The Whistler

Osprey
Black Falcon
Painted Snipe
Grey Goshawk
Mobbing behaviour
Birds in mangroves
Pacific Golden Plover
Historical egg collection
Birds in a native garden
1901-1925 Hunter records
Birds of Green Wattle Creek

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- ***To encourage and further the study and conservation of Australian birds and their habitat***
- ***To encourage bird observing as a leisure-time activity***

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Front cover: Australian Painted Snipe *Rostratula australis* – Photo: Ann Lindsey

Back cover: Pacific Golden Plover *Pluvialis fulva* - Photo: Chris Herbert

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The *Whistler* – Editorial

The Editors are pleased to provide our members and other ornithological enthusiasts with the third issue of the club's emerging journal. From the coast to the ranges the Hunter Region and adjacent areas offer us a range of environments in which to study birds. For many people interested in birds, particularly visitors to our region, the coast and rainforests will be a prime attraction. While the Hunter's bird habitats have not always been exactly the same, they have always been there, with the same birds (for the most part) utilising them since before European settlement. Fewer people will develop a great fascination for the remaining remnants of valley-floor woodlands, let alone our mangroves and larger gardens. The last, of course, is a new phenomenon creating habitat for birds. The mangroves have altered, sometimes beneficially, following human control of the estuarial waterways. This stands in contrast to the woodlands, which have suffered constant fragmentation in the face of development. These thoughts set the scene for the latest issue of The Whistler.

We are delighted to be able to offer, in this issue, one article and one supporting note that document the bird population of the Hunter Region in the early twentieth century. It is difficult not to be struck by the differences from what we observe today and by the changes that have taken place, not only by the disappearance (or something close to it) of some of the western species in the course of a hundred years, but also by the influx of many species, not all of them introduced, which seem to have either escaped observation earlier or expanded into the Region. With the modification of environments, and the creation of others that are entirely new to the Region, bird diversity seems actually to have increased even though the security of some of the long-term resident species has diminished with habitat loss. There is no reason to suppose that the rate of change will slow and some reason to believe that it may actually accelerate with the effects of climate change and of the Hunter's economic growth.

Thus we are happy that this issue also provides useful snapshots of the bird populations of selected woodland, mangrove, and garden sites that will hopefully make good reading now, but will certainly provide a useful point of reference for future Hunter ornithologists. These papers set out not so much to perform the standard scientific task of solving a problem, but rather to document what is occurring and to produce data-sets which need to exist even before the problems can become evident. These papers identify problems and offer tentative solutions, variously supported, upon which others may be able to build. The articles continue our efforts to look over time at a wide range of Hunter habitats. This will allow priorities for conservation and reservation to be proposed and future changes in bird populations to be quantified rather than rest on anecdotal evidence.

Particular species also receive special coverage in this issue: the Pacific Golden Plover and its preferred Hunter Estuary habitats are fully treated, while the Australian Painted Snipe is unfortunately not recorded enough to be closely associated with such specific sites. Problems are also raised about the seasonal distribution of the more familiar Grey Goshawk, a bird that we may in fact know rather less about than we thought we did—if the pattern of Hunter observations is anything to go by. On diurnal birds of prey, there are also two short notes which establish a culinary link between the raptors and small shorebirds. These articles all pose significant questions about bird behaviour, which is the particular focus of the remaining note on the way birds join forces in order to mob a rather unusual non-avian species. We hope that some of this material may inspire readers to contribute supplementary notes of their own, perhaps offering alternative explanations to those suggested here, or highlighting analogous problems.

We should like here to thank all those who assisted in the production of this volume, including the referees who must remain nameless, but with special mention of Liz Crawford, who, as Production Manager, finds yet another way to demonstrate her commitment to the birds.

Once again, we wish to acknowledge the financial support of the Hunter-Central Rivers Catchment Management Authority, who have sponsored this

volume of The Whistler. Without their support it would be difficult for HBOC both to produce a journal of the standard set for The Whistler and to distribute it more widely than our membership. A wider distribution will ensure that it reaches and informs those charged with making decisions and taking actions which conserve birds and their habitat in the Hunter Region, and hopefully beyond. This is the primary purpose of our endeavours.

Mike Newman and Harold Tarrant
Joint Editors

The effect of habitat variables on bird density and species richness in Newcastle and Lake Macquarie mangrove forests

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This study aimed to determine whether the size of a temperate mangrove patch had any effect on bird density or bird species richness (number of species). Four isolated mangrove patches were chosen: two large (Black Neds Bay, 116 ha; Sandgate, 82 ha) and two small (Swansea, 4 ha; Carrington, 2.8 ha). A sampling area of 2 ha was used, and counts lasted 40 minutes. Mean canopy height was much greater at Sandgate than at the other three locations. Percent canopy cover was similar at all locations. The bird species richness was highest at Carrington, the site with the smallest patch size. Bird species richness increased with increasing canopy height variation. The presence of a second mangrove species at Carrington probably increased canopy height variation at that site. Patch size had no effect on bird density. Patch size did, however, change the species composition. There was a general shift from specialist feeders to generalists as patch size decreased. Two species were only found in the large patches: the Rufous Whistler *Pachycephala rufiventris* and the Grey Fantail *Rhipidura albiscapa*. These species probably require areas larger than 4 ha of a single non-fragmented habitat type to sustain them.

INTRODUCTION

Mangrove ecosystems support essential ecological functions (Valiela *et al.* 2001). They intercept land-derived nutrients, pollutants, and suspended matter before these contaminants reach deeper water, and they export materials that support near-shore food webs, including shrimp and prawns (Rodelli 1984, cited in Valiela *et al.* 2001). They serve as a nursery for marine species and support a great abundance of fish and invertebrates (Beck *et al.* 2001).

Australia has a fairly large number of species and subspecies of birds, mostly passerines, confined to or largely dependent on mangroves, which occur discontinuously as a narrow chain for thousands of kilometres along tropical and subtropical coasts (Ford 1982). Mangroves dominate the seaward fringe of many estuaries, more so in the tropics where many species and zones of recognisable mangrove communities exist (Simpson & Day 1986). In the temperate latitudes of the central coast of New South Wales, however, mangrove forests are structurally depauperate (Ford 1982), consisting mostly of one species, the Grey Mangrove *Avicennia marina*.

One species of bird that is largely dependent on mangroves is the Mangrove Gerygone *Gerygone levigaster*. They are small birds, attaining a size of just 11cm (Simpson & Day 1986). It is one of the most widely-distributed of the 16 bird species confined to mangroves in Australia (Noske 1996, cited in Noske 2001). It occurs as far south as the Central Coast of New South Wales in the east and the southern Kimberley in the west, as well as southern New Guinea. In the extensive mangals of the Darwin region, Woinarski *et al.* (1988, cited in Noske 2001) reported it in densities of 0.24-0.91 birds ha^{-1}. It is a foliage-gleaning insectivore.

Mangrove forests occur discontinuously along tropical and subtropical coasts (Ford 1982) and can be viewed as habitat islands. The formation of a habitat island on the mainland creates an edge effect (Krohne 2001). This involves a change in the physical and biological parameters of a habitat at its boundaries relative to what is found at its centre.

Within vegetation there are typically several layers. The whole structure represents a vertical zonation (Briggs & Smithson 1985) within which a varied wildlife frequently exists. This, too, shows a vertical structure related to the character of the vegetation. Linkages between diversity above ground and below ground may be functionally important at the ecosystem scale in terms of the maintenance and stability of ecosystem processes and the persistence of keystone species or other species with strong ecosystem effects (Hooper *et al.* 2000).

There is a strong correlation between the structural heterogeneity of a habitat and species diversity (Krohne 2001). This suggests that in more structurally diverse systems species can specialise to a greater extent on differences in microhabitat. There is considerable evidence to suggest that for avian species diversity increases with the diversity of the foliage structure in the habitat. As habitat structure (measured by variation in the height of vegetation) becomes more complex, more species of birds are present (Krohne 2001).

This study will aim to determine whether various habitat variables have any significant effect on bird density or bird species richness in temperate mangroves. The habitat variables that will be used are mangrove patch size, height of mangrove canopy, percent foliage cover, and number of mangrove species present.

METHODS

Four isolated patches of temperate mangrove forest were chosen for the study. Two patches, one large and one small, were chosen in the Hunter Estuary. Similarly, one large and one small patch were chosen at the entrance channel to Lake Macquarie, as shown in **Figure 1**.

In the Hunter Estuary the large mangrove patch was located at Sandgate. It comprised 82ha of isolated mangrove forest (**Figure 1**). The small mangrove patch in the Hunter Estuary of 2.8ha was located at Carrington. It is just 3km from the Newcastle CBD, and is surrounded by industrial and urban development. A boardwalk has been constructed through it (**Figure 1**). The large mangrove patch in Lake Macquarie was located at Black Neds Bay Nature Reserve, which is on the southern shore of the entrance channel. It comprised 116ha of mangrove forest (**Figure 1**). The small mangrove patch, 4ha in size, was located on the northern side of the entrance channel at Swansea.

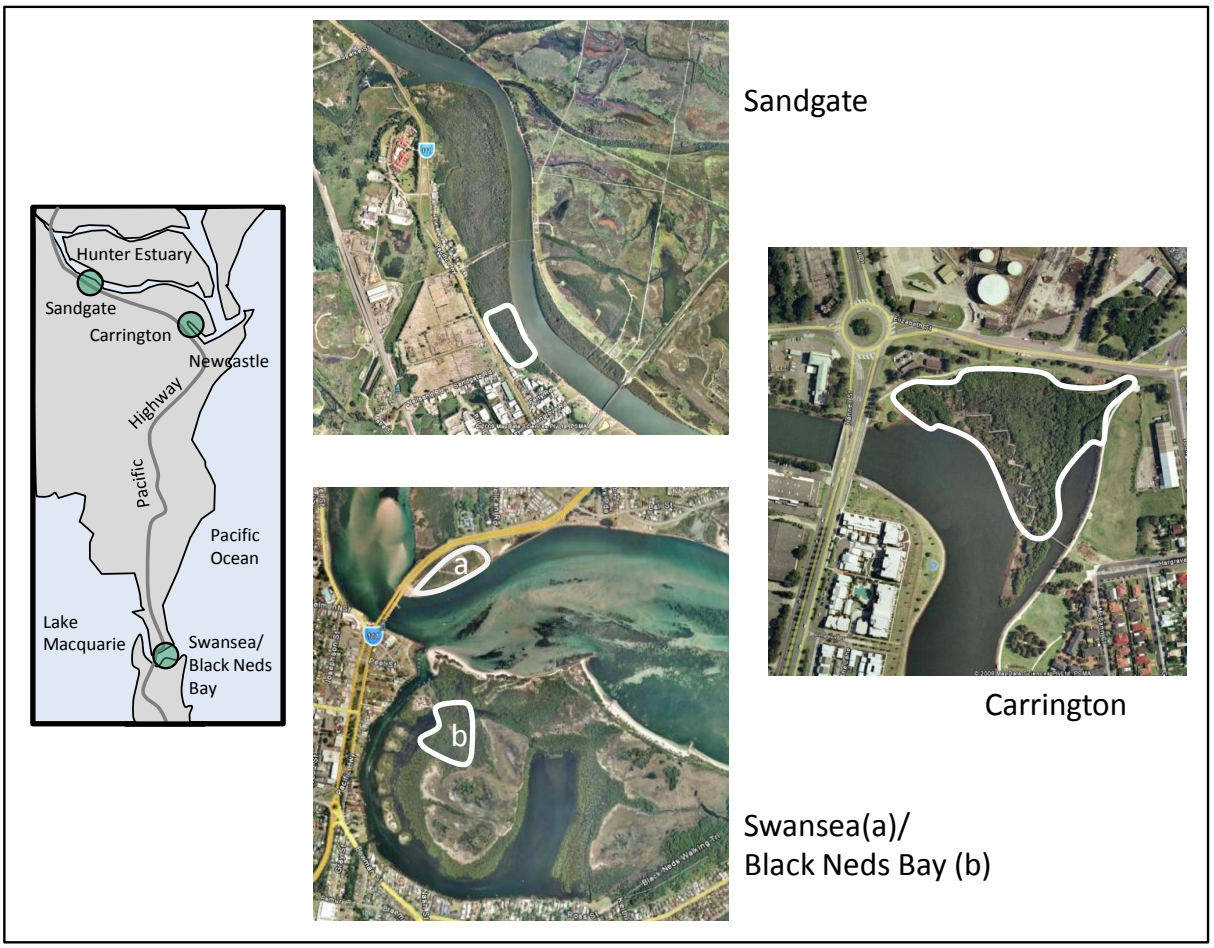

Figure 1. Locations of mangrove patches in the Hunter Estuary at Sandgate and Carrington and patches in Lake Macquarie at Black Neds Bay and Swansea.

