vegetation stand (<20 years old). Site 4 (10 ha; 23° 18.54'S, 150° 31.22'E), a highly cleared and disused horse riding venue, was located at the edge of Rockhampton. Sites 5 and 6

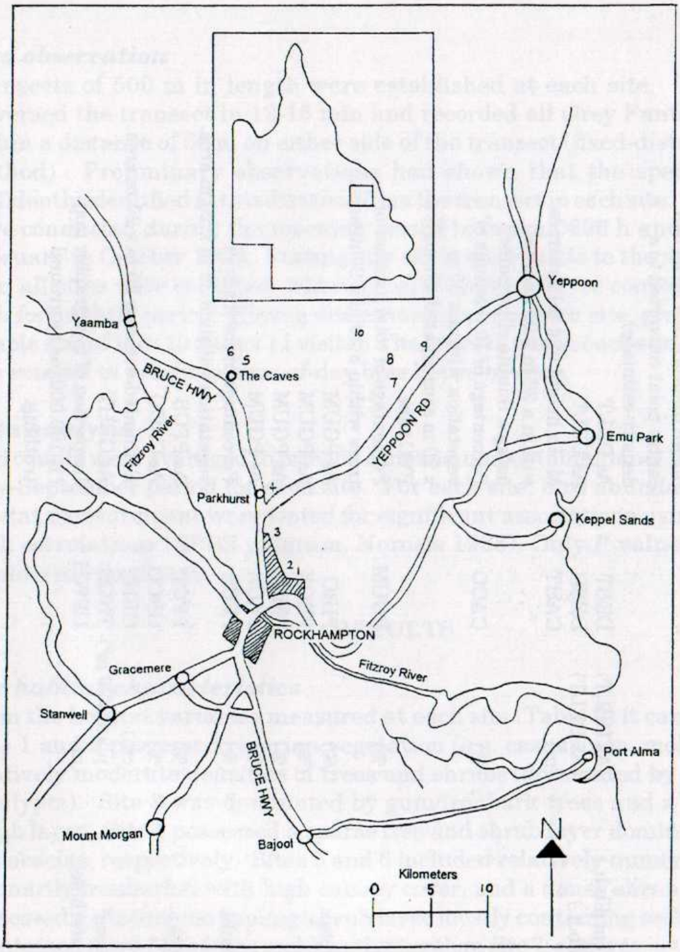

Fig. 1. Map showing the study area and study sites.

23° 10.04'S, 150° 28.92'E and 23° 39.67'S, 150° 29.30'E, respectively) were located inside a scientific park closed to the public. Sites 7 (> 20 ha; 23° 14.11'S, 150° 36.33'E) and 8 (5 ha isolate; 23° 12.63'S, 150° 36.53'E) were located alongside a dirt road and were surrounded by grazed paddocks. Site 8 was a lightly timbered area with regenerating shrubs following heavy grazing. Site 9 (> 20 ha; 23° 13.24'S, 150° 37.64'E) was located within a popular national park, with several well-used walking tracks. Site 10 (5 ha; 23° 10.70'S, 150° 33.90'E) was a largely isolated small remnant surrounded by grazing land and used by cattle, with an adjacent creek of permanent water supply.

TABLE 1. Summary of habitat variables measured at each site.

