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USE OF RIPARIAN AREAS BY TERRESTRIAL BIRDS OF THE MULGA LANDS - SOUTH WEST QUEENSLAND

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ABSTRACT

The total abundance of individuals and species richness of terrestrial birds were found to be significantly higher in riparian habitat compared to surrounding non-riparian habitat in the Mulga Lands of south west Queensland. Ninety eight sites in riparian and upslope areas were sampled during two winters and one summer from July 1997 to August 1998.

The extent of the differences varied with time and was greatest during winter 1997, when rainfall was below average, and least during winter 1998, when rainfall was well above average. Nearly half of the 65 species analysed were at least 50% more abundant in riparian than in upslope areas and approximately one third were at least 50% more abundant in upslope areas. Very few species were recorded exclusively in one habitat or the other. The results suggest that the ecological importance of riparian areas to terrestrial birds of the Mulga Lands may be most acute during extended dry periods.

INTRODUCTION

Vegetation adjacent to waterways (riparian areas) may support a disproportionally high component of total terrestrial biodiversity and, in addition, is important to the functioning of adjacent habitats (Szaro & Jakle, 1985; Risser, 1990; Gregory *et al.*, 1991; Catterall 1993). Substantial research into this issue has been conducted in temperate North America, where

riparian areas are considered important habitat for both migratory and resident bird populations, particularly in arid and semi-arid regions.

Studies of bird communities within the eucalypt forests of eastern Australia have also demonstrated total abundance and species richness are significantly higher in riparian areas. Gregory & Pressey (1982) noted 43 species of birds as being specifically associated with riparian areas in the eastern highlands of Australia. Recher *et al.* (1991) and Loyn (1985) observed that moist riparian areas dominated by wet sclerophyll and rainforest vegetation in south east Australia supported a richer and more abundant avifauna than adjacent drier forests associated with the slopes and ridges. Chan (1995) reported similar findings from eucalypt woodlands of the New South Wales northern tablelands.

In riparian areas of subtropical coastal lowlands in south east Queensland, Bentley & Catterall (1997) and Catterall *et al.* (2000), respectively, observed higher densities of migratory insectivorous birds, and higher bird abundances and species richness than in corresponding adjacent habitats. In the tropical savannas of northern Australia Woinarski *et al.* (2000) make similar findings and note that the riparian avifauna appeared most distinct from avifauna in adjacent habitats in regions of lower rainfall.

In the more arid regions of Australia, Nix (1993) proposed that riparian areas are of critical importance in maintaining bird populations during dry periods, and that their degradation since European settlement is a likely cause of species decline. According to Wilson (1999) the semi-arid Mulga Lands of south west Queensland are widely recognised as the State's most degraded bioregion. Wilson (1999) noted that land degradation in the form of soil erosion and major alterations to vegetation communities occurs across most land types within the region but is most severe within mulga and alluvial (riparian) land zones. However there is a scarcity of information regarding the implications of this for the region's fauna.

Here we examine the importance of riparian areas to terrestrial birds within the Mulga Lands of south west Queensland. Specifically we measure the extent to which bird densities and diversity vary between riparian and adjacent habitats

METHODS

Study area

Data for the study were collected between July1997 and August 1998 from 98 sites distributed throughout the Mulga Lands biogeographic region (Thackway & Cresswell 1995; Wilson 1999) of south west Queensland. The study area is

bounded by latitudes 25^{O} - 29^{O}S and longitudes 144^{O} - 149^{O}E, and contains major portions of the Maranoa/Balonne, Warrego, Paroo, and Bulloo River catchments, and the townships of St. George, Charleville, Cunnamulla and Quilpie.

The climate of the area is semi-arid with 60% to 70% of the annual average rainfall of between 270mm and 570mm occurring during the summer months (October to March). Average monthly temperatures exceed 35^{O}C during summer and fall below 5^{O}C during winter (Neldner 1984).

Mulga *Acacia aneura,* the dominant canopy species, occurs widely throughout the study area and its distribution is closely related to extensive areas of weathered Tertiary land surfaces supporting loamy sandy or gravelly red earths (Neldner 1984; Wilson 1999). Vegetation structure ranges from forest and woodland in the less arid eastern parts of the region to shrublands in the west. The riparian component of the landscape is much more limited in extent, and occurs on alluvial clays of Quaternary origin as forest or woodland formations throughout the region (Neldner 1984; Wilson 1999).

Study Sites and Data Collection

Birds were counted repeatedly on Riparian (n = 42) and Upslope (n = 56) sites over three sampling periods (Winter 1997*,* Summer 1997/8*,* Winter 1998). A subset of 90 (of the 98) sites were sampled during Winter 1997 and Summer 1997/8, and 89 sites were sampled during Winter 1998. The winter surveys were conducted in July and August in both years and the summer survey was undertaken from mid November to early February.

Riparian sites contained woodland or forest vegetation associated with major permanent or ephemeral watercourses. Riparian vegetation was typically dominated by: river red gum *Eucalyptus camaldulensis*, coolibah *E. coolibah*, and/or yapunyah *E. ochrophloia.* Upslope sites were located at least 200m distant from riparian areas (or known permanent water sources) and approximately half of the sites were located more than two kilometres away. These sites generally supported woodlands and/or shrublands dominated by mulga *Acacia aneura* and/or poplar box *E. populnea.* Grasslands, clay pans and cleared pastures were not sampled. Bore drains and areas in their vicinity were also excluded from the study. Apart from these differences both the Riparian and Upslope sites sampled a broad range of environmental conditions (e.g vegetation structure, disturbance, proximity to water etc.) present within the Bioregion.

At each site measurements of bird species density, using standardised area counts, were obtained. Three evenly spaced circular plots (25m radius) were located within a 300m long by 50m wide rectangular site. Each site was visited on two separate mornings by an observer who recorded the species and number of individuals (group size) of all birds seen during a 10 minute sample of each circular plot. Thus, the total time spent per site-sampling period was; 10 mins X 3 plots X 2 days, or 60 mins. Statistical analyses were conducted at this resolution by combining bird counts from all 6 individual 10 minute plots. Sites within 500m of drainage lines were positioned parallel to them. Riparian sites were positioned immediately adjacent to drainage lines. Data collection took place between 0.5 hrs and 3.5 hrs after sunrise, and rainy or very windy days were avoided.

Weather conditions during the survey periods were assessed by comparing the average monthly rainfall (from 14 locations throughout the bioregion) during, and one month prior, to each period, with the long-term average for the same months (BOM 1999). These calculations confirmed that conditions varied among the sampling periods. Rainfall during the Winter 1997 sampling period was well below average (6.4 mm/month vs. 21.4 mm/month long-term), while both Summer 1997/8 and Winter 1998 experienced rainfall well above average (60.2 mm/month vs. 43.6 mm/month long-term, and 56.7 mm/month vs. 21.4 mm/month long-term, respectively).

Analyses

Differences in total abundance and species richness between Riparian and Upslope site types were analysed using Analysis of Variance (ANOVA; Zar 1984). Separate single factor ANOVAs were carried out on these variables using data derived from each individual sampling period. To examine differences between riparian and upslope areas over all three sampling periods, two factor ANOVAs were used based on Riparian Status (two levels: Riparian, Upslope) and Sampling Period (three levels; Winter 1997, Summer 1997/8, Winter 1998). The effect of sampling period was regarded as a random factor (block) and as a result, seasonal effects are excluded here but will be examined in a separate publication.

Prior to data analyses all records of water birds, and birds flying over the study plots (direct flights greater than ten metres above the emergent vegetation layer) were excluded from the data set. To improve statistical assumptions associated with normality and heterogeneity of variance, all abundance data was log transformed prior to analyses. Presented means and standard errors are back-transformed.

To measure the magnitude of the difference in abundance between riparian and upslope habitats, a riparian index was calculated for each species recorded at five or more sites, and for total abundance and species richness. The Riparian Index was calculated as a simple ratio of the mean Riparian density divided by the mean Upslope density. Indices exceeding one indicate proportionally more observations from riparian treatments. The reverse is true for indices of less than one. For example, a species with a Riparian Index of 2.0 was on average twice as abundant in Riparian sites as Upslope sites. Species recorded exclusively at five or more Riparian or Upslope sites were allocated a Riparian Index of "High" or "Low" respectively.

RESULTS

A total of 4156 bird records was obtained, accounting for 8549 individuals of 104 species. During the Summer 1997/8 sampling period 2292 individuals (81 species) were counted. The Winter 1997 and Winter 1998 sampling periods yielded 3261 individuals (71 species), and 2996 individuals (84 species) respectively. The Appendix (pp13-16) contains a list of all 104 species and their frequency of occurrence. Sixty five species were present at five or more sites and given a Riparian Index.

Of the 65 species, 43% had abundances at least 50% higher in Riparian habitats (Riparian Index > 1.5), while 29% exhibited the reverse trend (Riparian Index < 0.66). Prominent species of Riparian sites included: White-plumed Honeyeater, Willie Wagtail, Grey Shrike-thrush, Yellow-throated Miner, Red-winged Parrot, Brown Treecreeper, Magpie-lark, Black-faced Cuckoo-shrike, Little Friarbird, Laughing Kookaburra, Whistling Kite, White -browed Treecreeper, Australian Ringneck, Sacred Kingfisher, Peaceful Dove and Restless Flycatcher. Prominent Upslope species included: Rufous Whistler, Weebill, Chestnut-rumped Thornbill, Jacky Winter, Crested Bellbird, Striated Pardalote, Red-capped Robin, Singing Honeyeater, Mistletoebird, Yellow-rumped Thornbill, Hooded Robin, Striped Honeyeater and Splendid Fairy-wren.