At Sandgate, Swansea and Black Neds Bay, the only plant species present in the sites was the Grey Mangrove *Avicennia marina* var. *australasica*. At Carrington, *A. marina australasica* dominated the forest vegetation, but the River Mangrove *Aegiceras corniculatum* was also present, and was in flower at the time of sampling.

The study was carried out in September and October, 2003. At each location a 2ha (200m x 100m) site was haphazardly chosen and pegged out. The sampling area measurements were the same as that recommended by Silcocks (1998), but different to the size of sites used by Date *et al.* (2002). They sampled plots of 1.2ha (200m x 60m). Sampling area measurements followed those recommended by Silcocks (1998) because this study involved all habitats whereas Date *et al.* (2002) was studying birds only in woodlands. Thus it was thought that the patch size dimensions recommended by Silcocks (1998) would be more appropriate for mangrove habitats than those used by Date *et al.* (2002).

The boundaries of each plot were at least 10m inside the edge of the mangrove forest. This was done to try to minimise edge effects. The edge of the mangrove forest was defined as where the grass or herb line began or, where grasses or herbs were absent by the start of the mangrove canopy.

Habitat structure was assessed at 11 randomly selected points within the site at Black Neds Bay, and at six randomly selected points at each of the other three sites. At each point, height of the canopy and percent canopy cover were measured. Canopy height was measured with a surveying staff. The staff was placed on the point, and the tallest part of the vegetation was recorded within an imaginary cylinder with radius 1m and vertical axis of revolution centered on the point. Percent canopy cover was measured with a mirror. A grid containing 100 x 1cm squares was drawn on the mirror. At each random point, the mirror was placed horizontally on top of the pneumatophores projecting from the mud. The number of grid squares that were more than half shaded from the sun by the canopy equaled the percent canopy cover at that point.

Birds were sampled before 10:30am within the 3 hour window either side of low tide. Each count lasted 40 minutes. Sampling time was different to that recommended by Silcocks (1998). In that study Birds Australia (BA) conducted a volunteer-based survey of the distribution of Australia's birds. While a number of surveying methods were accommodated, the preferred method that was recommended was a 2ha search for 20 minutes. The BA survey protocol was designed as a constant effort sampling procedure expected to find most but not all the birds at a site. It was decided for this study that in a dense habitat like a mangrove forest 20 minutes was not long enough to record all the birds within a 2ha area. Also, if multiple species move about an area larger than 2ha in the mangrove forest as a foraging flock, a longer survey interval would increase the probability that the flock is recorded in the survey site during sampling, and hence at the location.

Sampling during the 40 minutes involved making three line searches within the site. These line searches across the 100m wide site occurred at 40, 100, and 160m along the 200m long transect. On each line search, all species and the number of individuals per species seen or heard within 30-40m of the line were recorded. Birds flying over the site were only recorded if they were deemed to be using the flying space specifically because of the habitat or potential prey or food within the site. The cumulative abundance and species richness from the three line searches became the density and species richness for the sample.

Each site was sampled on two separate days. On each day, two replicate counts were made. The time between replicates was no longer than 15 minutes. Thus, each location was sampled 4 times, and mean density and species richness were then calculated.

RESULTS

The canopy height was significantly higher at Sandgate than at the other 3 locations ($p<0.01$, **Figure 2**). Carrington had the greatest variation in canopy height (**Figure 2**). Mean canopy cover was found to be similar at all locations (**Figure 3**). Within each site except Sandgate a large variation in percent canopy cover was measured (**Figure 3**).

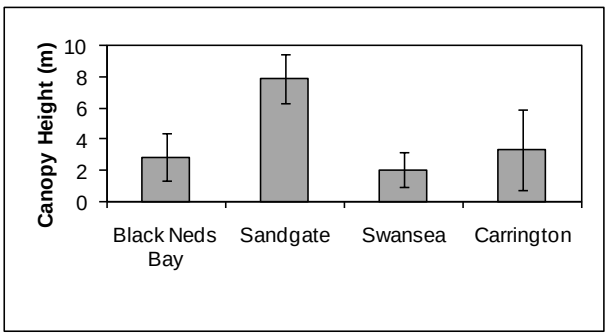

Figure 2. Mean canopy height and its variation (shown by error bars) at each location.

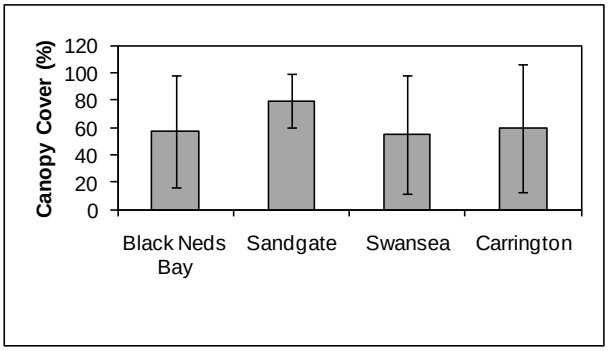

Figure 3. Mean percent canopy cover and its variation (shown by error bars) at each location.

A total of 41 species was recorded during the study (**Table 1**). At Black Neds Bay, 12 species were recorded, compared with 15 at Sandgate and Swansea, and 30 at Carrington. Four species were recorded in all locations: These were the Silvereye *Zosterops lateralis*; Yellow-faced Honeyeater *Lichenostomus chrysops*; Brown Honeyeater *Lichmera indistincta*; and Black-faced Cuckoo-shrike *Coracina novaehollandiae*. The Mangrove Gerygone was only recorded in the locations with the three largest patch sizes. Four species were recorded in only the two large mangrove patches. These were the Eastern Rosella *Platycercus elegans*; Rufous Whistler; Brown Thornbill *Acanthiza pusilla*; and Grey Fantail. Six species were recorded in only the two small mangrove patches. These were the Welcome Swallow *Hirundo neoxena*; Galah *Eolophus roseicapillus*; Eastern Great Egret *Egretta modesta*; Magpie-lark *Grallina cyanoleuca*; Red Wattlebird *Anthochaera carunculata*; and Spotted Dove *Streptopelia chinensis*.

Table 1. Species recorded at the sampling locations (# indicates presence).

Common Name	**Scientific Name**	**Black Neds Bay**	**Sandgate**	**Swansea**	**Carrington**
Silvereye	*Zosterops lateralis*	#	#	#	#
Yellow-faced Honeyeater	*Lichenostomus chrysops*	#	#	#	#
Brown Honeyeater	*Lichmera indistincta*	#	#	#	#
Black-faced Cuckoo-Shrike	*Coracina novaehollandiae*	#	#	#	#
Mangrove Gerygone	*Gerygone levigaster*	#	#	#	
Eastern Rosella	*Platycercus elegans*	#	#		
Rufous Whistler	*Pachycephala rufiventris*	#	#		
Brown Thornbill	*Acanthiza pusilla*	#	#		
Grey Fantail	*Rhipidura albiscapa*	#	#		
Yellow Thornbill	*Acanthiza nana*	#	#		#
White-breasted Woodswallow	*Artamus leucorynchus*	#			#
Willie Wagtail	*Rhipidura leucophrys*	#			#
Sacred Ibis	*Threskiornis molucca*		#		#
Australian Raven	*Corvus coronoides*		#		#
Sacred Kingfisher	*Todiramphus sancta*		#		#
Sulphur-crested Cockatoo	*Cacatua galerita*		#		
Spotted Pardalote	*Pardalotus punctatus*		#		
Welcome Swallow	*Hirundo neoxena*			#	#
Galah	*Eolophus roseicapillus*			#	#
Eastern Great Egret	*Ardea modesta*			#	#
Magpie-lark	*Grallina cyanoleuca*			#	#
Red Wattlebird	*Anthochaera carunculata*			#	#
Spotted Dove	*Streptopelia chinensis*			#	#
Common Mynah	*Acridotheres tristis*			#	
Pied Oystercatcher	*Haematopus ostralegus*			#	
Whimbrel	*Numenius phaeopus*			#	
Eastern Curlew	*Numenius madagascariensis*			#	
Rufous Night Heron	*Nycticorax caledonicus*				#
Little Pied Cormorant	*Phalacrocorax melanoleucos*				#
Common Starling	*Sturnus vulgaris*				#
Little Black Cormorant	*Phalacrocorax sulcirostris*				#
Figbird	*Sphecotheres viridis*				#
Laughing Kookaburra	*Dacelo gigas*				#
Crested Pigeon	*Ocyphaps lophotes*				#
Little Egret	*Egretta garzetta*				#
Darter	*Anhinga melanogaster*				#
Australian Pelican	*Pelecanus conspicillatus*				#
Superb Fairy-wren	*Malurus cyaneus*				#
Silver Gull	*Larus novaehollandiae*				#
Striated Heron	*Butorides striatus*				#
Brown Goshawk	*Accipiter fasciatus*				#

Figure 4 shows the mean bird density recorded at each location. The variation in counts is much higher at Sandgate than at the other three locations.

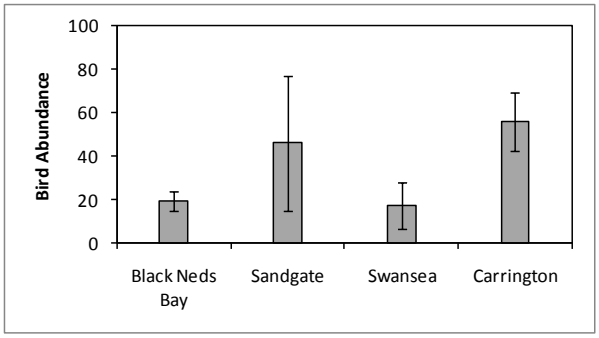

Figure 4. Mean bird abundance per hectare and the variation (shown by error bars).

Mean species richness per count at each of the locations is shown in **Figure 5**. The average variation in species recorded per survey increased as mangrove patch size decreased.

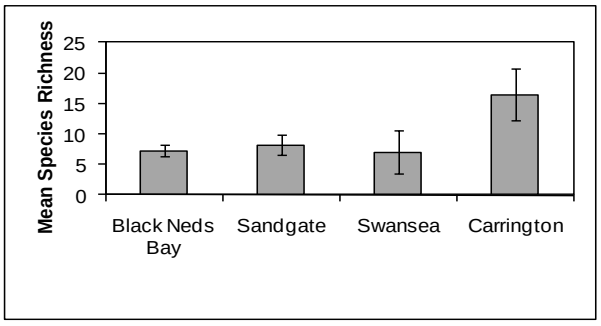

Figure 5. Mean number of species and the variation (shown by error bars) counted per survey.

Mean bird density in large mangrove patches was 33 per hectare compared with 36 per hectare in small patches. This was not significantly different at the 5% level. The average number of bird species recorded per count was eight in large mangrove patches and 12 in small ones. This was not significantly different at the 5% level.

The Mangrove Gerygone was recorded in densities in the range 0 to 2 birds ha^{-1}. Mean density was 1.09 birds ha^{-1}. Three species were recorded as breeding during the surveys, all of which were at Carrington. These were the White-breasted Woodswallow *Artamus leucorynchus*, Magpie-lark, and Australian Raven *Corvus coronoides*.

DISCUSSION

The structure of the mangroves at the Sandgate site was different from the other three sites. The trees, on average, were taller (**Figure 2**). Also, the relatively small variation of percent cover within the Sandgate site (**Figure 3**) shows that there is a more homogeneous cover. The greater height of these mangroves may be because they are protected from the southerly wind by elevated terrain on Sandgate Road.

The large variation in bird density at Sandgate (s^2=965.5) was because migrating Yellow-faced Honeyeaters were recorded on the first sampling day, but were not moving through the site on the second occasion. Variation in numbers of Yellow-faced Honeyeaters (s^2=836.92) contributed 87 percent to the total variation in density at Sandgate. Variation in counts of the other 14 species (s^2=127.58) accounted for the remaining 13 percent.

The Mangrove Gerygone was not recorded at Carrington, the smallest mangrove patch. As it is confined to mangroves, it may be that the critical minimum patch size needed to support this species in temperate latitudes is greater than 2.8 hectares. Mean density recorded for this species (1.09 birds ha^{-1}) was higher than was recorded in the Darwin region (0.24 to 0.91 birds ha^{-1}, Woinarski *et al.* 1988 cited in Noske 2001).

One species that was only found in the two small mangrove patches was the Red Wattlebird. Being one of the largest honeyeaters, it may be better able to survive in a range of habitats than the smaller honeyeaters.

Four species were found at all locations. These were the Silvereye, Yellow-faced Honeyeater, Brown Honeyeater and Black-faced Cuckoo-shrike. In this study mangrove patch size does not seem to affect these species.

The data in this study supports the strong correlation between the structural heterogeneity of a habitat and species richness (Krohne 2001). If structural heterogeneity in this study is measured by the standard error of mean canopy height at the four locations (**Figure 2**), then mean bird species richness (**Figure 5**) increases with increasing habitat structural heterogeneity. Both are greatest at Carrington.