Habitat variable	Units	Ref. Code	Methods
Density of large trees (> 20 cm d.b.h.[A])	(plants/ha)	DELT	Point-quarter sampling method (mean distance of 4 trees to a centre point converted to a density estimate).
Density of small trees (5-10 cm d.b.h.)	(As DELT)	DEST	As DELT
Density of shrubs[B] (< 5 cm d.b.h.)	(As DELT)	DESH	As DELT
Canopy[C] height	(m)	CAHT	Mean height of 4 tallest trees within a 20 m x 20 m area using a Suunto clinometer.
Canopy cover	(%)	CACO	Percentage of 10 readings of vegetation within a 20 m x 20 m area sighted through a PVC tube.
Percentage gum *Eucalyptus*	(%)	PGUM	Percentage of total number of trees within a 20 m x 20 m area.
Percentage ironbark *Eucalyptus*	(%)	PIRO	As PGUM
Percentage box *Eucalyptus*	(%)	PBOX	As PGUM
Percentage *Melaleuca*	(%)	PMEL	As PGUM
Percentage *Acacia*	(%)	PACA	As PGUM
Projected foliage cover of shrubs	(%)	PFCS	Percentage of coverage of vegetation within a 20 m x 20 m area.
Projected foliage cover of trees	(%)	PFCT	As PFCS
Ground cover[D]	(%)	GRCO	As CACO
Ground height	(cm)	GRHT	Estimated within a 20 m x 20 m area.
Total number of ground species[E]	(plants/20 m^2)	TNGS	As GRHT
Distance from permanent waterhole	(m)	DPWH	Inspection of topographic map (1: 100 000) or by ground truthing.

[A]d.b.h. = diameter at breast height; [B]shrubs also defined as plants between 1 - 3 m tall; [C]vegetation strata 8 m above ground; [D]vegetation layer 1 m above ground; [E]all herb, grass and fern types.

Bird observation
Transects of 500 m in length were established at each site. The observer traversed the transect in 12-15 min and recorded all Grey Fantails observed within a distance of 50 m on either side of the transect (fixed-distance transect method). Preliminary observations had shown that the species could be confidently identified at this distance from the transect in each site. Observations were conducted during the morning period between 0600 h and 0900 h from February to October 1996. Fortnightly visits were made to the sites, and data from all sites were collected, where possible, within three consecutive days of each fortnightly period. Eleven visits were made to each site, giving an overall sample size of 110 (10 sites x 11 visits). The order in which each site was censused was rotated to preclude time-of-day bias between sites.

Data analysis
Bird counts were averaged to provide a mean number (abundance) of birds in the May-September period for each site. For each site, bird abundance and each habitat measurement were tested for significant associations using Spearman rank correlations (SPSS program, Norusis 1988). Only *P* values <0.05 were considered significant.

RESULTS

Site habitat characteristics
From the habitat variables measured at each site (Table 2) it can be seen that sites 1 and 2 possessed riparian vegetation (e.g. casuarinas, melaleucas) and relatively moderate densities of trees and shrubs (dominated by box/ironbark eucalypts). Site 3 was dominated by gum/ironbark trees and a dense acacia shrub layer. Site 4 possessed a sparse tree and shrub layer dominated by gums and acacias, respectively. Sites 5 and 6 included relatively numerous tall trees (primarily ironbarks) with high canopy cover, and a dense shrub layer. Site 7 possessed a continuous sapling/shrub layer mostly containing melaleucas. Site 8 contained more *Melaleuca* and *Eucalyptus* than site 7, and was not continuously layered. Site 9 had a relatively high density of trees (especially ironbarks) and shrubs, and hence provided high canopy cover. Site 10 had a very sparse tree layer (box-dominated) and a mostly absent understorey.

Bird abundance
In 1996, Grey Fantails arrived in the Rockhampton district during early April, were consistently seen at the study sites from early May to early September, but had completely departed by October (Fig. 2). Over this winter period, Site 8 had the lowest abundance, and other low counts were recorded for sites 2, 3, 4 and 10. Site 6 recorded the highest abundance, and other relatively high counts were observed in sites 1, 5, 7 and 9 (Table 3). The mean $\pm$ standard deviation of bird abundance for all site visits combined was 12.2 ± 4.6.

TABLE 2. Habitat measurements of each site.