Very few species were recorded exclusively in either in Riparian or Upslope zones areas. Only four species had greater than 95 % of individuals within Upslope treatments (Riparian Index > 0.05; Appendix): Splendid Fairy-wren, Yellow-rumped Thornbill, Chestnut-rumped Thornbill and Jacky Winter. Similarly, three species had more than 95% of individuals in Riparian areas (Riparian Index >20.0; Appendix): Pied Currawong, Laughing Kookaburra and Fairy Martin.

Table 1. Results of Analyses of Variance (ANOVA) examining differences in Riparian Status for Total Abundance.
Results are shown for each individual sampling period and over all sampling periods. Analyses based on Log (x+1) transformed values. Probability levels: * = P<0.05; ** P<0.01; *** = p<0.001; ns = not significant. Riparian Index = mean Riparian abundance/mean Upslope abundance.

Variable	No. of Site-Times	Riparian Index	ANOVA Results (F value; Probability level)		
			Riparian Status (df = 1)	Sampling Time (df = 2)	Interaction (df = 2)
Winter 1997 Abundance	90	3.82	52.17***	N/A	N/A
Summer 97/8 Abundance	90	2.30	42.12***	N/A	N/A
Winter 1998 Abundance	89	1.55	12.59**	N/A	N/A
Total Abundance	269	2.38	102.68***	8.83***	6.15**

Table 2. Results of Analyses of Variance (ANOVA) examining differences in Riparian Status for Species Richness.
Results are shown for each individual sampling period and over all sampling periods. Analyses based on Log (x+1) transformed values. Probability levels: * = P<0.05; ** P<0.01; *** = p<0.001; ns = not significant. Riparian Index = mean Riparian richness/mean Upslope richness.

Variable	No. of Site-Times	Riparian Index	ANOVA Results (F value; Probability level)		
			Riparian Status (df = 1)	Sampling Time (df = 2)	Interaction (df = 2)
Winter 1997 Species Richness	90	1.26	21.15***	N/A	N/A
Summer 97/8 Species Richness	90	1.12	6.62*	N/A	N/A
Winter 1998 Species Richness	89	1.00	0.00^{ns}	N/A	N/A
Species Richness	269	1.29	19.76***	4.46*	9.17***

Riparian habitats supported significantly ($p<0.001$) higher overall densities than adjacent Upslope habitats (Table 1; Figure 1). Over the three sampling periods and all 104 species, the average bird density was more than twice as high in Riparian areas compared with Upslope habitats. The most dramatic differences were evident during Winter 1997 when nearly four times as many birds were recorded from Riparian areas compared with Upslope habitats (Table 1). During Winter 1998 there were approximately 50 percent more observations from Riparian areas, while more than twice as many birds were observed in Riparian habitats during the Summer 1997/8 sampling period (Table 1).

Broadly similar patterns are evident for species richness (Table 2; Figure 2), although there was less difference between Riparian and Upslope habitats. Species richness was significantly higher in Riparian habitats during Winter 1997 and Summer 1997/8, and over all three Sampling Periods. However, no difference could be detected for Winter 1998, because of an increase in the number of species recorded within Upslope habitats.

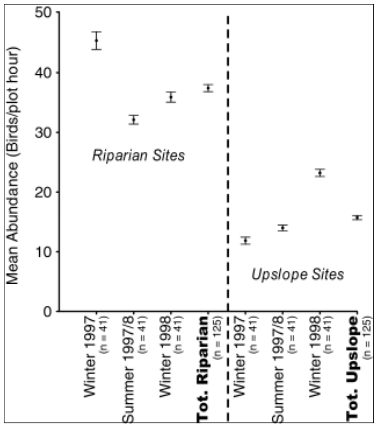

Figure 1: Riparian and upslope differences in total bird abundance (mean and standard error) over three sampling periods

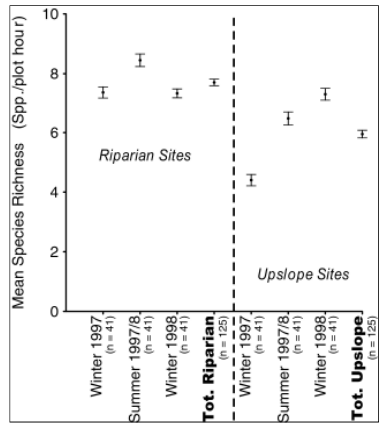

Figure 2: Riparian and upslope differences in species richness (mean and standard error) over three sampling periods

DISCUSSION

The results clearly demonstrate that riparian areas supported a greater number of birds and bird species than adjacent upslope habitats. Although the magnitude of total abundance was obviously influenced by a few highly abundant species (e.g. White-plumed Honeyeater, Yellow-throated Miner), the observation that nearly half of all species analysed were at least 50% more abundant in riparian areas indicates that these habitats provide important resources for many species. The further observation that such species come from a wide range of genera, feeding guilds, and other life history characteristics indicates that such resources have widespread benefits to terrestrial birds.

A variety of environmental factors may underlie the important role that riparian areas play in providing habitat for birds. These include: 1) the presence of more water in riparian areas; 2) increased structural complexity of the vegetation in riparian areas; and/or 3) higher levels of primary and secondary production arising from enhanced nutrient status of riparian areas (see Thomas *et al.* 1979; Riding & Carter 1992). While this study does not attempt to test the role of these related factors it is noteworthy that during Summer 1997/8 and Winter 1998 there was abundant free-standing water at locations many kilometres from riparian areas. On the other hand when rainfall was below average during Winter 1997, a much larger proportion of total abundance came from riparian sites. This observation is consistent with the findings of Woinarski *et al.* (2000) that report higher contributions to

total abundance and species richness from riparian habitats toward the end of the dry season and at locations with lower annual average rainfall. This suggests that even when there was ample water in upslope areas, riparian areas continued to support higher numbers of individuals and species, and that during adverse seasons the role of riparian areas may be further enhanced.

While many species appear to show a definite preference for either upslope or riparian areas, very few species were found exclusively in one or other. This indicates that a wide range of species utilised riparian habitats for at least part of their needs. Therefore, these habitat types should be viewed as a habitat complex rather than independent entities. The suggestion from these data that seasonal variation in rainfall affects the strength of the riparian/ upslope relationship is further support for this view. Management strategies must therefore consider the habitats of both riparian and adjacent upslope areas. Strategies aimed exclusively at the riparian habitats without regard for conditions in upslope areas may not be completely successful. However, the fact that riparian areas occupy such a small proportion of the landscape (often < 1%; see Knopf *et al.* 1988; Hewitt 1990) suggests the possibility that relatively minor improvements in riparian management may have widespread benefits to terrestrial bird populations across the landscape.

The results are broadly consistent with the findings of other studies within arid and semi-arid climates overseas (see for example Knopf *et al.*1988; Szaro & Jakle 1985; Johnson & Haight 1985; Holstein 1984), and are also similar to comparable work in northern Australia (Woinarski *et al.* 2000) and the more mesic south east Queensland (Bentley & Catterall 1997; Catterall *et al.* 2000). Of particular note are comparisons of the community indices: total abundance and species richness. This study records Riparian Indices of 2.38 and 1.29 for total abundance and species richness, respectively, when averaged across all three sampling periods. In eucalypt forests of south east Queensland, calculations from Bentley & Catterall (1997) suggest values of 1.86 and 1.83 respectively (over two seasons and one year), while Kingston & Catterall (unpublished) also recorded 1.86 for total abundance, but 1.5 for species richness during the same three sampling periods as the present study. Calculations from Woinarski *et al.* (2000) suggest values of 1.36 and 1.45 respectively. While there are minor differences in the design of these studies, comparisons with the results of the present study suggest that semi-arid riparian areas, may be characterised by less separation of species, but greater concentrations of individuals especially during dry periods.

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Appendix: Mean abundance of all species at Riparian and Upslope sites. Taxonomy and order of species follow Christidis & Boles (1994). Analyses based on Log (x+1) transformed values. Presented means are back-transformed. Riparian Index = mean Riparian abundance/mean Upslope abundance. Species with riparian indices denoted as "High" or "Low" indicate those observed exclusively in Riparian or Upslope sites respectively.