Despite its small size, the Carrington site is important as a habitat for birds. The presence of the River Mangrove is significant to the richness of birdlife recorded compared to the other three locations. It may be the co-existence of the two mangrove species at Carrington that creates the

greater structural heterogeneity (**Figure 2**) required for greater species richness. However, it may just be important for birds in general given its location, as some of the species are not mangrove-dependent (e.g., Magpie-lark, Spotted Dove). A patch of its size is probably all edge habitat, which is accessible to species from neighbouring (open) habitats (M. Newman, *pers. comm.*). This could also explain the high species richness.

The mangroves at Carrington, however, are limited by the size of the area in which they are contained. It is too small to support the habitat requirements of the Mangrove Gerygone, Rufous Whistler and Grey Fantail. These species need larger patches to sustain them.

The results of this study should add extra conservation value to the known benefits of the Carrington mangroves. Situated near the mouth of Throsby Creek, the Carrington mangroves remove sediment, pollutants, and rubbish that enter the system from many stormwater pipes located upstream. Conservation of these mangroves will become even more important as the increasing inner-city population will require local aesthetically-appealing retreats.

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Bird populations in a rural native garden in New South Wales

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Birds were recorded weekly between 2001 and 2008 in a rural garden at East Seaham in the Lower Hunter Region. The 119 species, including 17 which are nominally resident, recorded during the eight years of this study demonstrate that a large but relatively isolated rural garden provides important bird habitat. Planting native shrubs attracted a number of smaller species by providing both food and shelter from predators. Grey Butcherbirds when resident have a profound adverse impact on the smaller species of birds, an effect which is probably exacerbated by the isolation of the site from surrounding bushland.

INTRODUCTION

This is a report of bird observations made over the last eight years at a site in the Lower Hunter Region. In some cases the changes noted can be readily explained, while in others a cause can be surmised. However, the number of interacting variables means that some of the changes remain a mystery.

The Site

The site is a two hectare property at 29 Wallaroo Road, East Seaham (32º 40' 09" S, 151º 45' 56" E). The property is registered as site no. 999 in the Birds Australia Atlas Survey. It includes areas of grass, both long and mowed, scattered trees, native shrubs and a small dam. The trees over 3m tall number about 250 and consist mainly of ironbark, forest red gum *Eucalyptus tereticornis* and spotted gum *Corymbia maculata*, with a few melaleucas, casuarinas and other unidentified species. In three areas the trees form copses which provide a canopy but there is little understorey. There are seven flowering palms beside the house. The native shrubs are grouped in clumps separated by areas of grass and include over 80 grevilleas. Across the road there are a number of farm dams and large open areas for the grazing of horses, cattle and sheep. Within a kilometre there are significant areas of forest leading to the Wallaroo Nature Reserve and Wallaroo State Forest.

METHODOLOGY

Each month has been divided into four weeks: week one being the 1st to the 7th, week two the 8th to the 14th, week three the 15th to the 21st and week four the 22nd to the end of the month. There are thus 48 weeks in the year. A record is kept of species seen or heard from the property each week. No attempt is made to identify the abundance of each species. This method leads to certain anomalies. Flyovers such as eagles and pelicans are included, although they never actually visit the property. Other birds which rarely or never visit the property are recorded because their calls carry a long distance. Examples are the Eastern Whipbird *Psophodes olivaceus*, Pheasant Coucal *Centropus phasianinus*, Wonga Pigeon *Leucosarcia picata* and White-winged Chough *Corcorax melanorhamphos*. Other smaller species such as wrens, finches and thornbills may be missed because their calls do not carry and they are only recorded when they actually visit the property. The records must be presumed to understate the actual situation, as observation is on a casual basis ancillary to the routine daily activities of the two observers. There is also the question of the diligence of the recorders, which may vary from week to week. Doubtless some avian visitors go un-noticed. There are some gaps in the records corresponding to periods when no-one was available to do the recording. The number of record weeks therefore varies from year to year. For this reason the data is presented, not as the number of weeks in a year in which a species was present but as the Reporting Rate. For example, if in a particular year, records were kept for 44 weeks and a certain species was recorded in 22 weeks, it would be shown as having a reporting rate of 50 percent.

RESULTS

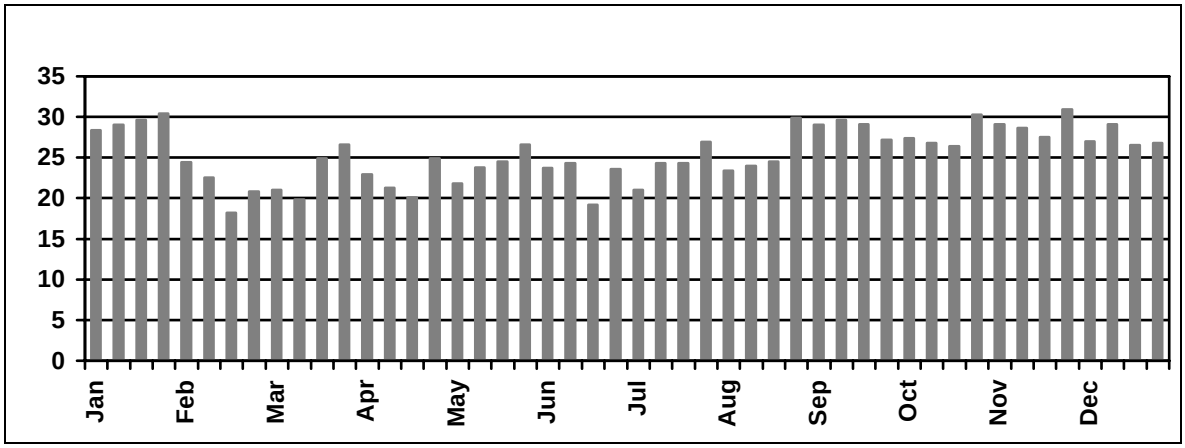
A total of 119 species has been recorded. Of these, 17 have been recorded in more than 80 percent of weeks and are considered resident. A further 26 have been characterised as frequent visitors, being recorded in more than 20 percent of weeks. Another 7 are seasonal, summer visitors. The remainder are occasional visitors, some having been recorded only once in the eight years.

Resident Species
Australian Wood Duck *Chenonetta juba*
Pacific Black Duck *Anas superciliosa*
Crested Pigeon *Ocyphaps lophotes*
Masked Lapwing *Vanellus miles*
Galah *Eolophus roseicapillus*
Sulphur-crested Cockatoo *Cacatua galerita*
Eastern Rosella *Platycercus eximius*
Laughing Kookaburra *Dacelo novaeguineae*
Noisy Miner *Manorina melanocephala*
Grey-crowned Babbler *Pomatostomus temporalis*
Black-faced Cuckoo-shrike *Coracina novaehollandiae*
Grey Butcherbird *Cracticus torquatus*
Australian Magpie *Cracticus tibicen*
Willie Wagtail *Rhipidura leucophrys*
Australian Raven *Corvus coronoides*
Magpie-lark *Grallina cyanoleuca*
Welcome Swallow *Hirundo neoxena*
Frequent Visitors
Chestnut Teal *Anas castanea*
Bar-shouldered Dove *Geopelia humeralis*
Wonga Pigeon *Leucosarcia picata*
Little Pied Cormorant *Microcarbo melanoleucos*
Cattle Egret *Ardea ibis*
White-faced Heron *Egretta novaehollandiae*
Straw-necked Ibis *Threskiornis spinicollis*
Wedge-tailed Eagle *Aquila audax*
Yellow-tailed Black-Cockatoo *Calyptorhynchus funereus*
Rainbow Lorikeet *Trichoglossus haematodus*
Australian King-Parrot *Alisterus scapularis*
Pheasant Coucal *Centropus phasianinus*
Fan-tailed Cuckoo *Cacomantis flabelliformis*
Satin Bowerbird *Ptilonorhynchus violaceus*
Spotted Pardalote *Pardalotus punctatus*
Eastern Spinebill *Acanthorhynchus tenuirostris*
Lewin's Honeyeater *Meliphaga lewinii*
Yellow-faced Honeyeater *Lichenostomus chrysops*
Red Wattlebird *Anthochaera carunculate*
Blue-faced Honeyeater *Entomyzon cyanotis*
Noisy Friarbird *Philemon corniculatus*
Eastern Whipbird *Psophodes olivaceus*
Pied Butcherbird *Cracticus nigrogularis*
Pied Currawong *Strepera graculina*
White-winged Chough *Corcorax melanorhamphos*
Jacky Winter *Microeca fascinans*

Seasonal Visitors	
Eastern Koel *Eudynamys orientalis*	Oct-Feb
Channel-billed Cuckoo *Scythrops novaehollandiae*	Sep-Jan
Dollarbird *Eurystomus orientalis*	Nov- Feb
White-throated Gerygone *Gerygone albogularis*	Aug-Apr
Cicadabird *Coracina tenuirostris*	Nov-Jan
Rufous Whistler *Pachycephala rufiventris*	Aug-Feb
Mistletoebird *Dicaeum hirundinaceum*	Nov-Apr

The number of species recorded in any week varies from a minimum of 12 to a maximum of 42. There is a distinct pattern in the annual variation in the average number of species recorded weekly **(Figure 1**). Between the 4th week of August and the end of January the number of species averaged over 26.5, while between February and the 3rd week of August the average was always below this figure. The average number of species recorded over the whole eight years for the Spring/Summer period was 27.2 and for the Autumn/Winter period 23.1, a difference of 4.1. This pattern persists, though reduced to a difference of 2.9, when the seasonal migrants are excluded. Whether this reflects a reduced number of species in the winter, or whether the birds are simply quieter and less noticeable, is not known. There is a small peak in the number of species seen towards the end of March which may be a consequence of the presence of migrants on passage. The consistency in the number of species during the two periods suggests that although recording was on a casual basis it does provide a reliable record of the bird population, at least for the regular species.

Figure 1. Annual variation in the average number of species seen weekly.



Species which Increased

The Reporting Rates of a number of species including the Bar-shouldered Dove, Yellow-tailed Black-Cockatoo, Little Corella *Cacatua sanguinea*, Eastern Rosella, Eastern Koel, Eastern Spinebill, Red Wattlebird and Spotted Pardalote increased during the study (**Figures 2** and **3)**.

Three new species, not present in the first few years, have appeared: the Rainbow Lorikeet *Trichoglossus haematodus* (first seen July 04), Blue-faced Honeyeater (October 04) and Little Corella (September 05). There have also been occasional visits by Long-billed Corellas *Cacatua tenuirostris*. The corellas come from a mixed colony which has recently established itself a few kilometres away at Seaham. The honeyeaters have been attracted by the native garden (particularly the grevilleas) as it has grown and matured. The reason for the increase in the lorikeets is unclear as they feed in the flowering eucalypts and there does not appear to have been any significant change in the suitability of the survey site during the study. They also favour the palms for the short period when these are in flower.

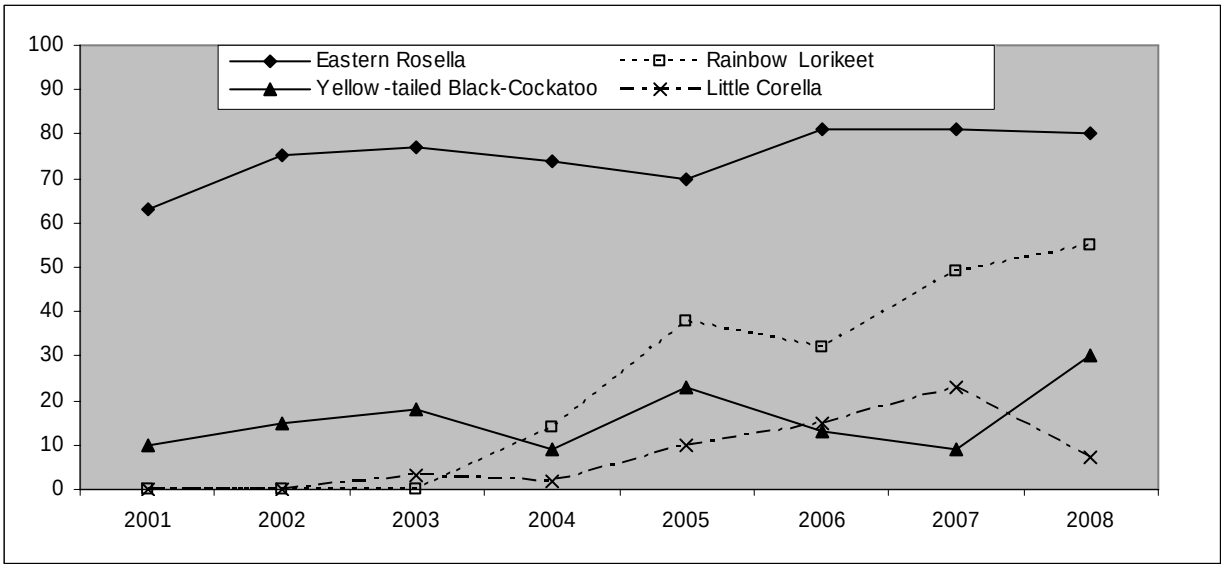


Figure 2. Reporting rates (percentage) of species which increased.