Ref. Code	Site # 1	2	3	4	5	6	7	8	9	10
DELT	453.5	242.1	144.5	174.9	327.5	222.1	266.5	52.9	303.8	83.8
DEST	96.5	156.3	210.8	12.0	767.6	325.5	1106.1	752.9	2239.6	2.4
DESH	796.6	539.0	616.4	328.3	6550.8	3909.1	1117.4	407.7	3359.2	5.4
CAHT	24.1	22.9	16.5	27.3	21.0	21.8	13.9	8.5	23.2	16.8
CACO	37.0	33.0	28.0	24.0	35.0	35.0	36.0	8.0	44.0	37.0
PGUM	38.0	30.0	55.0	90.00	21.0	56.0	21.0	53.0	31.0	5.0
PIRO	30.0	40.0	40.0	0.0	91.0	10.0	58.0	17.0	41.0	0.0
PBOX	40.0	30.0	5.0	10.0	0.0	16.0	20.0	0.0	2.0	95.0
PMEL	17.0	17.0	0.0	10.0	0.0	2.0	76.0	63.0	0.0	0.0
PACA	27.5	17.7	98.0	87.0	0.0	4.0	14.0	0.0	33.0	0.0
PFCS	5.0	12.0	11.0	10.0	27.0	32.0	25.0	43.0	23.0	19.0
PFCT	56.0	54.0	50.0	46.0	49.0	65.0	60.0	64.0	69.0	54.0
GRCO	33.0	69.0	80.0	90.0	5.0	35.0	10.0	100.0	21.0	85.0
GRHT	40.0	43.0	40.0	110.0	10.0	30.0	20.0	45.0	35.0	28.0
TNGS	8.0	8.0	12.0	10.0	3.0	3.0	7.0	2.0	7.0	9.0
DPWH	200	20	3000	4000	7200	7200	2800	50	20	60

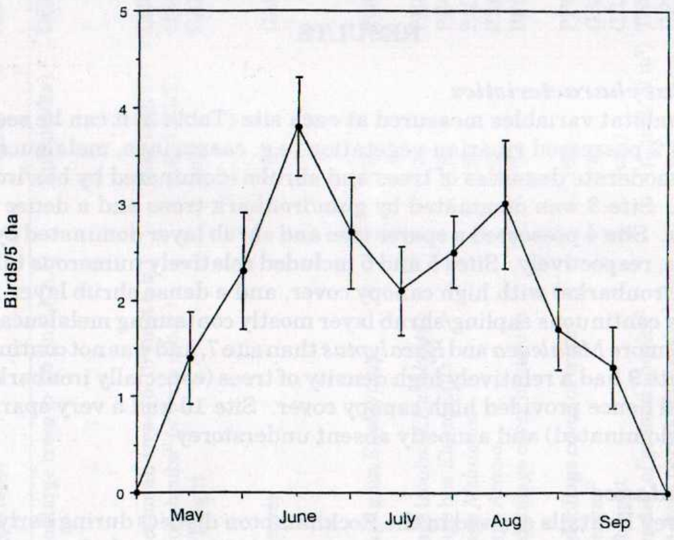

Fig. 2. Abundance of Grey Fantails at all sites between May and September 1996. Error bars represent standard errors of means (n = 110).

TABLE 3. Mean abundance (n = 11 visits) of Grey Fantails in each site between May and September 1996 (sites listed from least to most intact based on visual inspection in the field and the habitat measurements of Table 2).

	Site	Birds/5 ha
Most intact	6	18.0
↑	5	17.0
	9	16.5
	1	15.5
	7	14.0
	2	10.0
	3	10.0
	4	8.0
	10	7.5
Least intact	8	5.0

Relationship between habitat variables and bird abundance

The results of the correlation analysis had three variables significantly correlated with bird abundance, namely density of large trees DELT ($P<0.05$), density of shrubs DESH ($P<0.01$, Fig. 3) and ground cover GRCO ($P<0.01$) (Table 4). This analysis indicated that bird abundance increased in forest/woodland areas that were continuously layered, having a relatively dense arrangement of tall trees and shrubs. Such characteristics were recorded for sites 1, 5, 6, 7 and 9. Areas with reduced tree/shrub densities mostly exhibited higher ground cover (e.g. sites 2, 3, 4, 8 and 10). Ground cover was negatively correlated with tree/shrub density ($P<0.01$), and density of large trees was positively correlated with shrub density ($P<0.05$).