Species	Mean Species Abundance (Number of Sites over all three sampling periods in brackets)			Riparian Index (for species recorded at 5 or more sites only)
	Riparian (n = 125)	Upslope (n = 144)	Total (n=269)	
Emu *Dromaius novaehollandiae*	0.009 (1)	0.026 (3)	0.018 (4)	
Stubble Quail *Coturnix novaezealandiae*	0.009 (1)	0 (0)	0.004 (1)	
Australian Wood Duck *Chenonetta jubata*	0.046 (4)	0 (0)	0.021 (4)	
Pacific Baza *Aviceda subcristata*	0.006 (1)	0 (0)	0.003 (1)	
Black-breasted Buzzard *Hamirostra melanosternon*	0.006 (1)	0 (0)	0.003 (1)	
Black Kite *Milvus migrans*	0.006 (1)	0 (0)	0.003 (1)	
Whistling Kite *Haliastur sphenurus*	0.105 (11)	0.008 (1)	0.052 (12)	13.58
Wedge-tailed Eagle *Aquila audax*	0 (0)	0.015 (3)	0.008 (3)	
Little Button-quail *Turnix velox*	0 (0)	0.005 (1)	0.003 (1)	
Common Bronzewing *Phaps chalcoptera*	0.138 (15)	0.148 (19)	0.143 (34)	0.93
Crested Pigeon *Ocyphaps lophotes*	0.260 (13)	0.245 (19)	0.252 (32)	1.06
Peaceful Dove *Geopelia striata*	0.116 (16)	0.023 (4)	0.065 (20)	5.12
Galah *Cacatua roseicapilla*	0.404 (20)	0.307 (21)	0.352 (41)	1.32
Little Corella *Cacatua sanguinea*	0.164 (9)	0.010 (2)	0.079 (11)	16.69
Major Mitchell's Cockatoo *Cacatua leadbeateri*	0.083 (7)	0.019 (2)	0.049 (9)	4.33
Sulphur-crested Cockatoo *Cacatua galerita*	0.036 (4)	0.023 (3)	0.029 (7)	1.58
Cockatiel *Nymphicus hollandicus*	0.103 (7)	0.091 (6)	0.097 (13)	1.14
Red-winged Parrot *Aprosmictus erythropterus*	0.339 (24)	0.134 (13)	0.226 (37)	2.52
Pale-headed Rosella *Platycercus adscitus*	0.075 (8)	0.050 (5)	0.062 (13)	1.49
Australian Ringneck *Barnardius zonarius*	0.807 (25)	0.266 (21)	0.495 (46)	3.03
Blue Bonnet *Northiella haematogaster*	0.018 (2)	0.011 (1)	0.014 (3)	
Red-rumped Parrot *Psephotus haematonotus*	0.042 (4)	0.008 (1)	0.024 (5)	5.46
Mulga Parrot *Psephotus varius*	0.092 (8)	0.104 (11)	0.098 (19)	0.88
Budgerigar *Melopsittacus undulatus*	0.018 (1)	0 (0)	0.008 (1)	
Pallid Cuckoo *Cuculus pallidus*	0 (0)	0.013 (2)	0.007 (2)	
Fan-tailed Cuckoo *Cacomantis flabelliformis*	0 (0)	0.005 (1)	0.003 (1)	
Horsfield's Bronze-Cuckoo *Chrysococcyx basalis*	0 (0)	0.005 (1)	0.003 (1)	
Laughing Kookaburra *Dacelo novaeguineae*	0.187 (20)	0.005 (1)	0.087 (21)	38.31
Sacred Kingfisher *Todiramphus sanctus*	0.255 (22)	0.041 (7)	0.136 (29)	6.26
Rainbow Bee-eater *Merops ornatus*	0.076 (12)	0.081 (11)	0.078 (23)	0.94

Species	Mean Species Abundance			Riparian Index
	Riparian (n = 125)	Upslope (n = 144)	Total (n=269)	
Dollarbird *Eurystomus orientalis*	0.052 (8)	0.015 (3)	0.032 (11)	3.54
White-browed Treecreeper *Climacteris affinis*	0.117 (10)	0.015 (2)	0.061 (12)	7.91
Brown Treecreeper *Climacteris picumnus*	0.397 (25)	0.104 (11)	0.233 (36)	3.83
Superb Fairy-wren *Malurus cyaneus*	0.020 (2)	0.034 (3)	0.028 (5)	0.59
Splendid Fairy-wren *Malurus splendens*	0 (0)	0.117 (9)	0.061 (9)	Low
Variegated Fairy-wren *Malurus lamberti*	0.074 (5)	0.099 (9)	0.087 (14)	0.75
Spotted Pardalote *Pardalotus punctatus*	0 (0)	0.005 (1)	0.003 (1)	
Red-browed Pardalote *Pardalotus rubricatus*	0.013 (1)	0.005 (1)	0.009 (2)	
Striated Pardalote *Pardalotus striatus*	0.044 (4)	0.139 (14)	0.093 (18)	0.32
Weebill *Smicrornis brevirostris*	0.172 (7)	0.584 (32)	0.376 (39)	0.29
Western Gerygone *Gerygone fusca*	0.013 (1)	0 (0)	0.006 (1)	
Inland Thornbill *Acanthiza apicalis*	0.009 (1)	0.010 (1)	0.009 (2)	
Chestnut-rumped Thornbill *Acanthiza uropygialis*	0.011 (1)	0.611 (32)	0.295 (33)	0.02
Yellow-rumped Thornbill *Acanthiza chrysorrhoa*	0 (0)	0.144 (12)	0.074 (12)	Low
Yellow Thornbill *Acanthiza nana*	0 (0)	0.034 (3)	0.018 (3)	
Southern Whiteface *Aphelocephala leucopsis*	0 (0)	0.011 (1)	0.006 (1)	
Spiny-cheeked Honeyeater *Acanthagenys rufogularis*	0.678 (25)	0.583 (41)	0.627 (66)	1.16
Striped Honeyeater *Plectorhyncha lanceolata*	0.006 (1)	0.089 (10)	0.049 (11)	0.06
Noisy Friarbird *Philemon corniculatus*	0.051 (5)	0.039 (6)	0.044 (11)	1.31
Little Friarbird *Philemon citreogularis*	0.448 (24)	0.060 (8)	0.227 (32)	7.43
Blue-faced Honeyeater *Entomyzon cyanotis*	0.051 (4)	0.044 (3)	0.047 (7)	1.15
Noisy Miner *Manorina melanocephala*	0.410 (9)	0.058 (2)	0.211 (11)	7.05
Yellow-throated Miner *Manorina flavigula*	1.308 (24)	0.622 (25)	0.913 (49)	2.10
Singing Honeyeater *Lichenostomus virescens*	0.030 (3)	0.155 (11)	0.095 (14)	0.19
Grey-headed Honeyeater *Lichenostomus keartlandi*	0 (0)	0.011 (1)	0.006 (1)	
White-plumed Honeyeater *Lichenostomus penicillatus*	9.631 (40)	0.989 (40)	3.360 (80)	9.73
Brown Honeyeater *Lichmera indistincta*	0.023 (2)	0.021 (3)	0.022 (5)	1.14
Painted Honeyeater *Grantiella picta*	0.006 (1)	0.008 (1)	0.007 (2)	
White-fronted Honeyeater *Phylidonyris albifrons*	0 (0)	0.010 (2)	0.005 (2)	
Black Honeyeater *Certhionyx niger*	0.006 (1)	0 (0)	0.003 (1)	
Crimson Chat *Ephthianura tricolor*	0 (0)	0.005 (1)	0.003 (1)	
Jacky Winter *Microeca fascinans*	0.006 (1)	0.229 (22)	0.119 (23)	0.02
Red-capped Robin *Petroica goodenovii*	0.011 (2)	0.133 (16)	0.074 (18)	0.08
Hooded Robin *Melanodryas cucullata*	0.009 (1)	0.061 (10)	0.036 (11)	0.14
Eastern Yellow Robin *Eopsaltria australis*	0.034 (4)	0.005 (1)	0.018 (5)	6.91
Grey-crowned Babbler *Pomatostomus temporalis*	0.029 (3)	0.106 (9)	0.069 (12)	0.27
White-browed Babbler *Pomatostomus superciliosus*	0.021 (1)	0 (0)	0.010 (1)	
Hall's Babbler *Pomatostomus halli*	0.051 (2)	0.097 (8)	0.075 (10)	0.52