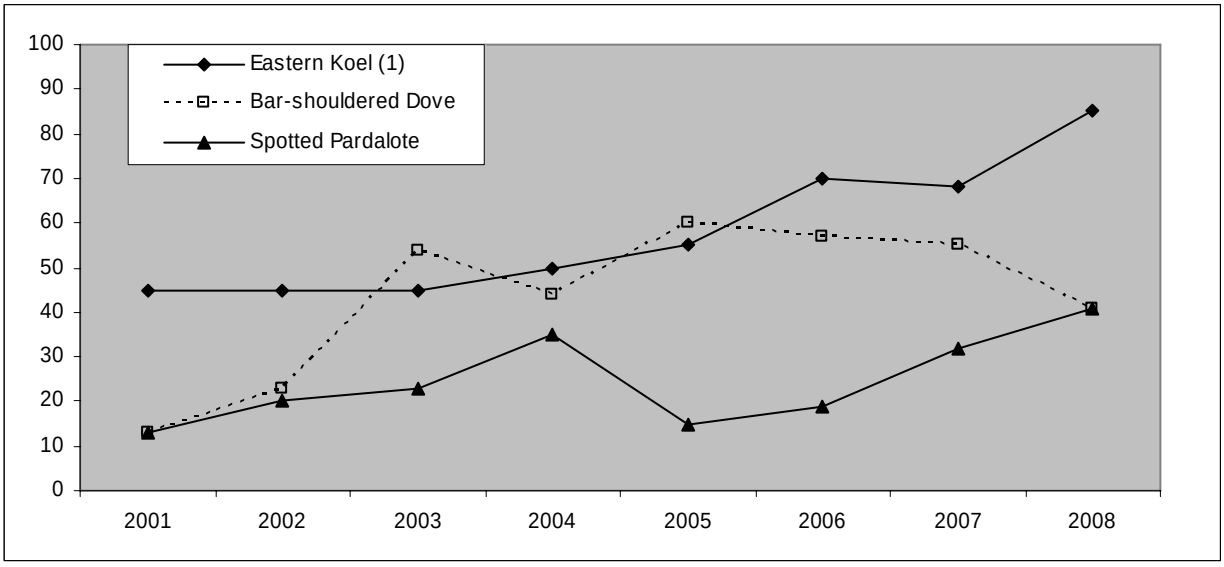


Figure 3. Reporting rates (percentage) of species which increased.
(1) Data for the Eastern Koel are a percentage of the summer weeks only (Oct-Feb).

Species which Decreased

Three birds have not been recorded for several years although they remain relatively common in the region. These are Golden Whistler *Pachycephala pectoralis* (last seen August 02), Yellow-rumped Thornbill *Acanthiza chrysorrhoa* (January 03) and White-breasted Woodswallow *Artamus leucorynchus* (April 03).

Species showing an ongoing decline were the Little Black Cormorant *Phalacrocorax sulcirostris*, Wonga Pigeon, Pallid Cuckoo *Cacomantis pallidus*, White-throated Gerygone, Black-faced Cuckoo-shrike, and Jacky Winter (**Figure 4)**. A Little Pied Cormorant *Microcarbo melanoleucos* remains a frequent visitor.

Effect of Butcherbirds

The Reporting Rates of a number of small birds declined or ceased between 2002 and 2006 but showed a temporary revival in September 2006 (**Figure 5)**. This appears to be related to the presence or absence of a pair of Grey Butcherbirds around the house. Grey Butcherbirds had always been among the visitors to the property but, in October 2001 a very vocal pair took up residence near the house. Although no aggressive behaviour towards the small birds was observed, butcherbirds are known predators and it was suspected that they may be responsible for the sudden decline in the prevalence of many of the smaller species. This theory received dramatic support in September 2006. Near the end of August, one of the butcherbirds was found dead and the other disappeared. There followed a five-week period during which there was an explosion of small birds around the house. This is illustrated in the following graphs (**Figures 5** and **6).** However, these trends in Reporting Rate do not do full justice to what happened because they do not show the abundance of the birds; there were at least a dozen Eastern Spinebills and twenty plus Silvereyes *Zosterops lateralis* present (after an absence of four years). In early October, the butcherbirds returned. Whether this was a new pair or one of the originals with a new partner is not known. They again became resident around the house although they were never as vocal as the earlier pair. There was an immediate drop in the number of small birds with some species disappearing again over the next few months.

The effect of the butcherbirds' absence is more dramatically shown in **Table 1,** where the Reporting Rates are shown for periods corresponding to changes in the presence of the butcherbirds.

Table 1. Impact of the presence of Grey Butcherbirds on the Reporting Rates (RR) of other bird species.

	Prior to 10/01	**10/01 to 8/06**	**Sept 2006**	**10/06 to 3/07**
Butcherbird status	**Inter-mittent**	**Perm-anent**	**Absent**	**Perm-anent**
Reporting Rate	**RR (%)**	**RR (%)**	**RR (%**	**RR (%)**
Grey Butcherbird	19	93	0	100
Superb Fairy-wren	44	0.5	100	0
Grey Fantail	75	7	75	4
Double-barred Finch	19	2	0	0
Red-browed Finch	6	0.5	50	0
White-throated Gerygone	38	27	50	21
Lewin's Honeyeater	75	10	75	8
Yellow-faced Honeyeater	81	8	100	21
Jacky Winter	81	49	50	17
Spotted Pardalote	25	20	75	13
Silvereye	31	0	50	4
Varied Sittella	13	1	0	0
Eastern Spinebill	75	17	100	63
Yellow Thornbill	13	2	0	0
Yellow-rumped Thornbill	31	105	0	0
Willie Wagtail	100	45	75	38
Welcome Swallow	100	63	80	75
Rufous Whistler	25	21	40	4

Although the data appear to strongly support the butcherbird theory, there remain some anomalies. For example, the revival of the Double-barred Finches *Taeniopygia bichenovii*, such as it was, occurred in February 2007, several months after the return of the butcherbirds and is presumably an unrelated occurrence.

Honeyeaters

With the Red Wattlebird, Eastern Spinebill, Lewin's Honeyeater and Yellow-faced Honeyeater, we appear to have two conflicting trends. They suffered a similar collapse to the other small birds in 2002, assumed to be a consequence of the butcherbirds' presence, but not only has their revival been permanent, they have continued to increase, despite the butcherbirds' return (**Figure 6**). This is considered most likely due to the maturing of the native garden.

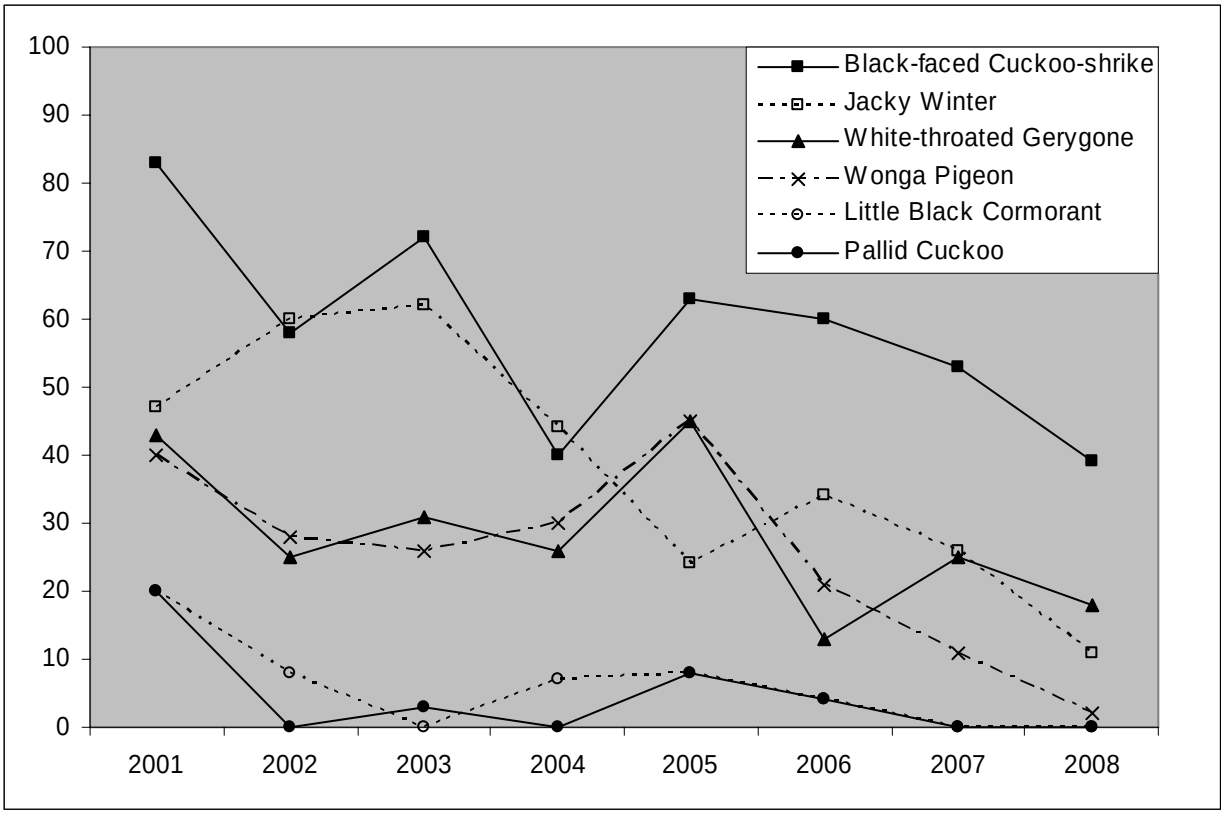


Figure 4. Annual reporting rates (percentage) of species which have declined.

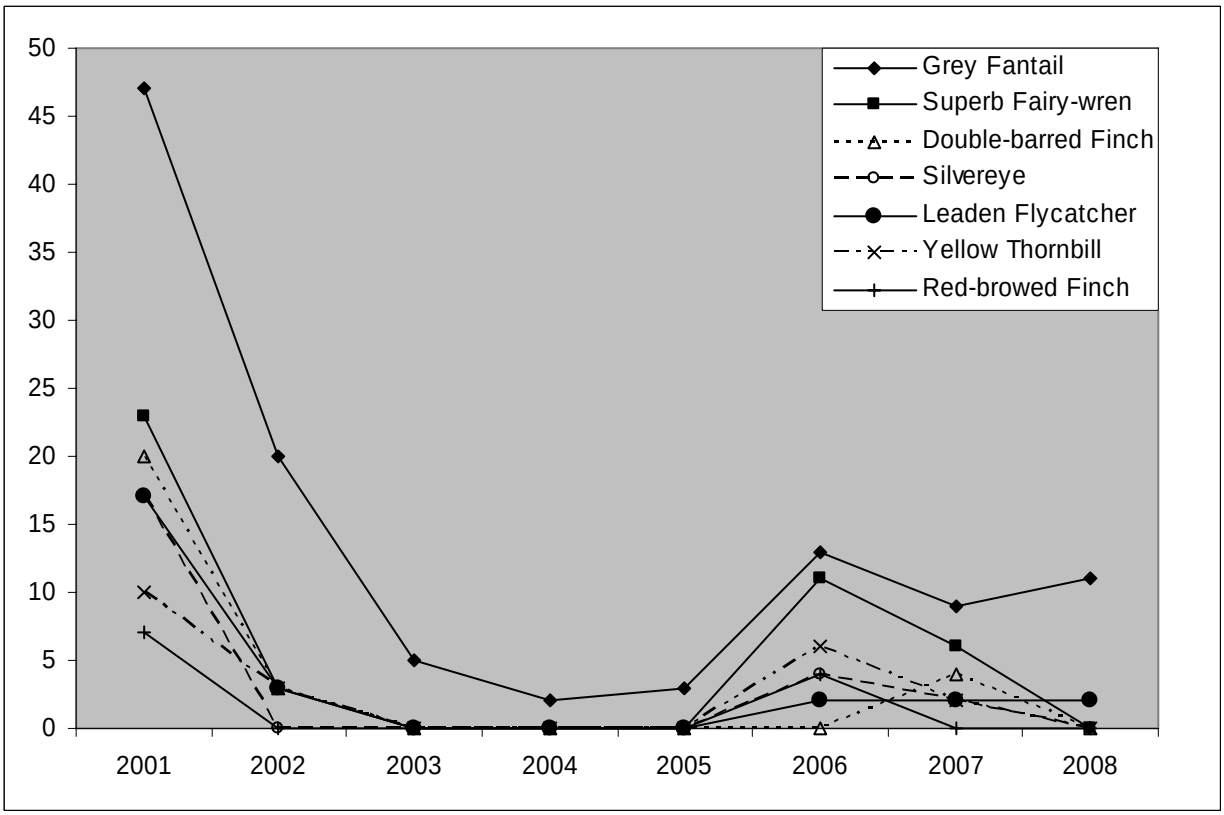


Figure 5. Impact of Grey Butcherbirds' absence for 5 weeks in September 2006 on the annual reporting rates of small bird species.