DISCUSSION

This study revealed that the wintering Grey Fantail has a distinct preference for certain areas containing dense shrubs and tall trees, such as sites 5, 6 and 9. The more structurally diverse forest/woodland areas used by Grey Fantails (e.g. sites 5, 6 and 9) tended to be relatively 'intact' compared to the remaining areas that had simpler forest/woodland structures, using the term 'intact' to describe forest/woodland areas that are layered throughout by well defined tree and shrub layers. Thus even a habitat generalist such as the Grey Fantail has a preference for certain habitat characteristics and, if its wintering grounds are cleared to a mixed extent, it is likely that it will prefer relatively intact areas that are continuously layered and dense. The negative correlation between bird abundance and ground cover demonstrates the effect of tree/shrub density on ground cover. That is, increased tree/shrub density would result in decreased ground species production and less ground cover due to reduced sunlight penetration through the vegetation layers.

Fig. 3. Relationship between Grey Fantail abundance and shrub density. Sites are represented by each point on the plot.

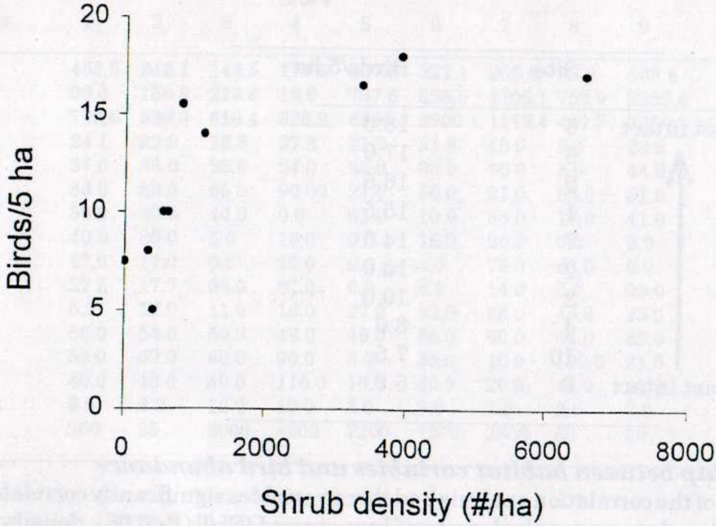

TABLE 4. Spearman rank correlation coefficients between habitat variables and Grey Fantail abundance.

Ref. Code	Coefficient
CACO	0.477
CAHT	0.310
DELT	0.754*
DESH	0.936**
DEST	0.486
DPWH	0.439
GRCO	-0.827**
GRHT	-0.558
PACA	0.043
PBOX	-0.116
PFCS	0.170
PFCT	0.284
PGUM	0.000
PIRO	0.495
PMEL	-0.258
TNGS	-0.347

*P<0.05
**P<0.01

One ecological requirement of the Grey Fantail is an abundant supply of perches from which it can capture insects by hawking (e.g. Cameron 1985, Beck 1996). In continuously layered habitats, there are more vegetation strata and hence perches available. In such areas, the birds may perform more prey attacks per unit time, since they may fly shorter distances in their pursuits, return to nearby look-out perches, scan for prey, and then execute more attacks. If an area contains no understorey, the birds must fly longer distances without having intermediate strata for resting between such flights, which would be energetically more demanding. The preference for denser, continuously layered areas may also be related to resource supply. For example, dense eucalypt-dominated areas sustain diverse and abundant invertebrate populations (e.g. Majer *et al.* 1992, Majer & Postle 1994). Furthermore, denser tree and shrub layers probably provide greater shelter from predators, and this may be especially important given the small physical size of the Grey Fantail (mean 8 g).

In tropical/subtropical central Queensland, land clearing has been particularly severe, and extensive land clearing still occurs throughout Australia. The long-term effect of habitat disturbance on the survival of migratory birds is yet to be investigated, but studies on Nearctic migrants (e.g. Rappole & McDonald 1994) have shown that wintering ground events (cf. breeding phases) tend to control the size of migrant populations. The Grey Fantail, along with other migrants, may be viewed as being quite generalistic with respect to habitat use, but the extent to which such versatility allows wintering migrants to cope with pressures exerted by habitat disturbance on a wide scale is largely unknown.