Species	Mean Species Abundance			Riparian Index
	Riparian (n = 125)	Upslope (n = 144)	Total (n=269)	
Cinnamon Quail-thrush *Cinclosoma cinnamomeum*	0 (0)	0.008 (1)	0.004 (1)	
Varied Sittella *Daphoenositta chrysoptera*	0 (0)	0.023 (2)	0.012 (2)	
Crested Bellbird *Oreoica gutturalis*	0.035 (5)	0.109 (14)	0.074 (19)	0.32
Golden Whistler *Pachycephala pectoralis*	0.006 (1)	0 (0)	0.003 (1)	
Rufous Whistler *Pachycephala rufiventris*	0.107 (12)	0.301 (31)	0.206 (43)	0.36
Grey Shrike-thrush *Colluricincla harmonica*	0.397 (29)	0.157 (21)	0.263 (50)	2.53
Restless Flycatcher *Myiagra inquieta*	0.117 (11)	0.015 (3)	0.061 (14)	7.90
Magpie-lark *Grallina cyanoleuca*	0.314 (23)	0.106 (13)	0.199 (36)	2.96
Grey Fantail *Rhipidura fuliginosa*	0.045 (5)	0.070 (8)	0.058 (13)	0.64
Willie Wagtail *Rhipidura leucophrys*	0.574 (25)	0.262 (28)	0.400 (53)	2.19
Black-faced Cuckoo-shrike *Coracina novaehollandiae*	0.231 (23)	0.069 (12)	0.142 (35)	3.32
White-bellied Cuckoo-shrike *Coracina papuensis*	0.022 (2)	0 (0)	0.010 (2)	
Ground Cuckoo-shrike *Coracina maxima*	0 (0)	0.008 (1)	0.004 (1)	
White-winged Triller *Lalage sueurii*	0.028 (4)	0.023 (4)	0.025 (8)	1.24
Olive-backed Oriole *Oriolus sagittatus*	0.014 (2)	0.013 (1)	0.014 (3)	
White-breasted Woodswallow *Artamus leucorhynchus*	0.028 (2)	0 (0)	0.013 (2)	
Masked Woodswallow *Artamus personatus*	0.017 (3)	0.008 (1)	0.012 (4)	
White-browed Woodswallow *Artamus superciliosus*	0.150 (7)	0.021 (1)	0.080 (8)	7.03
Black-faced Woodswallow *Artamus cinereus*	0.013 (1)	0 (0)	0.006 (1)	
Little Woodswallow *Artamus minor*	0.011 (1)	0.026 (3)	0.019 (4)	
Grey Butcherbird *Cracticus torquatus*	0.035 (5)	0.069 (9)	0.053 (14)	0.50
Pied Butcherbird *Cracticus nigrogularis*	0.035 (4)	0.044 (6)	0.040 (10)	0.78
Australian Magpie *Gymnorhina tibicen*	0.138 (14)	0.115 (14)	0.126 (28)	1.20
Pied Currawong *Strepera graculina*	0.051 (5)	0 (0)	0.023 (5)	High
Australian Raven *Corvus coronoides*	0.174 (19)	0.130 (14)	0.150 (33)	1.34
Little Crow *Corvus bennetti*	0.013 (1)	0 (0)	0.006 (1)	
White-winged Chough *Corcorax melanorhamphos*	0.124 (5)	0.031 (3)	0.074 (8)	4.07
Apostlebird *Struthidea cinerea*	0.414 (13)	0.403 (15)	0.408 (28)	1.03
Spotted Bowerbird *Chlamydera maculata*	0.075 (9)	0.083 (13)	0.079 (22)	0.91
Richard's Pipit *Anthus novaeseelandiae*	0 (0)	0.020 (4)	0.010 (4)	
Zebra Finch *Taeniopygia guttata*	0 (0)	0.051 (4)	0.027 (4)	
Double-barred Finch *Taeniopygia bichenovii*	0.029 (4)	0.055 (7)	0.043 (11)	0.53
Mistletoebird *Dicaeum hirundinaceum*	0.006 (1)	0.091 (13)	0.050 (14)	0.06
Fairy Martin *Hirundo ariel*	0.112 (7)	0.005 (1)	0.054 (8)	22.87
Rufous Songlark *Cinclorhamphus mathewsi*	0.050 (7)	0.020 (4)	0.034 (11)	2.52
Brown Songlark *Cinclorhamphus cruralis*	0.009 (1)	0 (0)	0.004 (1)	

PREDATION ON AUSTRALASIAN GANNET *MORUS SERRATOR* BY SOUTHERN GIANT-PETREL *MACRONECTES GIGANTEUS*

GREGORY J. ANDERSON

ABSTRACT

Successful predation of an Australasian Gannet, *Morus serrator*, by a juvenile Southern Giant-petrel, *Macronectes giganteus*, is reported for the first time. The circumstances and method of killing and eating are descibed. In their breeding and nonbreeding seasons Southern Giant-petrels are opportunistic predators and scavengers taking both vertebrate and invertebrate prey (Marchant & Higgins 1990). Literature reporting other avian prey and methods of predation by this species is summarised.

OBSERVATIONS

On June 15, 1996, at least two juvenile Giant-petrels *Macronectes* sp. were observed from Point Lookout, North Stradbroke Island, southeast Queensland (27°25' S, 153°32' E). Also present were large numbers (hundreds) of Australasian Gannets (*Morus serrator)* feeding close to shore by plunging into the sea. One or two Giant-petrels were seen at various times throughout the day, usually in flight, but on two occasions single birds were observed sitting on the water. Conditions were overcast but visibility was very good. Observations were made using 7x35 binoculars and a spotting scope with a 20x eyepiece.

At 1630 hours a juvenile Giant-petrel was observed in an agitated state on the water approximately 20m from shore. Closer inspection revealed a greenish tip to the bird's bill indicating that this individual was a Southern Giant-petrel *Macronectes giganteus*. The cause of the bird's agitation soon became clear as it was in the process of drowning an Australasian Gannet. The much larger Petrel was standing/sitting on the back of the Gannet, which at this stage was still very much alive and struggling to free itself. The Petrel held the neck of the Gannet in its bill and was forcing the head of the bird beneath the surface of the water. After about 5 minutes the struggles of the Gannet diminished and by 10 minutes the bird was completely limp. During the entire time its head was held underwater. While the Gannet was struggling vigorously the Giant-petrel had its wings spread, presumably for balance.

After the Gannet was dead the Petrel released its hold and proceeded to pluck the carcass at the base of the neck just forward of the right wing. It continued to straddle the bird while it performed this operation. After approximately 10 minutes of plucking the Petrel began feeding on the carcass from the plucked area. Observations were continued for a further 10 minutes as the Giant-petrel continued to feed. This entire event was only interrupted once (during the plucking stage) when a White-bellied Sea-Eagle *Haliaeetus leucogaster* attempted to steal the prey and approached very close to the Giant-petrel. After approximately 30 seconds of an aggressive response from the Giant-petrel (jabbing with its bill), the Sea-Eagle departed.

The means by which the Petrel initially approached the Gannet was not observed. It is possible that the Gannet was injured and then attacked by the Petrel, but the vigorous nature of the Gannet's struggles when it was first observed suggests it was not seriously injured before the Petrel attacked. It is possible that the Gannet was apprehended by the swimming Petrel after it surfaced from a feeding dive.

DISCUSSION

Giant-petrels are aggressive and opportunistic predators and scavengers taking both vertebrate and invertebrate prey. During the breeding season many species of birds are taken to feed the young. These include a number of species of penguins and many small to medium sized seabirds such as Common Diving-Petrel *Pelecanoides urinatrix*, South Georgian Diving-Petrel *Pelecanoides georgicus*, Southern Fulmar *Fulmarus glacialoides*, Antarctic Petrel *Thalassoica antarctica*, Cape Petrel *Daption capense*, Snow Petrel *Pagodroma nivea*, White-headed Petrel *Pterodroma lessoni*, Blue Petrel *Halobaena caerulea*, Antarctic Prion *Pachyptila desolata*, Slender-billed Prion *Pachyptila belcheri*, Grey Petrel *Procellaria cinerea*, Sooty Shearwater *Puffinus griseus*, Short-tailed Shearwater *Puffinus tenuirostris*, Wilson's Storm-Petrel *Oceanites oceanicus*, Imperial Cormorant *Phalacrocorax atriceps*, Greater Sheathbill *Chionis alba*, Great Skua *Catharacta skua* and Kelp Gull *Larus dominicanus* (Green, 1986; Hunter, 1983, Punta & Herrera, 1995). While much of the foraging of breeding Giant-petrels is carried out around breeding colonies of other species, particularly penguins, it is highly likely that some of their prey is caught at sea.

Observations on Giant-petrel predation on other birds during the non-breeding season are more limited, but avian prey species include several penguin species (Marchant & Higgins, 1990), Cape Petrel (Harper, 1987),

Black-browed Albatross *Diomedea melanophris* (Cox, 1978) and Yellow-nosed Albatross *Diomedea chlororhyncos* (Barton, 1979). Hunter (1983) has suggested that the ability of Giant-petrels to take a variety of prey may be more important in the winter when penguin and seal carrion is scarce.

There are only a few recorded instances of Southern Giant-petrels killing birds at sea. Occasionally this may be incidental when the Petrels are part of dense feeding flocks. For example, in such a situation Harper (1987) observed a Southern Giant-petrel beat a Cape Petrel with its outstretched wings to disable it, then kill and eat the bird. A mixed group of Southern and Northern Giant-petrels has been observed feeding on a live Yellow-nosed Albatross *Diomedea chlororhynchos* (Barton, 1979), but whether the Albatross was initially disabled by one or more Giant-petrels or whether it was injured in some other way could not be determined. However, several examples of hunting of birds have been recorded and this is likely to be the norm. In each of the recorded cases, the Petrel landed on the surface nearby, then swam up to its victim. For smaller species, the prey is grasped by the wing and battered against the surface (Harper, 1987) but this is not practical for larger species. In one instance, where the prey was an immature Black-browed Albatross *Diomedea melanophris*, the victim was approached while it slept. The Southern Giant-petrel flew in and landed on the back of the albatross, grasped the bird by the neck, and forced its head underwater until the victim drowned (Cox, 1978). This mode of killing is very similar to that described here.

Hunting by Southern Giant-petrels has been recorded off the Argentinean coast where one or more individuals of this species have been observed repeatedly attacking a breeding colony of Imperial Cormorants (Punta and Herrera, 1995). The Petrel(s) would drive the birds out over the water then chase a bird that had become separated from the others. The attack was aimed at forcing the cormorant onto the water and sometimes involved the Petrel hitting the cormorant with its beak or body. Once on the surface the Petrel would land and continue the attack with its beak until the cormorant was dead. Only two of 85 attacks observed succeeded in killing the cormorant.