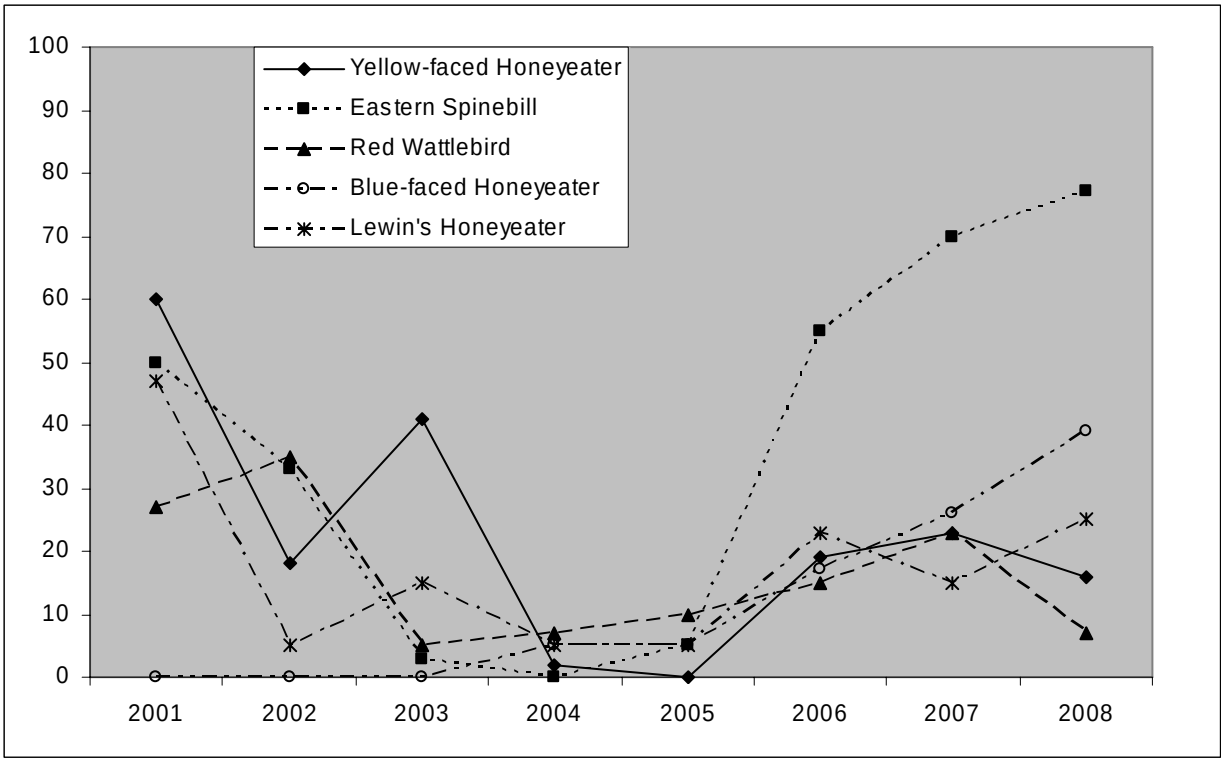


Figure 6. Variation in annual reporting rate (percentage) of honeyeater species.

The Blue-faced Honeyeaters, which were not present originally, have also been attracted by the native shrubs and appear unaffected by the presence of the butcherbirds. Perhaps their size and aggressive nature makes them a match for predators, although one would have expected the same argument to apply to the Red Wattlebird. In addition to providing food for the nectar-feeders, the shrubs as they increase in size provide cover, which may explain the rather surprising resurgence of the smaller-sized spinebills.

Ducks

Australian Wood Ducks and Pacific Black Ducks are resident on the dams on this and adjacent properties while Chestnut Teal *Anas castanea* are frequent visitors. The teal are particularly attracted to *Azolla*, a native floating aquatic fern when this is present on the dam. Between July and September of 2002 and again in December of that year, Hardheads *Aythya australis* were present, although not seen before or since. A surprise omission from the record is the Grey Teal *Anas gracilis*. These are relatively common in the local area but have never been recorded at this site although there are nine farm dams within half a kilometre. Perhaps there is something about the size or layout of this and the adjacent dams that deter them.

Breeding

Birds that have bred successfully at this site are Grey Butcherbird, Noisy Miner *Manorina melanocephala*, Noisy Friarbird *Philemon corniculatus*, Masked Lapwing and Grey-crowned Babbler. A pair of Tawny Frogmouths *Podargus strigoides* produced two chicks one year but lost them to a goanna before they fledged. Australian Magpies and Tawny Frogmouths have built nests but abandoned them. A Crested Pigeon has nested in the same callistemon three years running but has yet to produce a chick. Satin Bowerbirds and Mistletoebirds have also nested, only to have their nests destroyed by predators. Although they have not nested on the site, Australian Wood Ducks and Pacific Black Ducks have appeared with young but have suffered large losses. Young Australian Magpies, Laughing Kookaburras and Galahs are around every summer, indicating that these birds also breed regularly in the immediate vicinity, although not on this property. On one occasion, a young Noisy Miner fell out of the nest and being unable to get back, perched on a branch lower down. Within 15 minutes, it was taken by a Brown Goshawk *Accipiter fasciatus* although no goshawk had been recorded in the previous 12 months. This reinforces the notion that more birds are around than are recorded.

Grey-crowned Babblers

There are several clans of Grey-crowned Babblers, a species listed as "vulnerable" under the *NSW Threatened Species Conservation Act 1995*, within a few kilometres and one clan resident on the site. This group originally consisted of seven birds which increased to ten and then declined until only two were left. This pair has bred successfully on a number of occasions but several of the chicks have died from an unknown cause. Others have disappeared and are assumed to have died rather than joining another clan. It is not certain that the two remaining birds are the original pair or some of their offspring. On one occasion, the four birds, two adults and two young, hopped about on the grass very noisily for several days after the young left the nest. Then one of the young was found dead and the birds' behaviour immediately changed. The surviving young bird was parked in a callistemon where it remained quietly for about a week while the adults fed it, before emerging and beginning to forage again with the adults.

Migrants

Among the seasonal visitors, the Channel-billed Cuckoos *Scythrops novaehollandiae* are particularly punctual, always arriving in the second week of September. They are also the first of the migrants to disappear although their departure is a little more drawn out, their raucous call sometimes being heard into February. It appears that a few of the White-throated Gerygones and Mistletoebirds over winter, as they have occasionally been recorded through the winter months. In some summers (02/03, 03/04, 05/06, 06/07), the Cicadabird has not been recorded at all. The Rufous Whistlers are very variable in their occurrence. In some years they have been recorded as early as August, while in others the first record has not been until December. The last record of the summer also varies between December and February. In two years (01 and 02) they were recorded throughout the winter.

CONCLUSIONS

The observation and recording of the bird species at this site has proved a fascinating pastime. Some of the changes observed can be plausibly explained while others remain unresolved. The number of possible factors influencing bird movements is such that a much longer study and co-ordination with investigations at other sites would be needed before further explanations could be expected. The 119 species recorded during the eight years of this study is in line with studies by the Hunter Bird Observers Club in the area and at Butterwick near Paterson, 10 kilometres to the west (Newman 2007). It demonstrates that a large but relatively isolated rural garden provides important bird habitat. Planting native shrubs has attracted a number of smaller species by providing both food and shelter from predators. Grey Butcherbirds when resident have a profound adverse impact on the smaller species of birds which is probably exacerbated by the isolation of the site from surrounding bushland.

REFERENCE

Newman, M. (2007). Bird population of a cattle property near Paterson, NSW - an eleven year study. *The Whistler* **1**: 46-48.

The birds of Green Wattle Creek – monthly surveys 1996-2009

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The Green Wattle Creek woodland at Butterwick is an important natural resource located on the edge of the Paterson River flood plain. In view of its limited size (approximately 120ha) and its relative isolation from similar low-lying woodland habitat the 144 species identified since 1993 is impressive. Monthly surveys over a 13-year period have allowed changes in the reporting rates and abundance of individual species to be measured. Analysis of the results highlights a number of statistically significant changes in the woodland bird population. The number of declining species exceeds those which are increasing. Among the declining species a cohort of ground-foraging birds stand out, including the Speckled Warbler *Chthonicola sagittata*, Brown Treecreeper *Climacteris picumnus*, Buff-rumped Thornbill *Acanthiza reguloides* and the White-winged Chough *Corcorax melanorhamphos*. The reason for their decline is attributed to the cessation of light cattle grazing shortly after the surveys commenced resulting in a progressive increase in understorey and ground cover vegetation making the woodland less suitable for ground-foraging species. Of this group only the Speckled Warbler, a threatened species listed as vulnerable, retains resident status and it is increasingly restricted to habitat at the edge of the woodland. In contrast the Lewin's Honeyeater *Meliphaga lewinii* has benefited from the increased understorey growth. The reasons for the decline of other species like the Fuscous Honeyeater *Lichenostomus fuscus* are less clear and factors like variations in rainfall and the loss of connectivity to similar woodland habitat may be important. The diversity of its bird population, the presence of threatened species, the use of the area by migrants on passage and nomads seeking drought refuge all make the Green Wattle Creek woodland an area requiring a degree of protection and management which is sympathetic to its natural assets. The Speckled Warbler is a particularly important case. For instance an extensive fire could cause the local extinction of this species in view of the limited connectivity to similar habitat.

INTRODUCTION

This study was carried out in an area of woodland at the end of Green Wattle Creek Road, Butterwick 32º 40' S 151º 39' E in the Lower Hunter Valley near Paterson, comprising approximately 120ha (approximately 40 ha surveyed) of remnant woodland situated at the edge of the Butterwick floodplain. A similar study was made in parallel on an adjacent working cattle property (Newman 2007) allowing a comparison of the bird populations of the two sites. A third parallel study was conducted on a cattle property, Warakeila, in the upper Allyn River Valley (Newman & Lindsey 2008). Key features of this investigation are the cessation of light grazing shortly after the surveys commenced, the absence of any burning for at least twenty years and the isolation of the study area from similar habitat. Its bird population contains several species which are uncommon in the Butterwick area including a breeding population of the Speckled Warbler *Chthonicola sagittata* which is listed as vulnerable under the NSW Threatened Species Act.

All three studies commenced as part of the "Birds on Farms" project run by Birds Australia. The studies were continued during the "New Atlas of Australian Birds" (Barrett *et al*. 2003) and the "Ongoing Atlas" projects which used compatible survey techniques. However this study was more intensive with surveys made at monthly intervals as opposed to three months in the parallel studies.

As with the previous papers the intention is to generate baseline data against which future bird population trends can be gauged. Discussion of changes in bird populations during this study and comparison with the other studies is limited to examples where trends and differences are obvious. A more detailed evaluation of these aspects will be the subject of subsequent papers as will differences in the sub-populations of different habitats sampled at the four 2ha sites.

METHODS

156 surveys were conducted monthly by the author over a 13-year period commencing April 1996. Observation typically commenced about one hour after sunrise and took about four hours to complete. A constant survey effort was adopted in which each survey followed the same route (**Figure 1**). Separate records were kept for the total survey and for the four 2ha sites at which 20-minute counts were made. The numbers of birds for each species was recorded based on birds both seen and heard.

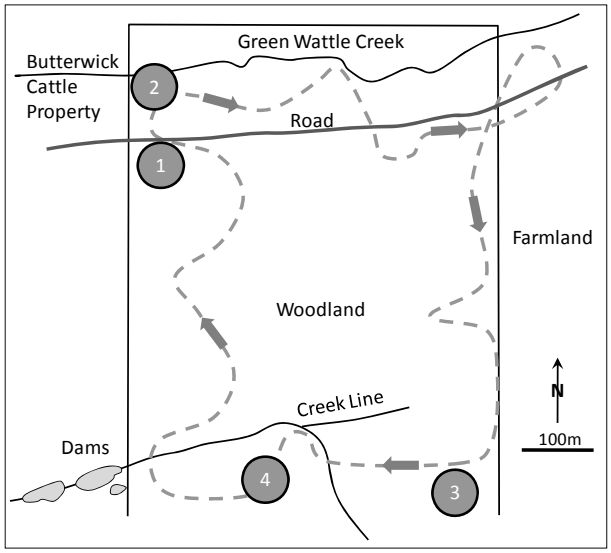

Figure 1. Survey route and 2ha survey sites at Green Wattle Creek woodland.