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REFERENCES

ABBOTT, I. 1975. Density and species diversity of bird populations in *Eucalyptus* forests in Victoria, Bass Strait Islands, and Tasmania. *Proc. Roy. Soc. Vic.* 87: 187-193.

ASKINS, R. A., EWERT, D. N. & NORTON, R. L. 1992. Abundance of wintering migrants in fragmented and continuous forests in the U. S. Virgin Islands. In Hagan, J. M. & Johnston, D. W. (Eds.) *Ecology and Conservation of Neotropical Migrant Landbirds*, pp. 198-206. Washington: Smithsonian Institution Press.

BARRETT, G. W., FORD, H. A. & RECHER, H. F. 1994. Conservation of woodland birds in a fragmented rural landscape. *Pacific Conserv. Biol.* 1: 245-256.

BECK, J. 1996. *Habitat Preference and Usage by the Migratory Grey Fantail (Rhipidura fuliginosa) in the Rockhampton District*. Honours Thesis, Central Queensland University, Rockhampton.

CAMERON, E. 1985. Habitat usage and foraging behaviour of three fantails (Rhipidura: Pachycephalidae). In Keast, A., Recher, H. F., Ford, H. & Saunders, D. (Eds.) *Birds of Eucalypt Forests and Woodlands: Ecology, Conservation, Management*, pp. 177-191. Chipping Norton: Surrey Beatty & Sons.

CATTERALL, C. P., KINGSTON, M. B., PARK, K. & SEWELL, S. 1998. Deforestation, urbanisation and seasonality: interacting effects on a regional bird assemblage. *Biol. Cons.* 84: 65-81.

CRAWFORD, M. 1993. *Birds in Capricornia*. Rockhampton: Central Queensland University.

DOLMAN, P. M. & SUTHERLAND, W. J. 1994. The response of bird populations to habitat loss. *Ibis* 137: 38-46.

EVANS, R., CATTERALL, C. P. & BRUMM, G. V. 1997. The habitat value of extremely small bushland remnants to birds in Brisbane. *Sunbird* 27: 38-44.

KAVANAGH, R. P., SHIELDS, J. M., RECHER, H. F. & ROHAN-JONES, W. G. 1985. Bird populations of a logged and unlogged forest mosaic at Eden, New South Wales. In Keast, A., Recher, H. F., Ford, H. & Saunders, D. (Eds.) *Birds of Eucalypt Forests and Woodlands: Ecology, Conservation, Management*, pp. 273-281. Chipping Norton: Surrey Beatty & Sons.

KIKKAWA, J. 1974. Comparison of avian communities between wet and semi-arid habitats of eastern Australia. *Aust. Wildl. Res.* 1: 107-116.

LEISLER, B. 1992. Habitat selection and coexistence of migrants and Afrotropical residents. *Ibis* 134: 77-82.

LOVEI, G. L. 1989. Passerine migration between the Palaearctic and Africa. *Current Ornithol.* 6: 143-174.

LOYN, R. H. 1985. Birds in fragmented forests in Gippsland, Victoria. In Keast, A., Recher, H. F., Ford, H. & Saunders, D. (Eds.) *Birds of Eucalypt Forests and Woodlands: Ecology, Conservation, Management*, pp. 323-331. Chipping Norton: Surrey Beatty & Sons.

MAJER, J. D. & POSTLE, A. C. 1994. Comparisons of arthropod species richness in eastern and western Australian canopies: a contribution to the species number debate. *Mem. Qld. Mus.* 36: 121-131.

MAJER, J. D., RECHER, H. F. & GANESHANANDAM, S. 1992. Variation in foliar nutrients in *Eucalyptus* trees in eastern and western Australia. *Aust. J. Ecol.* 17: 383-393.

NORUSIS, M.J. 1988. *SPSS/PC + V2.0 Base Manual.* Chicago: SPSS Inc.