The frequency with which bird species appear in the diet of Giant-petrels feeding young suggests that these large seabirds are proficient at capturing birds at sea and it is possible that they also regularly prey on seabirds during the non-breeding season. Although most of the birds caught are quite small, Giant-petrels are powerful birds and they are clearly able to subdue much

larger species, including albatrosses, so an Australasian Gannet is well within their capability. Gannets often feed in large flocks and their method of feeding may make them susceptible to predation by Giant-petrels.

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FOOD CACHING BEHAVIOUR IN THE AUSTRALIAN MAGPIE *GYMNORHINA TIBICEN.*

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INTRODUCTION

Food caching behaviour has been reported in a variety of bird and mammal species (Sherry 1985); and is especially associated with the Corvids (crows, jays and jackdaws) (James & Verbeek 1983) and Parids (tits and chickadees) (Baker et al. 1990). This behaviour has not been reported widely among the Artamidae, a predominantly Australian family of birds closely related to Corvids (Sibley *et al* 1988) which includes Butcherbirds (*Cracticus*), Currawongs (*Strepera*), Woodswallows (*Artamus*) and the Australian Magpie *Gymnorhina tibicen*.

Bell (1983) noted a food burying behaviour in the Pied Currawong *Streperea graculina*, and in a comprehensive study of the western race of the Australian Magpie, Robinson (1956 p.303) briefly notes that "in times of plenty magpies were observed hiding food under stones or in the scrub". These appear to be the only descriptions of food caching behaviour in the Artamidae to date.

OBSERVATIONS

During the 2001 breeding season (July-Nov) three male Australian magpies each from three separate breeding pairs were observed caching food. The magpies were located in Greenbank (40km SW of Brisbane), Noosa (120km N of Brisbane) and Mount Cotton (40km SE of Brisbane). They were being observed during a larger study whose aim is to examine the effect supplementary feeding on their reproductive success, timing of breeding and behaviour (Rollinson unpublished data).

When the caching behaviour was noted the birds were being provided with supplementary food by humans. After feeding, the males collected food in their beaks and moved away to choose an area in which to bury the food. In all pairs observed the food caching behaviour was performed only by the male, and females were not seen caching food.

The locations of the buried food were noted and examined after the magpies had left. Most caches were simply a loose covering of leaves and twigs placed over the food and always within 0.5 metres of a tree. On one occasion the male bird from the Noosa pair was observed caching the food behind a section of peeling bark of a Red Bloodwood Gum. What happened to the food once it was stored is at present uncertain. The magpies were not observed returning to the cached food.

The cache sites were revisited 24 hrs later but only one contained the food. It cannot be assumed that the magpies had removed the stored food. More investigation is needed to confirm whether they actually return for the food. These observations suggest the possibility that the birds are using landmarks (ie. trees) to relocate the cached food rather than random placement. Such use of landmarks is well known among Corvids (Sherry 1985) but needs to be confirmed for the Australian Magpie.

The Australian Magpie fills an ecological niche similar to that occupied by crows, jays, and jackdaws (Brown & Veltman 1987). The food caching behaviour observed in the Australian Magpie enhances this niche similarity. The trait was observed here, and by Robinson (1956), in association with abundant artificial food. It is possible that food caching behaviour in the Australian Magpie is a response to the general feeding of wildlife by Australians (Thomas 2000; Rollinson unpublished data). If, under natural circumstances, food caching behaviour only occurs in rare times of food abundance then this may account for the lack of reported observation and description in the literature.

The motivations behind food caching often vary greatly between food caching species. Why and how Australian magpies appear to store food, and recover it, would give us insight into their spatial memory and warrants further study.

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AUSTRALIAN KING-PARROT *ALISTERUS SCAPULARIS* EATING SILVER ELKHORN FERN *PLATYCERIUM VEITCHII*.

CRAIG EDDIE

ABSTRACT

The diet of the Australian King-Parrot *Alisterus scapularis* typically includes fruit, nuts, seeds, herbaceous plants, nectar, blossoms and leaf buds (Forshaw and Cooper 1981). An observation of two birds eating Silver Elkhorn Fern *Platycerium veitchii* is described here. Until now ferns (Pteridophyta) have not been reported as a food of this parrot (Higgins 1999, Barker and Vestjens 1989).

OBSERVATIONS

On 28 September 2001, fauna observations were made while walking in Palmgrove National Park (Scientific), approximately 90km NW of Taroom, Central Queensland. A stop was made at the confluence of two narrow sandstone gorges (25°58'54" S, 149°24'46" E) vegetated by Spotted Gum *Corymbia citriodora*, Queensland Blue Gum *Eucalyptus tereticornis*, Carnarvon Fan Palm *Livistona nitida*, Swamp Mahogany *Lophostomen suaveolens* and dry rainforest species. At 0935 EST a male Australian King-Parrot flew down from a mature Swamp Mahogany and landed on a clump of Silver Elkhorn growing with other epiphytic and lithophytic plants on a huge sandstone boulder. The male remained perched warily on a fertile frond until joined by a female on a nearby Silver Elkhorn clump. The female immediately began eating the outer edge of a sterile base frond (nest-frond). The male followed suite and both birds clambered along the outside of each Silver Elkhorn clump using the fertile fronds as foot and beak holds. Both birds grasped one small piece of sterile frond from each of several plants, masticated this with their beaks and swallowed after several seconds. The birds fed in this manner for about five minutes until they were startled and flew off. Other chewed sterile fronds of Silver Elkhorn were seen in the vicinity, but could not be positively attributed to Australian King-Parrots.

Silver Elkhorn is a common lithophytic or epiphytic fern on the sandstone outcrops of Central Queensland (Andrews 1990, author pers. obs.). It is not known whether Silver Elkhorn represents a 'normal' component of the diet of this species, or its consumption was a response to shortages of other food sources given the prolonged drought in this locality at the time of the observation.

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THE AVIFAUNA OF COOLMUNDA DAM FROM 1983 TO 2000

ERIC BIRT

ABSTRACT

A total of 221 bird species was recorded during 32 visits to Coolmunda Dam and its surroundings in southern Queensland. Sixty seven of these species were observed breeding. Regular visits were made from 18 May 1983 to 28 July 2000 and the results obtained record the avifauna of the area and changes in its composition over that period.

The results show the artificial dam was a useful refuge for waders and waterfowl during a severe drought. Two species of woodland birds, Hooded Robin and Little Lorikeet, have not been observed in the area for a decade. These changes may also arise from seasonal conditions or the reduction of marginal habitat for these species from the building of the dam, the continuing changes in the use of surrounding land for agriculture, or both.

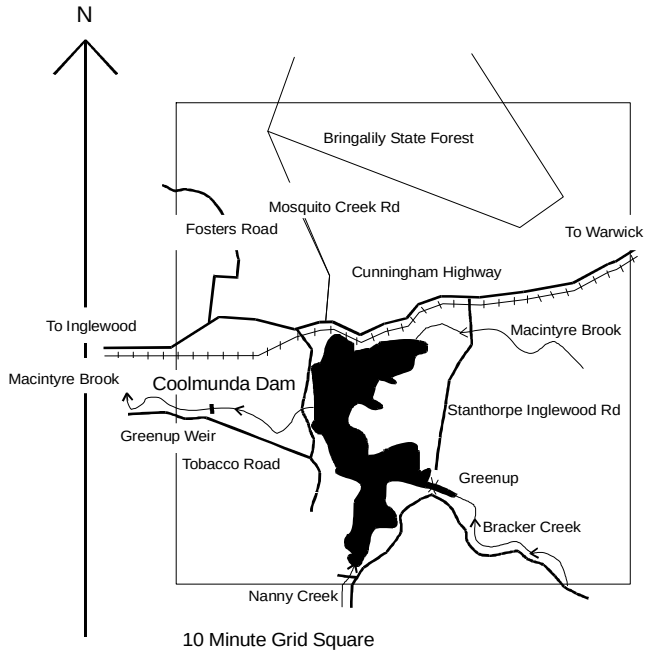
INTRODUCTION

Coolmunda Dam is located 94 kilometres west of Warwick and 14 kilometres east of Inglewood within the 10 minute grid block centred at 28°25'S and 151°15'E in southern Queensland. It was built between 1963 and 1968 to irrigate land and permit new agricultural enterprises in previously undeveloped areas, particularly west of the dam. This work arises from the continuation of bird atlassing by the author in the period between first (1977 to 1981) and second (1998 to 2002) national Atlas of Australian Birds administered by Birds Australia.

METHODS

The area surveyed is within the 10 minute grid block centred at 28°25' S and 151°15' E in southern Queensland (See Map). Coolmunda Dam is located in the southern half of this grid block alongside the Cunningham Highway. The grid block also includes Bringalily State Forest to the north, other native vegetation including ironbark/cypress pine woodland and heathland, cleared land and cultivated land.

Surveys were conducted in the grid block from 1983 to 2000. A camp base was established near the edge of the dam during each of the 32 visits of 3 to 5 days duration.



Area Map: Coolmunda Dam

Each survey usually included driving along all roads, and in Bringalily State Forest, within the block, and walking where practical; driving around the dam and walking into the shore where practical; and walking on a farm just north of the dam. The farm is Ironbark/Cypress Pine woodland used for cattle grazing and is partly cleared.