In the following sections some species have been classified as summer and winter visitors based on the relative frequency of their occurrence during October-January compared with April-July (i.e. the periods when birds were deemed most likely to be migrating through the area were not considered). Discussion of changes in the bird population during the study is based on a comparison of the results for 1997-2002 with 2003-2008. The exclusion of 12 surveys from this analysis creates two symmetrical sets of data each including 72 monthly surveys and allows the initial nine surveys made in 1996 when the survey technique was being fine tuned to be discarded. Differences in the reporting rates (RR; the percentage of surveys on which a species was recorded) and abundance (mean number of individual birds seen for each species considering only those surveys when a species was present) were compared for the two periods.

HABITAT OVERVIEW

A vegetation survey, with emphasis on the 2ha sites was made in April 2009. The following description relates to the habitat at the end of the study in 2009.

Cattle grazing ceased shortly after the bird surveys commenced resulting in a progressive increase in both ground cover and understorey vegetation. The woodland is approximately 120ha in area and rectangular in shape. Green Wattle Creek runs along the 0.5km long northern boundary and vegetation at its edges contains rainforest species. Although the area has been logged in the past the trees are about 30m in height and form a closed canopy in the northern half of the wood. At the southern end the habitat is temperate woodland with a more open canopy. The survey route primarily involves the closed canopy areas but the open woodland is sampled at 2ha site 4.

Four tree species dominate the canopy; Forest Red Gum *Eucalyptus tereticornis*, Spotted Gum *Corymbia maculata*, Grey Gum *Eucalyptus punctata* and Narrow-leaved Ironbark *Eucalyptus crebra*, with small numbers of White Mahogany *Eucalyptus acmenoides.* A combination of historical logging, removal of dead timber for firewood and the absence of recent fires means there are limited nest holes for birds. Recent illegal logging of live trees targeted mature ironbarks. Mistletoe *Dendrophthoe vitellina* is a feature of the woodland at and near 2ha site 1 and at 2ha site 3 with the Spotted Gum and Narrow-leaved Ironbark preferred hosts.

Lantana camara and Blackthorn *Bursaria spinosa* dominate the understorey layer, varying in relative proportions and density through the northern end of the woodland. Green Wattle *Acacia irrorata* and the smaller shrubs *Ozothamnus diosmifolius* and *Leucopogon juniperinus* are also present, the latter being the dominant ground cover species in places where taller shrubs, particularly the invasive Lantana are absent. Other ground cover species include Kidney Weed *Dichondra repens*, *Daviesia ulicifolia* which is a prickly shrub, Mulga Fern *Cheilanthes sieberi* and in areas of dense vegetation White Root *Pratia purpurascens.* Areas where the ground cover is predominantly leaf and bark litter without a shrub layer have decreased since grazing ceased. In the open woodland areas native grasses including Blady Grass *Imperata cylindrica*, Kangaroo Grass *Themeda australis* and Tufted Hedgehog Grass *Echinopogon caespitosus*, provide ground cover with a few invasive shrub species.

Site 1 vegetation is dominated by the four species of tall trees mentioned earlier which have minor mistletoe infestations. Lantana is the dominant understorey species providing approximately 50 percent ground coverage. The remainder of the

ground is more open with small shrubs, *Dianella sp.* and some native grass. Formerly there was a permanent pond which was drained when a small Equestrian Centre was established between sites 1 and 2 shortly after the surveys commenced. The ground in this area is relatively bare.

Site 2 is situated on Green Wattle Creek and includes the edge of the grassed Equestrian Centre oval. Consequently in addition to the species mentioned previously at site 1, which occur on the higher ground, the wetter areas contain species only found along the creek lines including *Melaleuca stypheloides*, Cheese Tree *Glochidion ferdinandi*, Muttonwood *Myrsine diosmifolius* and the native vine *Parsonsia straminea* which form a mid-storey layer (3 to 15m) below the taller canopy trees. About half the ground is covered by dense understorey dominated by Lantana. In the more open areas there are a few species like Native Olive *Notelaea spp.* and *Lomandra sp.*

At site 3, in addition to the dominant canopy trees mentioned at sites 1 and 2, there is an extensive dense understorey growth of Blackthorn to a height of 3m with minor amounts of Kurrajong *Brachychiton populneus*, wattle and the introduced species Lantana and Wild Olive *Olea europaea africana*. There are minor patches of the small shrub *Leucopogon juniperinus*.

Forest Red Gum is the dominant tree in the open woodland at site 4, with a few Narrow-leaved Peppermints. Wallaby grass provides dense ground cover with very few weeds and introduced grass species. There is one well established Wild Olive and a few Lantanas, but other than these exotic species there is no shrub layer. There is some fallen timber including several trees up-rooted during storms.

FACTORS IMPACTING ON SURVEY DATA

The primary purpose of the study was to determine the presence of species at the four 2ha sites and for the total survey route. In addition an estimate was made of the number of each species present. The four sites are separated by several hundred metres and there is typically an interval of at least 20 minutes between making each 2ha count. This minimises the probability of the same birds being sampled at more than one of the 2ha sites, although it does not completely eliminate the possibility because outside the breeding season woodland birds often form mobile mixed species foraging groups.

Most of the area surveyed is woodland with a closed canopy involving trees of about 30m in height. This causes difficulties with the identification of small birds, a problem which is exacerbated when they are not vocal. Consequently small species tended to be under reported. In addition birds like raptors and the *Hirundinidae* soaring silently above the canopy are not visible and hence are also under reported. Where possible surveys commenced about one hour after sunrise when birds are active and adverse conditions involving wind and rain were avoided. During summer rising diurnal temperature is an issue, with the deafening noise of cicadas seriously affecting the detection of birds by their calls. In addition there was a tendency for the wind to increase about 2 hours into the survey. The combined impact of these issues is to make recording more difficult particularly at site 3 where there is both a closed canopy and dense understorey vegetation making visual identification of birds difficult.

Regular visits were made to the area for three years before the systematic surveys commenced. At that time and until 1998 the area was lightly grazed. Grazing subsequently ceased with a progressive increase in ground and understorey cover. During 1998 a small Equestrian Centre was established involving the clearing of vegetation between 2ha sites 1 and 2 and part of site 2. The Equestrian Centre is only used infrequently and has limited impact other than creating a grassy oval which provides foraging habitat for some species including flocks of finches which can be accurately counted. At the same time the Equestrian Centre was established trees and scrub were felled and left to decay along the perimeter of the wood on the section of the survey route approaching 2 ha site 3 (**Figure 1)**. The decay of fallen timber and the gradual regeneration of this perimeter strip attracted a number of small species from adjacent areas of the woodland where the understorey was becoming progressively dense in the absence of grazing. Small adjustments to the survey route were made to sample this area.

As indicated above, edge habitat is important to a number of species of woodland birds. The survey route samples the borders of the woodland at several places and at one point a 15-minute detour is made into a patch of grazed lightly timbered pasture. Elsewhere species more than 100m from the woodland boundary were ignored. During the

study residential development took place on two blocks of 2ha size adjacent to the western boundary of the wood, involving some clearing of vegetation and the creation of small dams.

Between 2002 and 2006 the area suffered a period of extended drought which impacted on both the woodland habitat and its use by birds.

Several factors impact on the assessment of population change during the study. Firstly observer experience with the birds, their calls and their use of the area increased over the duration of the study and hence survey effort may have been more effective during the second half of the study exaggerating the extent to which species appeared to increase. Conversely this bias would under-estimate the magnitude of the change for decreasing species. Secondly where species are identified by call, particularly flocks of small species like the pardalotes it is impossible to determine the number of birds accurately. Hence the count is inevitably an underestimate. The extent to which birds call varies through the year with peaks during the breeding season. This also impacts on both the detection of species (RR) and their abundance (number of individuals). A further complication is the influence of migrant birds (e.g. Yellow-faced Honeyeater *Lichenostomus chrysops*) during spring and autumn. The period of migration is quite short and may be missed in some years if the timing of the monthly survey does not correspond with the passage of birds through the woodland.

RESULTS

The results are summarized in **Table 1** which provides a comparison of the number of species and their abundance (i.e. number of individual birds) between seasons. A total of 135 species were positively identified. Four additional species were excluded from the analysis, three because identification was tentative and the other because it was considered to have escaped from a captive population. The greatest number of species 111 was recorded in spring (September to November) compared with 108 in summer (December to February) and 104 and 105 in autumn (March to May) and winter (June to August) respectively reflecting the absence of summer migrants during these months. The average number of species/survey was highest in spring during the peak of the breeding season and lowest in autumn and winter. However the lowest number of species recorded on a single survey was during summer, probably as a consequence of under reporting associated with the oppressive conditions in January and February when birds are both less active and less vocal.

The abundance of birds was greatest in spring. Numbers were relatively constant in the other seasons being lowest in summer probably associated with under reporting through missed detections as discussed above. The lowest number of birds counted coincided with the lowest number of species during a summer count.

On average 21 percent of the birds for the whole survey were recorded at the 2ha sites and this proportion showed little variation between seasons (range 20 to 22 percent).

Table 1. Summary of survey statistics.

	All Surveys	**Summer**	**Autumn**	**Winter**	**Spring**
Species Recorded	135	108	104	105	111
Average/survey	46.5	47.9	42.7	42.8	52.9
Maximum	62	60	49	51	62
Minimum	31	31	33	34	42
Number of Birds	47,989	10,478	11,096	12,372	14,043
Average/survey	307.6	268.6	284.5	317.2	360.1
Maximum	560	358	398	436	560
Minimum	144	144	201	175	266
Birds at 2ha sites **(%)**[1]	21.4	22.1	20.2	21.3	22.0

[1]Percentage of total birds seen on the surveys which were recorded at the 2ha sites.

Species Regularly Recorded Year Round

The 27 species listed in **Table 2** had a reporting rate of >80 percent and are generally very common in the study area. Even though only three species were recorded on every survey most of these species are thought to be residents.

Numbers of Yellow-faced Honeyeater, Grey Fantail *Rhipidura albiscapa* and Spotted Pardalote *Pardalotus punctatus*, three of the more numerous species, fluctuated throughout the year peaking during spring and autumn migration.

Most of the species were distributed throughout the woodland area. However Eastern Rosella *Platycercus eximius*, Superb Fairy-wren *Malurus cyaneus* , Australian Magpie *Cracticus tibicen* and Red-browed Finch *Neochmia temporalis* often foraged in the cleared areas at the woodland edge, particularly the Equestrian Centre oval, sometimes forming substantial flocks which could be accurately counted. The Noisy Miner *Manorina melanocephala* also favoured the edge of the woodland and was conspicuously absent from interior areas where the tree canopy was closed even when the shrub layer was sparse.

The Eastern Whipbird *Psophodes olivaceus* was well distributed along the wet habitat of Green Wattle Creek as well as in the drier woodland areas where introduced Lantana provided dense ground cover. The Variegated Fairy-wren *Malurus lamberti* favoured areas where the Lantana had colonised the drier woodland.

During summer the Golden Whistler *Pachycephala pectoralis* was primarily restricted to areas of wetter habitat, particularly along creek lines but during autumn moved into the drier woodland.

Table 2. Species recorded regularly in all seasons.

Common Name	Scientific Name	Reporting Rate (%)	Mean Number Present[1]	Maximum Number
Eastern Rosella	*Platycercus eximius*	94.9	8.6	32
Laughing Kookaburra	*Dacelo novaeguineae*	97.4	4.8	11
White-throated Treecreeper	*Cormobates leucophaea*	98.7	4.8	11
Superb Fairy-wren	*Malurus cyaneus*	100.0	26.6	51
Variegated Fairy-wren	*Malurus lamberti*	92.9	8.3	27
White-browed Scrubwren	*Sericornis frontalis*	94.9	5.0	15
Brown Gerygone	*Gerygone mouki*	91.7	4.7	33
Striated Thornbill	*Acanthiza lineata*	94.2	12.1	38
Yellow Thornbill	*Acanthiza nana*	89.1	7.0	28
Brown Thornbill	*Acanthiza pusilla*	92.3	3.4	10
Spotted Pardalote	*Pardalotus punctatus*	99.4	12.0	43
Eastern Spinebill	*Acanthorhynchus tenuirostris*	84.6	4.5	15
Lewin's Honeyeater	*Meliphaga lewinii*	99.4	7.9	17
Yellow-faced Honeyeater	*Lichenostomus chrysops*	97.4	28.1	60
Fuscous Honeyeater	*Lichenostomus fuscus*	93.6	8.7	22
Noisy Miner	*Manorina melanocephala*	89.1	7.3	35
Eastern Whipbird	*Psophodes olivaceus*	98.1	8.2	17
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	80.8	3.4	17
Golden Whistler	*Pachycephala pectoralis*	96.8	5.1	15
Grey Shrike-thrush	*Colluricincla harmonica*	93.6	3.5	12
Grey Butcherbird	*Cracticus torquatus*	92.9	3.3	8
Australian Magpie	*Cracticus tibicen*	98.7	6.9	16
Grey Fantail	*Rhipidura albiscapa*	100.0	18.8	46
Australian Raven	*Corvus coronoides*	96.8	4.3	11
Jacky Winter	*Microeca fascinans*	89.7	4.1	11
Eastern Yellow Robin	*Eopsaltria australis*	100.0	6.5	19
Red-browed Finch	*Neochmia temporalis*	95.5	22.5	101

[1] Mean number seen on surveys when the species was present.