RAPPOLE, J. H. & McDONALD, M. V. 1994. Cause and effect in population declines of migratory birds. *Auk* 111: 652-660.

SMITH, P. 1985. Woodchip logging and birds near Bega, New South Wales. In Keast, A., Recher, H. F., Ford, H. & Saunders, D. (Eds.) *Birds of Eucalypt Forests and Woodlands: Ecology, Conservation, Management*, pp. 259-271. Chipping Norton: Surrey Beatty & Sons.

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GRASS OWL STATUS AND DIET AT CHARTERS TOWERS, NORTH QUEENSLAND

P.L. BRITTON and A.B. ROSE

The Grass Owl *Tyto capensis* is widespread and sometimes locally numerous in the Wet Tropics, but the western population on the semi-arid Mitchell-grass plains west of Richmond is believed to be extinct (Storr 1984, Schodde & Mason 1980). Charters Towers is inland and semi-arid, but east of the Great Dividing Range and far from these western Mitchell-grass plains. Britton *et al.*(1996) concluded their discussion with the comment that a confirmed record near Charters Towers would be of considerable interest.

A road-killed female Grass Owl found by PLB and H.A. Britton in grassland at Mingela Pool (19°52' S,146°38' E), 45 km north-east of Charters Towers, on 3 October 1997 provided this confirmation, and there was a probable sighting by W. Baker at Toomba Station, 70 km west of Charters Towers, in mid-August 1998. This unconfirmed sighting prompted R. Bassingthwaighte (pers.comm.) to conclude that there might be an established population in the extensive tracts of grassland along Fletcher Creek at Toomba.

At midday on 27 September 1998, PLB , HAB and RB flushed a single bird from a well-used roosting site in an extensive area of Narrow-leaved Carpet Grass *Axonopus affinis* at 19°57' S, 145°37'E and two pellets were collected. This site is close to Fletcher Creek in Long Pocket and some 2 km from the other Fletcher Creek site. Later that day, using a vehicle during the twilight period, PLB, HAB, RB and J. Allen tried to find this species where it had been seen by W. Baker, but their only sighting was of a bird flushed from the grassland corridor between the two Fletcher Creek sites. On 29 September E.G. Bassingthwaighte flushed a single bird from grassland at Pony Pocket at 1400 h. This site, about 5 or 6 km west of Long Pocket, is in much drier, lightly wooded country about 1.5 km from any standing water or watercourse.

The two pellets were sent to ABR, who identified mammal and insect remains using his reference collection and relevant literature (Watts & Aslin 1981, CSIRO 1991). The data in Table 1 indicate that Canefield Rats *Rattus sordidus* and House Mice *Mus domesticus* were dominant in the diet at Toomba; an insect head count also revealed the presence of six short-horned grasshoppers (Orthoptera - Acridoidea). The Canefield Rat is a common prey item of coastal Queensland Grass Owls (Hollands 1991), and this same species was the only identified prey in two *Tyto* pellets (probably of Grass Owl) found west of Charters Towers at Lake Powlathanga (Britton *et al.* 1996). Apparently linked with a prolonged and substantial wet season since November 1997, the introduced House Mouse is now present in exceptional numbers at diverse sites around

Charters Towers. However, the Canefield Rat is an unexpected dominant so far west (see map in Strahan 1983).

TABLE 1. Grass Owl pellets collected at Toomba Station, North Queensland on 27 September 1998.

67 x 27 mm.	Two Canefield Rats, one House Mouse and six short-horned grasshoppers.
51 x 31 mm.	One Canefield Rat and two House Mice.

It is hoped that further data to be gathered during the new Birds Australia Atlas Survey will further clarify whether there is a viable breeding population of Grass Owls in the extensive tracts of grassland along Fletcher Creek at Toomba Station.

ACKNOWLEDGEMENTS

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REFERENCES

BRITTON, P.L., BRITTON, H.A. & ROSE, A.B. 1996. Note on the diet of the Letter-winged Kite near Charters Towers, North Queensland. *Sunbird* 26 : 63-65.