One or two days were spent on the lake and inflowing creeks in a canoe. The first day, weather permitting, was always a trip up Macintyre Brook as far as it was navigable. If another day was available for canoeing it was spent in the Bracker Creek or Nanny Creek areas. When the dam is full all three creeks are navigable by canoe for some distance within the 10 minute block. Recent visits

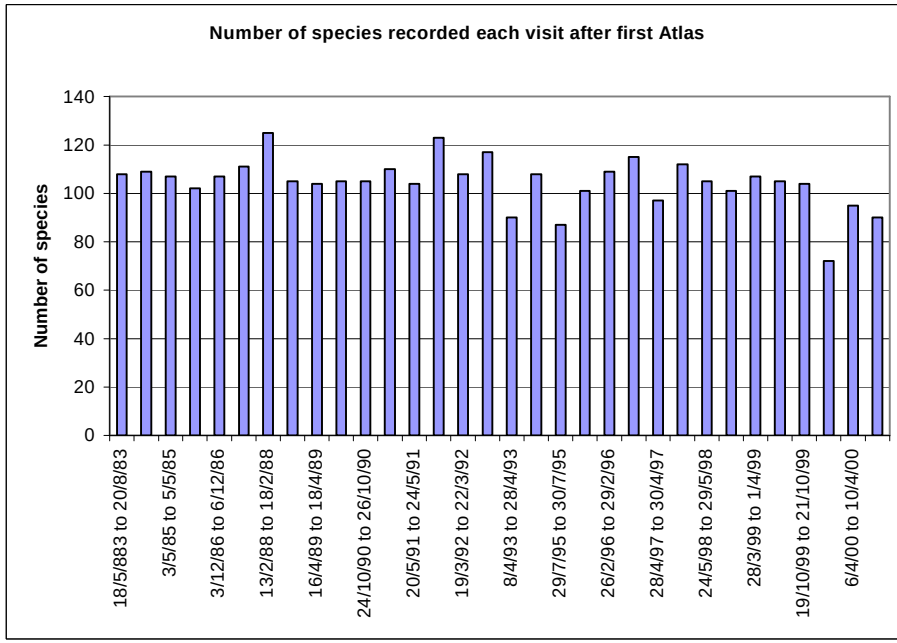


Figure 1: Species seen on each visit

have included some surveying by canoe and on foot in the Greenup Weir area, 4-kilometres below the dam wall on Macintyre Brook.

Species were recorded as present or absent during each visit and their abundances scored as common, occasional, uncommon or rare. The third last visit (13/2/00 to 15/2/00) was a 5 km radius area search (centre Lat. 28° 26'52S x Long.151°12'59E) as required for the 1998 Birds Australia Atlas. Hence the lower number of species recorded. All other surveys were of the entire 10 minute block.

RESULTS

A systematic list of the birds of the Coolmunda block, recorded in the period April 1978 to July 2000, comprises a total of 221 bird species, of which at least 67 species were recorded as breeding (See Appendix pp28-33).

The mean number of species per visit over the survey period was 105 (Figure 1), of which 31 species were seen during each visit, and 24 more species were observed during 90% of all visits.

The range of migratory wader species peaked between November 1991 and October 1993. Migratory wader species recorded during this period were Latham's Snipe, Black-tailed Godwit, Bar-tailed Godwit, Eastern Curlew, Marsh Sandpiper, Common Greenshank, Wood Sandpiper, Common Sandpiper, Red-necked Stint, Sharp-tailed Sandpiper, and Curlew Sandpiper.

Examination of the species recorded from August 1983 to July 2000 shows some interesting and sometimes disturbing trends. Listed below are the most significant of these. Hooded Robin (*Melanodryas cucullata*) was recorded on 6 out of 12 visits from August 1983 to February 1991 but only recorded once in 20 visits since then.

Little Lorikeet (*Glossopsitta pusilla*) was only recorded on 8 out of 11 visits from August 1983 to October 1990. Hoary-headed Grebe (*Poliocephalus poliocephalus*) was recorded on 5 out of 8 visits from August 1983 to May 1988 but only recorded once in 24 visits since then. Plumed Whistling Duck (*Dendrocygna eytoni*) was only recorded on 5 out of 7 visits from August 1983 to February 1988.

DISCUSSION

Coolmunda Dam is a very important wetland in the watershed of Macintyre Brook that flows into the Macintyre River and has boosted waterbird populations of the locality well beyond their former status. It supports many migratory species either in passage or for longer periods, and is the focus for a significant variety of other bird species in the locality. Though the dam is used for irrigation, recreational boating and fishing, it supports a wide variety of wetland birds in a dry area and was a significant refuge for migratory wading birds during the study period along with other permanent water bodies in the region. For example, Cooby Dam (near Toowoomba) and Leslie Dam (near Warwick) also acted as drought refuges for wader species (RAOU Murray-Darling Basin Waterbird Project).

This survey has recorded the increases some species such as Little Corella, probably as a result of increased clearing of land for agriculture around the dam, but the loss of some common species in the last 10 years cannot be explained easily. There appears to have been no major change to the dam and its surrounds in that period. For some species, the surrounding area may represent marginal habitat and their loss from the area may be a consequence of land use changes and relaxation of the avifaunal community in the longer

term. Populations of inland species such as the Hooded Robin are at the eastern limit of their range and are more likely to be displaced by long term land use changes in the region around Coolmunda Dam and the building of the dam has not slowed their demise.

ACKNOWLEDGEMENTS

To Peter Duckworth of Bridport, Tasmania my sincere thanks for his encouragement and invaluable assistance in compiling this manuscript. I am also extremely grateful to Dr Colin Owen, who has allowed me free access to his property at Coolmunda over the period of this survey.

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Appendix: Bird Species of the Coolmunda Block

LOCATION :- This list contains birds recorded in the 10' block around Coolmunda Dam.

The centre point of the block is 28° 25' S and 151° 15' E.

PERIOD :- From April 1978 to Oct 1996.

OBSERVER :- Eric Birt et al

STATUS :- C = Common, O = Occasional, U = Uncommon, R = Rare.

BREEDING :- Birds shown breeding are those which I have observed nesting or with young and is not a complete list by any means of the birds which breed in the area.

1996	ATLAS	SPECIES NAME	SCIENTIFIC NAME	STATUS	REMARKS
3	1	Emu	Dromaius novaehollandiae	O	
9	9	Stubble Quail	Coturnix novaezealandiae	U	
17	199	Magpie Goose	Anseranus semipalmata	R	Small flock March 1996. Not recorded since Feb 88
18	205	Plumed Whistling-duck	Dendrocygna eytoni	O	Plentiful at times
21	217	Musk Duck	Biziura lobata	C	
22	214	Freckled Duck	Stictonetta naevosa	R	
24	203	Black Swan	Cygna atratus	C	Breeds occasionally
29	202	Australian Wood Duck	Chenonetta jubata	C	Breeds
33	208	Pacific Black Duck	Anas superciliosa	C	Breeds
34	212	Australasian Shoveler	Anas rhynchotis	R	
36	211	Grey Teal	Anas gibberifrons	C	Breeds
37	210	Chestnut Teal	Anas castanea	O	
40	213	Pink-eared Duck	Malacorhyncus membranaceus	O	
41	215	Hardhead	Aythya australis	C	
42	61	Australasian Grebe	Tachybaptus novaehollandiae	C	Breeds
43	62	Hoary-headed Grebe	Poliocephalus poliocephalus	U	Recorded only once since 1988
44	60	Great Crested Grebe	Podiceps cristatus	O	Plentiful at times
130	101	Darter	Anhinga melanogaster	C	Breeds in area
131	100	Little Pied Cormorant	Phalacrocorax melanoleucos	C	Breeds