The Brown Gerygone *Gerygone mouki* breeds along Green Wattle Creek and is regularly recorded in small numbers (4.7/survey). The exceptionally high peak number of 33, which included birds foraging in the drier woodland areas, indicates the occasional movement of non-breeding birds into the area.

Striated Thornbill *Acanthiza lineata* and Yellow Thornbill *Acanthiza nana* are small species which often forage high in the canopy sometimes in mixed flocks. Hence they are probably under-recorded compared to the less numerous Brown Thornbill *Acanthiza pusilla*, which tends to forage separately at lower height and with less tendency to flock.

Regular Seasonal Visitors

For the purpose of defining which species are seasonal visitors the summer and winter seasons were re-defined as the four-month periods October-January and May-August respectively to minimise the complication of birds passing through the area during the spring and autumn migration. Inclusion in **Table 3** as a summer visitor is based on being recorded during more than 30 percent of the summer surveys and at least five times more frequently in summer than winter. Twelve species met these criteria and one species the Rose Robin *Petroica rosea* matched the converse criteria for the winter season.

The Rufous Whistler *Pachycephala rufiventris* in addition to being the most numerous of the seasonal visitors was the only species recorded on every one of the 52 summer surveys. Occasionally an individual stays, as indicated by its presence on 10 percent of the winter surveys. Rufous Whistlers, which were highly vocal in spring, held territories throughout the drier woodland area.

The other common summer visitors were the Sacred Kingfisher *Todiramphus sanctus*, White-throated Gerygone *Gerygone albogularis*, and the Leaden Flycatcher *Myiagra rubecula*, none of which was recorded in winter.

The Dollarbird *Eurystomus orientalis* was primarily seen on the edges of the wood during the early part of the season but in late summer foraged with dependent young in the tree canopy.

The Eastern Koel *Eudynamis orientalis* and the Channel-billed Cuckoo *Scythrops novaehollandiae* are large highly vocal cuckoos which regularly pass through and over the study area in summer. These species have large territories extending beyond the woodland which is probably not core feeding and breeding habitat. The Brush Cuckoo *Cacomantis variolosus* frequents the denser woodland areas and based on the presence of dependent young breeds in the area. The Cicadabird *Coracina tenuirostris* also breeds at Green Wattle Creek and is recorded annually. The remaining two species the Rufous Fantail *Rhipidura rufifrons* and the Black-faced Monarch *Monarcha melanopsis* occur almost every summer.

In contrast to the summer visitors which are known to be north-south migrants, the Rose Robin is an altitudinal migrant moving down to the coastal lowlands in winter from the higher country along the Great Dividing Range where it breeds.

Table 3. Species which are seasonal.

Common Name	Scientific Name	Mean Number[1]	Maximum Number	Summer RR[2] (%)	Winter RR[2] (%)
Eastern Koel	*Eudynamis orientalis*	1.2	2	65.4	0.0
Channel-billed Cuckoo	*Scythrops novaehollandiae*	1.4	4	67.3	0.0
Pallid Cuckoo	*Cacomantis pallidus*	1.2	2	36.5	1.9
Brush Cuckoo	*Cacomantis variolosus*	1.2	2	30.8	0.0
Sacred Kingfisher	*Todiramphus sanctus*	5.0	11	98.1	0.0
Dollarbird	*Eurystomus orientalis*	2.1	6	61.5	0.0
White-throated Gerygone	*Gerygone albogularis*	5.1	14	96.1	1.9
Cicadabird	*Coracina tenuirostris*	1.6	4	48.1	0.0
Rufous Whistler	*Pachycephala rufiventris*	10.4	30	100.0	11.5
Rufous Fantail	*Rhipidura rufifrons*	1.7	6	40.4	0.0
Leaden Flycatcher	*Myiagra rubecula*	8.0	13	98.1	0.0
Black-faced Monarch	*Monarcha melanopsis*	2.0	6	56.9	0.0
Rose Robin	*Petroica rosea*	1.5	4	0.0	44.2

[1] Mean number seen on the surveys for which the species was present.
[2] Reporting Rate.

Species Often Recorded

The 28 species in this category (**Table 4)** were recorded with a reporting rate in the range 20 to 80 percent. The broad range of species involved reflects both the woodland and the edge habitats of the study area.

The Silvereye *Zosterops lateralis*, and the White-naped Honeyeater *Melithreptus lunatus* are among the most frequently recorded woodland species. Two sub-species of Silvereye occur (*lateralis* in winter and *familiaris* in summer), sometimes in large flocks.

Six species, the Australian Wood Duck *Chenonetta jubata*, Pacific Black Duck *Anas superciliosa*, Masked Lapwing *Vanellus miles*, Galah *Eolophus roseicapillus*, Pied Butcherbird *Cracticus nigrogularis* and the Magpie-lark *Grallina cyanoleuca* are primarily species of the adjacent open country, although the two duck species may exploit the edges of the woodland for nest sites on occasions. The Willie Wagtail *Rhipidura leucophrys*, which favours the woodland edge, occurs in small numbers and is surprisingly scarce as it is common in the surrounding area.

The Striated Pardalote *Pardalotus striatus* and the Speckled Warbler are almost certainly resident in small numbers. The Striated Pardalote favours large trees on the edge of the woodland. The Speckled Warbler prefers woodland areas with limited understorey and appears to have declined during the study as will be discussed in a subsequent section. The Bar-shouldered Dove *Geopelia humeralis* increased during the study, breeding in the wet-adapted vegetation adjacent to Green Wattle Creek.

Table 4. Species often recorded.

Common Name	Scientific Name	Reporting Rate (%)	Average Number[1]	Maximum Number
Australian Wood Duck	*Chenonetta jubata*	54.5	5.1	14
Pacific Black Duck	*Anas superciliosa*	41.0	2.4	8
Bar-shouldered Dove	*Geopelia humeralis*	66.0	2.1	7
Masked Lapwing	*Vanellus miles*	21.2	1.6	3
Galah	*Eolophus roseicapillus*	44.2	2.7	9
Little Lorikeet	*Glossopsitta pusilla*	46.2	8.6	42
Australian King-Parrot	*Alisterus scapularis*	30.1	2.2	6
Shining Bronze-Cuckoo	*Chalcites lucidus*	34.0	1.6	6
Fan-tailed Cuckoo	*Cacomantis flabelliformis*	46.8	2.2	6
Satin Bowerbird	*Ptilonorhynchus violaceus*	42.3	1.4	4
Speckled Warbler	*Chthonicola sagittata*	71.8	3.8	18
Striated Pardalote	*Pardalotus striatus*	75.6	3.7	10
Red Wattlebird	*Anthochaera carunculata*	49.4	1.8	8
Scarlet Honeyeater	*Myzomela sanguinolenta*	50.0	14.3	54
White-naped Honeyeater	*Melithreptus lunatus*	63.5	3.5	15
Noisy Friarbird	*Philemon corniculatus*	41.0	3.8	27
Varied Sittella	*Daphoenositta chrysoptera*	35.9	4.3	14
White-bellied Cuckoo-shrike	*Coracina papuensis*	22.4	1.2	4
Crested Shrike-tit	*Falcunculus frontatus*	44.2	1.7	4
Olive-backed Oriole	*Oriolus sagittatus*	50.0	3.8	10
Pied Butcherbird	*Cracticus nigrogularis*	54.5	1.7	5
Pied Currawong	*Strepera graculina*	63.5	1.4	10
Willie Wagtail	*Rhipidura leucophrys*	50.0	1.6	5
Magpie-lark	*Grallina cyanoleuca*	73.1	2.5	8
White-winged Chough	*Corcorax melanorhamphos*	34.6	8.9	30
Silvereye	*Zosterops lateralis*	70.5	8.3	83
Mistletoebird	*Dicaeum hirundinaceum*	30.1	1.6	5
Double-barred Finch	*Taeniopygia bichenovii*	30.1	4.8	20

[1] Average number seen on the surveys for which the species was present.

The Little Lorikeet *Glossopsitta pusilla* and Scarlet Honeyeater *Myzomela sanguinolenta* are periodically present, sometimes in large numbers and there is circumstantial evidence that both species may breed locally. There is an interesting correspondence in the timing of use of the area by the two species as discussed later.

The presence of flocks of White-winged Choughs *Corcorax melanorhamphos* was a feature of the surveys in the initial years of the study but they subsequently decreased markedly.

The Olive-backed Oriole *Oriolus sagittatus* primarily occurs in summer being recorded on 90 percent of the summer surveys. However it also occurred on 25 percent of the winter surveys, mostly in August.

The Crested Shrike-tit *Falcunculus frontatus,* and Varied Sittella *Daphoenositta chrysoptera* are present periodically with the former species faithful to a well defined territory for extended periods and then disappearing. The White-bellied Cuckoo-shrike *Coracina papuensis*, which has bred at Green Wattle Creek, is another example of a species which occurs relatively frequently (RR 35 percent) but is uncommon in the surrounding area. The Noisy Friarbird *Philemon corniculatus* also occurs intermittently when feeding conditions are favourable.

Species Recorded Occasionally

The 67 species listed in **Table 5** were recorded on less than 20 percent of the surveys with 24 species present on two or fewer surveys. In some instances these species are rare not only in the study area but also in the Lower Hunter Region. The record of the Oriental Cuckoo *Cuculus optatus* is an example. However in other instances the dearth or lack of records is a consequence of the survey technique or the limitations of the habitat (e.g. no *Banksia* species). For instance the night birds are under recorded with a single record of the White-throated Nightjar *Eurostopodus mystacalis*, which breeds in the area (Newman 2008), just two and three records of the Tawny Frogmouth *Podgarus strigoides* and the Southern Boobook *Ninox novaeseelandiae* respectively. The Australian Owlet-nightjar *Aegotheles cristatus* and the Powerful Owl *Ninox strenua* have been recorded by other observers (Grant Bosie and Brett Shields pers. comm.).

Most of the survey time was spent in woodland with a closed canopy which contributes to under reporting of species flying overhead such as the raptors. Similar observation difficulties occur with White-throated Needletail *Hirundapus caudacutus,* Welcome Swallow *Hirundo neoxena*, Fairy Martin *Petrochelidon ariel* and Tree Martin *Petrochelidon nigricans*. The two martin species are difficult to separate with certainty when seen briefly above the tree canopy. However, as both species have been positively identified they have been tentatively assigned to individual species when recorded. Fortunately other species passing through the area like the cockatoo, parrot and corvid species are usually very vocal which assists their detection and identification. All three species of lorikeet listed in **Table 5**, namely the Rainbow Lorikeet *Trichoglossus haematodus,* Scaly-breasted Lorikeet *Trichoglossus chlorolepidotus* and Musk Lorikeet *Glossopsitta concinna* have been positively identified, but difficulties exist with identifying birds flying rapidly through woodland and separation at the species level is tentative.

The Grey Goshawk *Accipter novaehollandiae*, which has successfully bred in the area and has a secretive disposition, was recorded on 10 percent of the surveys.

The Common Starling *Sturnus vulgaris* and the Common Myna *Sturnus tristis* were recorded once and thrice respectively. Both these species are common around residential homes within 1km of the study site.

In discussing the remaining species emphasis is placed on the woodland birds for which Green Wattle Creek provides a scarce, perhaps unique habitat niche in the Butterwick area.

At the start of the study the Painted Button-quail *Turnix varius* was regularly present but it was rarely seen during the second half of the study. A similar decline was noted for a cohort of woodland birds which favour habitat with a sparse understorey including the Brown Treecreeper *Climacteris picumnus,* a winter visitor and the Buff-rumped Thornbill *Acanthiza reguloides*.

The Brown-headed Honeyeater *Melithreptus brevirostris* and the Dusky Woodswallow *Artamus cyanopterus*, which has bred in the wood, also decreased.

The Stubble Quail *Coturnix pectoralis,* Black-chinned Honeyeater *Melithreptus gularis* and the White-cheeked Honeyeater *Phylidonyris niger* were only tentatively identified and have been excluded from **Table 5**, as has the record of a

female Turquoise Parrot *Neophema pulchella*, which is thought to have escaped from captivity.