CSIRO, 1991. *The Insects of Australia*. Melbourne: Melbourne University Press.

HOLLANDS, D. 1991. *Birds of the Night*. Melbourne: Reed.

SCHODDE, R. & MASON, I.J. 1980. *Nocturnal Birds of Australia*. Melbourne: Lansdowne.

STORR, G.M. 1984. Revised List of Queensland Birds. *Rec. W. Aust. Mus. Suppl.* 19 : 1-189.

STRAHAN, R. (Ed.). 1983. *The Australian Museum Complete Book of Australian Mammals*. Sydney: Angus & Robertson.

WATTS, C.H.S. & ASLIN, H.J. 1981. *The Rodents of Australia*. Sydney: Angus & Robertson.

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PAST RECORD OF THE SPOTLESS CRAKE *PORZANA TABUENSIS* (RALLIDAE) AT LAKE EACHAM, NORTH QUEENSLAND

DARREN G. QUIN and BRUCE R. QUIN

The Spotless Crake *Porzana tabuensis* is a small, shy crake which usually feeds within the cover of dense vegetation (Blakers *et al*. 1984, Nielsen 1992, Marchant & Higgins 1993). It occupies a scattered distribution throughout Australia, and although it is encountered in all states, including Tasmania, large parts of the range of this species are not apparently occupied (Blakers *et al.* 1984, Marchant & Higgins 1993). A majority of records of the Spotless Crake are concentrated in south-eastern and south-western Australia. However, its shyness may account for the apparent absence of this species in various localities. This note reports a sighting from a locality where the Spotless Crake has not previously been recorded.

On 3 November 1990, a Spotless Crake was sighted at Lake Eacham, on the Atherton Tableland, North Queensland (approx. 17°16'S, 145°37'E; altitude 800 m). The bird was moving (presumably feeding) amongst dense shrubs below the rainforest canopy, above the waterline, but not far from the water's edge. The location of the sighting was about 200 m from the main picnic area, and only 5 m from a walking track. As far as we can ascertain, this is the first observation of a Spotless Crake in a volcanic lake surrounded by tropical rainforest. We consider that our sighting is valid. Despite limited experience with this species prior to the sighting, subsequent sightings in other parts of Australia leave us in no doubt with our identification.

In North Queensland, the status of the Spotless Crake is uncertain (Storr 1984, Nielsen 1992), although it is considered to be uncommon by Nielsen (1996) and there are few records in Blakers *et al.* (1984). It was not recorded by Bourke & Austin (1947) on the Atherton Tablelands, where Bravery (1970) suggested that it was "elusive and not often seen". Binns (1954) did not record the Spotless Crake at Lake Barrine, in similar habitat to that occurring at Lake Eacham, or in surrounding areas (including Lake Eacham). Gill (1970) also failed to record it in the Innisfail region, and White (1946) did not mention the Spotless Crake when discussing birds of a region bounded by Ingham and Mossman on the coast, adjacent ranges and Tablelands. Wheeler (1967) recorded it only at Bromfields Swamp, when discussing the birds of Cairns, Cooktown and the Atherton Tablelands. Storr (1984) considered that the species was moderately common in the north-eastern highlands of the Atherton Tablelands, where most records have been obtained (Nielsen 1996). Nielsen (1992) discussed the possibility of nocturnal northward migration during spring by this species, although permanent resident populations may exist on the Atherton Tableland (Nielsen 1996).

Habitats occupied by the Spotless Crake include permanent or ephemeral, terrestrial and littoral wetlands, which usually support continuous stands of tall emergent reeds, rushes and sedges, especially cumbungi (Blakers *et al.* 1984, Marchant & Higgins 1993). These wetlands may include rivers, streams, tidal creeks and lagoons, lakes, inundated depressions, peat bogs, saltmarsh and artificial wetlands, including those created by artesian bore drains in arid parts of Australia, or sewage ponds (Badman 1979, 1987; Blakers *et al.* 1984, Storr 1984, Marchant & Higgins 1993, Quin 1998). The Spotless Crake may also occur in shrubberies or thickets of mangrove (Blakers *et al.* 1984). In southern Victoria, the species also occupies one of the last remaining (following extensive vegetation removal) remnant swamp woodlands dominated by Mountain Swamp Gum *Eucalyptus camphora*, with an understorey of dense sedges (*Carex* and *Cyperus*) (Parks Victoria in prep., B.R. Quin & D.G. Quin pers. obs.).