1996	ATLAS	SPECIES NAME	SCIENTIFIC NAME	STATUS	REMARKS
133	99	Pied Cormorant	Phalacrocorax varius	C	Breeds
134	97	Little Black Cormorant	Phalacrocorax sulcirostris	C	Breeds, very numerous at times
135	96	Great Cormorant	Phalacrocorax carbo	C	Breeds
137	106	Australian Pelican	Pelecanus conspicillatus	C	Numbers vary greatly
141	188	White-faced Heron	Ardea novaehollandiae	C	Breeds
142	185	Little Egret	Egretta garzetta	O	
144	189	White-necked Heron	Ardea pacifica	O	Breeds some years
147	187	Great Egret	Egretta alba	O	
148	186	Intermediate Egret	Egretta intermedia	O	
149	977	Cattle Egret	Ardeola ibis	O	
152	192	Nankeen Night Heron	Nicticorax caledonicus	C	Breeds. Roosts in trees on creeks
156	196	Black Bittern	Dupetor flavicollis	R	
158	178	Glossy Ibis	Plegadis falcinellus	O	
159	179	Australian White Ibis	Threskiornis aethiopica	C	
160	180	Straw-necked Ibis	Threskiornis spinicollis	C	
161	181	Royal Spoonbill	Platalea regia	C	
162	182	Yellow-billed Spoonbill	Platalea flavipes	O	
163	183	Black-necked Stork	Xenorhyncus asiaticus	R	Seen 24.4.83, 2.4.87 and 27.9.97
165	241	Osprey	Pandion haliaetus	R	One bird seen 4.7.97
166	234	Pacific Baza	Aviceda subcristata	U	
167	232	Black-shouldered Kite	Elanus notatus	U	
169	230	Square-tailed Kite	Lophoictinia isura	R	
171	229	Black Kite	Milvus migrans	U	Observed breeding 1982
172	228	Whistling Kite	Haliastur sphenurus	C	Breeds
174	226	White-bellied Sea-eagle	Haliaeetus leucogaster	C	Breeds in area, one resident pair
175	218	Spotted Harrier	Circus assimilis	R	Not recorded since 1982
176	219	Swamp Harrier	Circus aeruginosus	O	
177	221	Brown Goshawk	Accipiter fasciatus		
179	222	Collared Sparrowhawk	Accipter cirrhocephalus	U	Breeding Oct 1989
182	224	Wedge-tailed Eagle	Aquila audax	O	
183	225	Little Eagle	Hieraaetus morphnoides	U	
184	239	Brown Falcon	Falco berigora	O	
185	235	Australian Hobby	Falco longipennis	O	
187	238	Black Falcon	Falco subniger	R	Recorded April 87 and Oct 1989 only
188	237	Peregrine Falcon	Falco peregrinus	U	
189	240	Nankeen Kestrel	Falco cenchroides	O	
199	50	Baillon's Crake	Porzana pusilla	R	
206	58	Purple Swamphen	Porphyrio porphyrio	O	
56	56	Dusky Moorhen	Gallinula tenebrosa	C	Breeds
209	55	Black-tailed Native-hen	Gallinula ventralis	U	
211	59	Eurasian Coot	Fulica atra	C	Very numerous some years
218	14	Painted Button-quail	Turnix varia	U	Pair seen in State Forest 1/10/96
221	168	Latham's Snipe	Gallinago hardwickii	O	

1996	ATLAS	SPECIES NAME	SCIENTIFIC NAME	STATUS	REMARKS
224	152	Black-tailed Godwit	Limosa limosa	R	
226	153	Bar-tailed Godwit	Limosa lapponica	R	Recorded Oct 1993 only
229	149	Eastern Curlew	Numenius madagascariensis	R	
233	159	Marsh Sandpiper	Tringa stagnatilis	O	
234	158	Common Greenshank	Tringa nebularia	O	
236	154	Wood Sandpiper	Tringa glareola	R	
238	157	Common Sandpiper	Tringa hypoleucos	R	
247	162	Red-necked Stint	Calidris ruficollis	R	
252	163	Sharp-tailed Sandpiper	Calidris acuminata	O	
254	161	Curlew Sandpiper	Calidris ferruginea	R	
262	170	Painted Snipe	Rostratula benghalensis	R	Male seen Nov 1991
270	146	Black-winged Stilt	Himantopus himantopus	C	
272	148	Red-necked Avocet	Recurvirostra novahollandiae	U	
273	137	Pacific Golden Plover	Pluvialis dominica	R	Recorded Oct 1989
278	143	Red-capped Plover	Charadrius ruficapillus	U	Occasionally
285	144	Black-fronted Plover	Charadrius melanops	C	Breeds
287	132	Red-kneed Dotterel	Erythrogonys cinctus	O	Breeds
288	135	Banded Lapwing	Vanellus tricolor	O	Pair nested Oct 1989
289	133	Masked Lapwing	Vanellus miles	C	Breeds
300	125	Silver Gull	Larus novaehollandiae	C	
305	111	Gull-billed Tern	Gelochelidon nilotica	R	
306	112	Caspian Tern	Hydroprogne caspia	U	
319	110	Whiskered Tern	Chlidonias hybrida	C	
320	109	White-winged Black Tern	Chlidonias leucopterus	R	5 birds seen 28.4.93
327	957	Rock Dove(Feral Pigeon)	Columba livia	O	
334	34	Common Bronzewing	Phaps chalcoptera	O	
337	43	Crested Pigeon	Ocyphaps lophotes	C	Breeds
344	30	Peaceful Dove	Geopelia placida	C	
345	32	Bar-shouldered Dove	Geopelia humeralis	C	
359	264	Red-tailed Black-Cockatoo	Calyptorhynchus magnificus	R	Seen July 1995 only
361	267	Yellow-tailed Black-Cockatoo	Calyptorhynchus funereus	O	
365	273	Galah	Cacatua roseicapilla	C	Breeds
368	271	Little Corella	Cacatua sanguinea	U	Breeds
370	269	Sulphur-crested Cockatoo	Cacatua galerita	C	Abundant at times, breeds
371	274	Cockatiel	Nymphicus hollandicus	C	Breeds
372	254	Rainbow Lorikeet	Trichoglossus haematodus	O	
373	256	Scaly-breasted Lorikeet	Trichoglossus chlorolepidotus	C	Bred 1986

1996	ATLAS	SPECIES NAME	SCIENTIFIC NAME	STATUS	REMARKS
376	260	Little Lorikeet	Glossopsitta pusilla	U	Plentiful at times, but not recorded since Oct 90
381	281	Australian King Parrot	Alisterus scapularis	O	
382	280	Red-winged Parrot	Aprosmictus erythropterus	O	
388	288	Eastern Rosella	Platycercus eximius		U
389	286	Pale-headed Rosella	Platycercus adscitus	C	Breeds
392	291	Australian Ringneck	Barnardius zonarius	R	Seen 27.9.97
394	297	Blue Bonnet	Northiella haematogaster	C	
396	295	Red-rumped Parrot	Psephotus haematonotus	C	Breeds
402	310	Budgerigar	Melopsittacus undulatus	O	Breeding Sept 1995
414	337	Pallid Cuckoo	Cuculus pallidus	U	
415	339	Brush Cuckoo	Cuculus variolosus	O	
417	338	Fan-tailed Cuckoo	Cuculus pyrrhophanus	O	
418	341	Black-eared Cuckoo	Chrysococcyx osculans	U	
419	342	Horsfield's Bronze-Cuckoo	Chrysococcyx basalis	U	
420	344	Shining Bronze-Cuckoo	Chrysococcyx lucidis	U	
423	347	Common Koel	Eudynamis scolopacea	U	
425	348	Channel-billed Cuckoo	Scythops novaehollandiae	U	Bred in 1996, Pied Currawong as foster parent
426	349	Pheasant Coucal	Centropus phasianinus	U	Seen and heard 3/10/96
430	242	Southern Boobook	Ninox novaeseelandiae	O	
438	313	Tawny Frogmouth	Podargus strigoides	U	
449	334	White-throated Needletail	Hirundapus caudacutus	U	
452	319	Azure Kingfisher	Ceyx azurea	O	Along creeks. Breeds
455	322	Laughing Kookaburra	Dacelo novaeguineae	C	
460	326	Sacred Kingfisher	Halcyon sancta	O	Breeds
462	329	Rainbow Bee-eater	Merops ornatus	O	
463	318	Dollarbird	Eurystomus orientalis	O	November to March. Breeds
472	558	White-throated Treecreeper	Climacteris leucophaea	O	
475	555	Brown Treecreeper	Climacteris picumnus	O	Breeds
479	529	Superb Fairy-wren	Malurus cyaneus	C	Breeds
481	536	Variegated Fairy-wren	Malurus lamberti	O	
485	535	White-winged Fairy-wren	Malurus leucopterus	C	
498	565	Spotted Pardalote	Pardalotus punctatus	O	
501	976	Striated Pardalote	Pardalotus striatus	C	Breeds
520	504	Speckled Warbler	Sericornis sagittatus	C	
521	465	Weebill	Smicrornis brevirostris	C	Breeds
526	463	Western Gerygone	Gerygone fusca	O	
531	453	White-throated Gerygone	Gerygone olivacea	O	
533	475	Brown Thornbill	Acanthiza apicalis	R	
534	476	Inland Thornbill	Acanthiza pusilla	O	
536	481	Chestnut-rumped Thornbill	Acanthiza uropygialis	U	