In North Queensland, the Spotless Crake occupies dense, well-vegetated freshwater swamps and streams (Nielsen 1996), while there is a specimen from Paluma, a small town surrounded by upland tropical rainforest on the Paluma Range (Nielsen 1992). Nielsen (1992) suggested that the individual had possibly become disorientated by town lights and mist during northward migration, causing grounding. Lake Eacham also supports giant sedges (*Baumea articulata* and *Fuirena umbellata*), which surround the lake edges (Bourke & Austin 1947). Hence, Lake Eacham supports the important components of the preferred habitat of this species: wetlands with dense stands of emergent reeds (or sedges) (Marchant & Higgins 1993). Suitable vegetative habitat is found at this tropical, volcanic lake with adjacent rainforest. Thus, the recording of the Spotless Crake at this site is not altogether surprising.

This paper contributes to the knowledge of broad habitat types which this species may occupy, or at least utilise during spring migration, if suitable vegetative components are present. However, many more records are required to verify its status in North Queensland and the significance of tropical, volcanic lakes with rainforest. We have no evidence to suggest that the Spotless Crake is resident at Lake Eacham, as there is no mention of this species occurring at this site on a bird list provided by the Queensland National Parks and Wildlife Service, nor are there any records in the Queensland Bird Reports.

REFERENCES

BADMAN, F.J. 1979. Birds of the southern and western Lake Eyre drainage. *South Australian Ornithologist* 28: 29-55.

BADMAN, F.J. 1987. *Birds and the Bore drains of Inland South Australia*. Report prepared for the Nature Conservation Society of South Australia Inc., Adelaide.

BINNS, G. 1954. The camp-out at Lake Barrine, Atherton Tableland, north

Queensland. *Emu* 54: 29-46.

BLAKERS, M., DAVIES, S.J.J.F. & REILLY, P.N. 1984. *The Atlas of Australian Birds*. Melbourne: Royal Australasian Ornithologists Union & Melbourne University Press.

BOURKE, P.A. & AUSTIN, A.F. 1947. The Atherton Tablelands and its avifauna. *Emu* 47: 87-116.

BRAVERY, J.A. 1970. The birds of Atherton Shire, Queensland. *Emu* 70: 49-63.

GILL, H.B. 1970. Birds of Innisfail and hinterland. *Emu* 70: 105-116.

MARCHANT, S. & HIGGINS, P.J. (Eds.) 1993. *Handbook of Australian, New Zealand and Antarctic Birds. Volume 2: Raptors to Lapwings*. Melbourne: Oxford University Press.

NIELSEN, L. 1992. Spotless Crake at Paluma, North Queensland. *Sunbird* 22: 85-86.

NIELSEN, L. 1996. *Birds of Queensland's Wet Tropics and Great Barrier Reef*. Bowden: Gerard Industries.

PARKS VICTORIA in prep. *Draft Management Plan for Yellingbo Nature Conservation Reserve*. Melbourne: Parks Victoria.

QUIN, D.G. 1998. *Birds of Certain Bore Drains of Lake Eyre Region, South Australia*. Report prepared by Darren Quin of Birds Australia, Melbourne, for Kinhill Pty. Ltd.

STORR, G.M. 1984. Revised List of Queensland Birds. *Rec. West. Aust. Mus.*, Suppl. No. 19.

WHEELER, W.R. 1967. The birds of Cairns, Cooktown and the Atherton Tablelands. *Aust. Bird Watcher* 3: 55-75.

WHITE, S.R. 1946. Notes on the bird life of Australia's heaviest rainfall region. *Emu* 46: 81-122.

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