1996	ATLAS	SPECIES NAME	SCIENTIFIC NAME	STATUS	REMARKS
539	484	Buff-rumped Thornbill	Acanthiza reguloides	O	
541	486	Yellow-rumped Thornbill	Acanthiza chrysorrhoa	C	Breeds
542	471	Yellow Thornbill	Acanthiza nana	C	Breeds
543	470	Striated Thornbill	Acanthiza lineata	U	
544	466	Southern Whiteface	Aphelocephela leucopsis	O	
550	640	Spiny-cheeked Honeyeater	Acanthagenis rufogularis	C	
551	585	Striped Honeyeater	Plectorhynca lanceolata	O	Breeds
554	645	Noisy Friarbird	Philemon corniculatus	C	
555	646	Little Friarbird	Philemon citreogularis	C	
557	641	Blue-faced Honeyeater	Entomyzon cyanotis	C	Breeds
559	634	Noisy Miner	Manorina melanocephala	C	Breeds
560	635	Yellow-throated Miner	Monorina flavigula	U	
564	605	Lewin's Honeyeater	Meliphaga lewinii	R	Not recorded since 1983
570	614	Yellow-faced Honeyeater	Lichenostomus chrysops	O	
576	617	White-eared Honeyeater	Lichenostomus leucotis	O	Breeds
578	619	Yellow-tufted Honeyeater	Lichenostomus melanops	O	
583	613	Fuscous Honeyeater	Lichenostomus fuscus	U	
585	625	White-plumed Honeyeater	Lichenostomus penicillatus	C	Breeds
588	583	Brown-headed Honeyeater	Melithreptus brevirostris	O	
593	597	Brown Honeyeater	Lichmera indistincta	O	
606	591	Eastern Spinebill	Acanthorynchus tenuirostris	U	
613	586	Scarlet Honeyeater	Myzomela sanguinolenta	O	Common at times
615	450	Orange Chat	Ephthianura aurifrons	R	Seen June 1980
619	377	Jacky Winter	Microeca leucophaea	C	Breeds
623	381	Red-capped Robin	Petroica goodenovii	O	Breeds
625	384	Rose Robin	Petroica rosea	R	
627	385	Hooded Robin	Melanodryas cucullata	O	Breeding 1989. Not seen since 1991
631	392	Eastern Yellow Robin	Eopsaltria australis	O	
641	443	Grey-crowned Babbler	Pomatostomus temporalis	C	Breeds
653	549	Varied Sittella	Daphoenositta chrysoptera	O	
654	416	Crested Shrike-tit	Falcunculus frontatus	U	
659	398	Golden Whistler	Pachycephala pectoralis	C	
662	401	Rufous Whistler	Pachycephala rufiventris	C	Breeds
667	408	Grey Shrike-thrush	Collurincincla harmonica	O	
676	365	Leaden Flycatcher	Myiagra rubecula	O	Seen in summer Sept to Feb
677	366	Satin Flycatcher	Myiagra cyanoleuca	U	
679	369	Restless Flycatcher	Myiagra inquieta	C	Breeds
680	415	Magpie-lark	Grallina cyanoleuca	C	Breeds
682	361	Grey Fantail	Rhipidura fuliginosa	C	Breeds
685	364	Willie Wagtail	Rhipidura leucophrys	C	Breeds

1996	ATLAS	SPECIES NAME	SCIENTIFIC NAME	STATUS	REMARKS
686	673	Spangled Drongo	Dicrurus hottentottus	U	
687	424	Black-faced Cuckoo-shrike	Coracina novaehollandiae	C	Breeds
689	425	White-bellied Cuckoo-shrike(Little)	Coracina papuensis	U	
690	429	Cicadabird	Coracina tenuirostris	U	
691	423	Ground Cuckoo-shrike	Coracina maxima	U	
692	430	White-winged Triller	Lalage sueurii	O	
696	671	Olive-backed Oriole	Oriolus sagittatus	O	
697	432	Figbird	Sphecotheres viridis	U	
698	543	White-breasted Woodswallow	Artamus leucorhynchus	C	Breeds
700	545	White-browed Woodswallow	Artamus superciliosus	O	Large flocks occasionally
702	547	Dusky Woodswallow	Artamus cyanoleuca	O	
703	548	Little Woodswallow	Artamus minor	U	
705	702	Grey Butcherbird	Cracticus torquatus	O	
707	700	Pied Butcherbird	Cracticus nigrogularis	C	Breeds
708	705	Australian Magpie	Gymnorhina tibicen	C	Breeds
709	694	Pied Currawong	Strepera graculina	O	
716	930	Australian Raven	Corvus coronoides	O	
719	691	Little Crow	Corvus bennetti	U	
720	692	Torresian Crow	Corvus orru	C	
721	693	White-winged Chough	Corcorax melanorhamphos	C	Breeds, large mud nest.
722	675	Apostlebird	Struthidea cinerea	C	Breeds, mud nest.
729	680	Spotted Bowerbird	Chlamydera maculata	R	Seen 27.11.91
733	648	Singing Bushlark	Mirafra javanica	R	
735	647	Richard's Pipit	Anthus novaeseelandiae	C	Breeds
744	653	Zebra Finch	Poephila guttata	O	
745	655	Double-barred Finch	Poephila bichenovii	C	
751	661	Plum-headed Finch	Aidemosyne modesta	O	Common at times
752	662	Red-browed Firetail	Emblema temporalis	U	
753	652	Diamond Firetail	Emblema guttata	U	
759	657	Chestnut-breasted Mannikin	Lonchura castaneothorax	U	
770	564	Mistletoebird	Dicaeum hirundinaceum	O	
771	358	White-backed Swallow	Cheramoeca leucosternus	R	Seen 26.5.98
773	357	Welcome Swallow	Hirundo neoxena	C	Breeds
775	359	Tree Martin	Cecropis nigricans	C	Breeds
776	360	Fairy Martin	Cecropis ariel	C	Breeds
778	524	Clamorous Reed-warbler	Acrocephalus stentoreus	C	
781	523	Tawny Grassbird	Megalurus timoriensis	U	
782	522	Little Grassbird	Megalurus gramineus	O	Sometimes common
784	509	Rufous Songlark	Cinclorhamphus mathewsi	O	Common at times
785	508	Brown Songlark	Cinclorhamphus cruralis	U	
787	525	Golden-headed Cisticola	Cisticola exalis	O	
791	574	Silvereye	Zosterops lateralis	O	
802	999	Common Starling	Sturnus vulgaris	C	Introduced, breeds
	Total number of species observed to July 2000 was 222				
	Total number of species observed breeding was 64				

BOOK REVIEW

BIRDS. THEIR HABITS AND SKILLS

KAPLAN, G. AND ROGERS, L.J.

ALLEN & UNWIN 2001. 252PP. RRP $29.95

This book arrived for review shortly after I had heard Gisella Kaplan interviewed by Robin Williams on the subject of emotional intelligence in birds on ABC Radio National's Science Show. My curiosity piqued, I looked forward to reading it.

The authors are academics in the fields of biology, social sciences, neuroscience and animal behaviour. Their stated aim was to produce in this volume a synthesis of bird ecology, physiology and behaviour that would appeal to an audience that includes students and academics as well as the interested birdwatcher. In writing it they necessarily covered a great deal of ground, much of it well trodden by previous popular works.

The difficulty in a work like this is the inevitable clash between breadth of scope and depth of treatment. Add to this the great diversity of bird species and lifestyles and the wish to appeal to a broad audience with differing expectations and the job becomes a very tall order. The end result is a compromise that can never satisfy all readers. This is not to say that such popularisations have no place. Many useful publications have appeared on the market over the years; the most recent (though not necessarily the best) that comes to mind being the "book of the Attenborough TV series", *The Life of Birds*. All have their faults but do serve as useful introductions to take the general reader further into the world of birds. To the credit of Kaplan and Rogers, their book achieves this and also uses extensive referencing to allow the interested reader to research further into topics of interest.

The text is in five parts: the evolution and anatomical features of birds; lifecycles; the development and role of the senses; communication, learning and intelligence; and interactions between humans and birds. The first three parts are useful in their own right but also set the scene for Part 4: The Mind of Birds. I suspect that herein lie the major interests of the two authors. Chapters on communication and learning are followed by a very interesting

discussion of intelligence in birds. This topic is explored using research findings on memory, tool use, problem-solving and concept formation abilities in birds. In some ways, it is a pity that the authors did not reduce their coverage of earlier topics so that they could expand further on this material. Of course, the result would have been an entirely different book, but it would have been much more original in focus.

The final part, "Birds and Humans", has a relatively brief review of domestication and its consequences for bird welfare, and bird conservation. I found this to be the least satisfactorily treated section in that it tended to be long on polemic but short on fact and detail. There's nothing wrong with the introduction of personal viewpoints on these topics but the level of argument supporting these views was often lacking and sometimes possibly wrong. For example, I'd question whether collisions with vehicles and fences are major threats to bird populations. I did find intriguing the view that the plethora of superbly filmed nature documentaries we see on our television screens can develop in the viewer a false impression of the well-being of the animals and their environment. The authors cite their disappointment with the sadly diminished forests and fauna of Madagascar when visiting after seeing a film about the island. No other research is cited. I'd like to know of any social research exploring this mismatch of perception and reality in documentary viewers.

In a book review I read recently, the reviewer bemoaned the "acne" of poor editing he felt infects modern publishing. This volume is not immune from such blemishes. My greatest criticism of it is the poor editing of both factual errors and bad writing. Factual errors may be simple mistakes or may betray a lack of familiarity with the subject. Whatever the reason, there are simply too many of them in this book. Some I noted were: in a discussion of bowerbird bower use, the tooth-billed bowerbird is credited with building a "particularly elaborate" bower (p. 50); the lyrebird was named for the shape of it's tail, not its wings as stated (Fig. 3.3); pigeons are included in a list of domesticated birds that have precocial young (p. 186). Equally prevalent and irritating are the number of inexplicable *non sequiturs* in the text. I suspect that these arose from poor review of text subject to a lot of "cut and paste" during writing. It's very distracting to have the flow of thought disrupted by irrelevant sentences hidden in paragraphs.

This book competes for attention in a fairly crowded marketplace. Its rather drab appearance (though several colour plates inserted, most illustrations are

monochrome, and image quality is patchy) is compensated by some interesting topics but the overall production quality lets down the content. Perseverance will reward the reader with interesting food for thought and a means to delve deeper. This publication has a place in student and club libraries but I suspect the individual reader will find some of its competitors offer better value.

Richard Johnson

NOTES