Six other species were seen during my visits before the surveys started; Black-eared Cuckoo *Chalites osculans*, Masked Woodswallow *Artamus personatus*,White-browed Woodswallow *Artamus superciliosus*, Satin Flycatcher *Myiagra cyanoleuca*, Scarlet Robin *Petroica boodang* and Rufous Songlark *Cincloramphus mathewsi*.

The Nankeen Night-Heron *Nycticorax caledonicus* was seen in an additional survey in August 2009. Two other species, the Australian Owlet-nightjar and the Powerful Owl, have been recorded by other observers as discussed earlier. A large mixed flock of the nomadic Masked and White-browed wood-swallows used the wood as a drought refuge, roosting near site 4 (**Figure 1)** for several weeks in the spring of 1994 (Stuart 1995).

Table 5. Species seen occasionally.

Common Name	Scientific Name	Reporting Rate (%)	Mean Number[1]	Maximum Number
Black Swan	*Cygnus atratus*	1.3	2.0	2
Grey Teal	*Anas gracilis*	5.1	2.3	4
Chestnut Teal	*Anas castanea*	4.5	2.4	6
Hardhead	*Aythya australis*	0.6	1.0	1
Australasian Grebe	*Tachybaptus novaehollandiae*	0.6	1.0	1
Crested Pigeon	*Ocyphaps lophotes*	16.7	1.9	7
Peaceful Dove	*Geopelia striata*	1.3	1.5	2
Wonga Pigeon	*Leucosarcia picata*	19.9	1.4	4
Topknot Pigeon	*Lopholaimus antarcticus*	0.6	2.0	2
Tawny Frogmouth	*Podargus strigoides*	1.3	1.5	2
White-throated Nightjar	*Eurostopodus mystacalis*	0.6	1.0	1
White-throated Needletail	*Hirundapus caudacutus*	3.2	3.0	5
Little Pied Cormorant	*Microcarbo melanoleucos*	12.8	1.2	2
Great Cormorant	*Phalacrocorax carbo*	0.6	5.0	5
Little Black Cormorant	*Phalacrocorax sulcirostris*	3.2	1.0	1
White-necked Heron	*Ardea pacifica*	1.3	1.0	1
Eastern Great Egret	*Ardea modesta*	3.2	1.0	1
Cattle Egret	*Ardea ibis*	14.1	2.4	5
White-faced Heron	*Egretta novaehollandiae*	14.7	1.0	2
Straw-necked Ibis	*Threskiornis spinicollis*	12.2	4.8	27
Royal Spoonbill	*Platalea regia*	2.6	1.3	2
Pacific Baza	*Aviceda subcristata*	1.3	1.0	1
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	1.9	1.0	1
Whistling Kite	*Haliastur sphenurus*	7.1	1.0	1
Brown Goshawk	*Accipter fasciatus*	4.5	1.0	1
Collared Sparrowhawk	*Accipter cirrocephalus*	1.9	1.0	1
Grey Goshawk	*Accipter novaehollandiae*	10.3	1.4	3
Wedge-tailed Eagle	*Aquila audax*	11.5	1.4	2
Nankeen Kestrel	*Falco cenchroides*	1.3	1.0	1
Brown Falcon	*Falco berigora*	15.4	1.0	1
Australian Hobby	*Falco longipennis*	0.6	2.0	2
Purple Swamphen	*Porphyrio porphyrio*	2.6	2.0	4
Dusky Moorhen	*Gallinula tenebrosa*	3.2	2.6	7
Painted Button-quail	*Turnix varius*	14.1	3.1	14
Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*	1.9	1.3	2
Long-billed Corella	*Cacatua tenuirostris*	3.2	2.0	5
Sulphur-crested Cockatoo	*Cacatua galerita*	15.4	1.4	3
Rainbow Lorikeet	*Trichoglossus haematodus*	16.0	4.6	14
Scaly-breasted Lorikeet	*Trichoglossus chlorolepidotus*	1.9	1.3	2

[1] Mean number seen on surveys when present.

Table 5. Species seen occasionally (cont.)

Common Name	Scientific Name	Reporting Rate (%)	Mean Number[1]	Maximum Number
Musk Lorikeet	*Glossopsitta concinna*	3.8	6.2	12
Crimson Rosella	*Platycercus elegans*	0.6	1.0	1
Red-rumped Parrot	*Psephotus haematonotus*	1.9	3.0	4
Pheasant Coucal	*Centropus phasianinus*	8.3	1.1	2
Horsfield's Bronze-Cuckoo	*Chalcites basalis*	1.9	1.3	2
Oriental Cuckoo	*Cuculus optatus*	0.6	1.0	1
Southern Boobook	*Ninox novaeseelandiae*	1.9	1.3	2
Rainbow Bee-eater	*Merops ornatus*	0.6	2.0	2
Brown Treecreeper	*Climacteris picumnus*	1.9	1.0	1
Regent Bowerbird	*Sericulus chrysocephalus*	2.6	1.0	1
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	9.0	3.8	11
Buff-rumped Thornbill	*Acanthiza reguloides*	17.9	3.4	7
Yellow-tufted Honeyeater	*Lichenostomus melanops*	0.6	1.0	1
New Holland Honeyeater	*Phylidonyris novaehollandiae*	0.6	1.0	1
Brown-headed Honeyeater	*Melithreptus brevirostris*	13.5	5.0	18
Blue-faced Honeyeater	*Entomyzon cyanotis*	0.6	1.0	1
Striped Honeyeater	*Plectorhyncha lanceolata*	1.9	1.0	1
Grey-crowned Babbler	*Pomatostomus temporalis*	18.6	3.2	8
White-winged Triller	*Lalage sueurii*	1.9	1.0	1
White-breasted Woodswallow	*Artamus leucorhynchus*	0.6	2.0	2
Dusky Woodswallow	*Artamus cyanopterus*	18.6	2.0	5
Spangled Drongo	*Dicrurus bracteatus*	3.2	1.0	1
Torresian Crow	*Corvus orru*	6.4	3.3	8
Welcome Swallow	*Hirundo neoxena*	12.2	1.6	4
Fairy Martin	*Petrochelidon ariel*	2.6	14.0	40
Tree Martin	*Petrochelidon nigricans*	6.4	15.2	50
Common Starling	*Sturnus vulgaris*	0.6	1.0	1
Common Myna	*Sturnus tristis*	1.9	1.3	2

[1] Mean number seen on surveys when present.

DISCUSSION

The total number of species recorded during this study of the Green Wattle Creek woodland and its immediate surrounds is currently 144. Three additional species the Stubble Quail, Black-chinned Honeyeater and the White-cheeked Honeyeater were tentatively identified and a fourth species, the Turquoise Parrot, was not included as it was thought to have escaped from a captive population.

The floristic characteristics of the area determine its intermittent use by some species. For instance the flowering of ironbarks and other gum species attract honeyeaters, for which mistletoe is also an important resource at times. The rarity of the New Holland *Phylidonyris novaehollandiae* and White-cheeked honeyeaters is attributed to the absence of *Banksia s*pecies.

Comparison with other Studies

During similar surveys at three-monthly intervals on the adjacent cattle property at Butterwick (Newman 2007) 126 species were recorded compared with 135 in the surveys of the present study. The larger number of species in this study reflects the greater diversity of the woodland habitat in the Green Wattle Creek study area and the extra survey effort associated with monthly as opposed to quarterly surveys over a longer period (13 vs. 11 years). However, the average number of species/survey was very similar at 46.5 (this investigation) and 45.3. In contrast the average number of individual birds recorded/survey was much higher in the present investigation at 307.6 compared with 249.1. This difference is attributed to the low proportion (15 percent) of vegetated habitat on the cattle property as compared with c.90% in the study area. As the four 2ha sites in the

former study selectively sampled areas of remnant vegetation along and adjacent to the creek it is not surprising that a higher proportion of the birds (64 percent) were recorded at the 2ha sites compared with 21 percent in this study, only one of which was adjacent to a creek and all of which had vegetation continuous with the larger study area.

At Warakeila (Newman & Lindsey 2008) another cattle property situated in the upper Allyn Valley, with about 15 percent remnant vegetation, the species list for surveys made over a 12-year period at a three-monthly interval was lower at 119. However the average number of species recorded/survey 49.5 was higher than in the other studies, probably a consequence of having a second observer at Warakeila and a longer survey route. The average number of birds/survey 336.2 at Warakeila was the highest of all the studies and more birds were recorded away from the 2ha sites (75 percent) than at the Butterwick property.

The species richness as indicated by the total number of species at the Butterwick property and in this study was higher than at Warakeila and is associated with their location on the edge of the Paterson River flood plain; dams and marshy areas along the creek attract more waterfowl, particularly on the Butterwick cattle property.

Variation in Regularly Recorded Species

The 27 species listed in **Table 2** were recorded on at least 80 percent of the surveys and are considered to be mainly resident. Only three species, a surprisingly small number, were recorded on all 156 surveys. However, because the species listed in **Table 2** are nearly always recorded the reporting rate is of limited use as a measure of population change. For these species variation in their abundance is more useful and has been used to calculate the percentage change by comparing the mean numbers seen during 1997-2002 with 2003-2008. From **Table 6** it is apparent that the 27 most commonly recorded species are almost equally split between those that appear to have increased and decreased. Of the 18 species with a variation of greater than 20 percent in abundance eight have increased and ten have decreased to an extent which is with one exception statistically significant. In **Table 6** where changes are statistically significant they are classed as either "significant" or "highly significant". The **Appendix** provides an explanation of these terms and the methods used to make the tests. The magnitude of the change in the remaining nine species is too small for any firm conclusion to be drawn.

Table 6. Changes in the abundance and reporting rate of species seen on 80 percent of surveys.

Increasing Species	**Change in Abund-ance[3] (%)**	**Change in Reporting Rate (%)**	**Decreasing Species**	**Change in Abund-ance (%)**	**Change in Reporting Rate (%)**
Lewin's Honeyeater [1]	48	1	Eastern Rosella [1]	-42	-8
Striated Thornbill [1]	36	12	Noisy Miner [2]	-42	-16
Spotted Pardalote [1]	32	1	Grey Shrike-thrush [2]	-40	-2
Red-browed Finch	28	-1	Black-faced Cuckoo-shrike [2]	-40	-12
Eastern Whipbird [1]	26	0	Brown Gerygone [1]	-30	3
Brown Thornbill [1]	25	-2	Golden Whistler [1]	-30	-7
White-browed Scrub-wren [1]	22	11	Australian Magpie [1]	-29	-3
Yellow-faced Honeyeater [1]	21	6	Jacky Winter [1]	-26	-3
Variegated Fairy-wren	16	9	Eastern Yellow Robin [1]	-24	0
Australian Raven	10	-3	Fuscous Honeyeater [1]	-22	-6
Eastern Spinebill	8	24	Yellow Thornbill	-18	3
Superb Fairy-wren	2	0	Laughing Kookaburra	-11	-3
Grey Butcherbird	2	-2	Grey Fantail	-1	0
			White-throated Treecreeper	-1	-3

[1] Highly significant change in abundance between 1997-2002 and 2003-2008 ($P<0.01$).

[2] Significant change in abundance between 1997-2002 and 2003-2008 ($P<0.05$).

[3] See **Appendix** for calculation method.

The approach taken in screening the results for change by comparing the two six-year periods is very simplistic. For instance many woodland species sometimes have non-linear trends including turning points in which a trend is reversed (Bounds *et al.* 2008).

Of the ten species which have declined in abundance to a statistically significant extent the Eastern Rosella, Noisy Miner, Black-faced Cuckoo-shrike, Australian Magpie and Jacky Winter *Microeca fascinans* are species which favour more open woodland. The increase in ground cover and understorey vegetation since grazing ceased is suggested as a potential cause of their decline. However, they remain common in the area particularly at the woodland edges. Although the Eastern Yellow Robin *Eopsaltria australis* is found in wet-adapted habitat it too favours ground-foraging opportunities at the forest edge. The reasons for the apparent decline in species like the Grey Shrike-thrush *Colluricincla harmonica*, Brown Gerygone, Golden Whistler, Fuscous Honeyeater and Yellow Thornbill are less obvious, particularly the first three species which favour dense vegetation. The result for Brown Gerygone is biased by a single abnormally large flock foraging in open woodland during the first half of the study and should probably be treated with caution. The decline of the Fuscous Honeyeater is of some concern as this species has a discontinuous distribution in the Lower Hunter with Green Wattle Creek appearing to be an isolated resident colony. The decline in abundance coincided with the disappearance of Fuscous Honeyeaters at the southern end of the survey area between sites 3 and 4 (**Figure 1)** which was formerly the stronghold of the species.

The decrease in the Noisy Miner abundance was dramatic towards the end of the study with the two colonies in the study area deserting their territories. Very interestingly, pairs of Grey Butcherbirds C*racticus torquatus*, which nested near the Noisy Miner colonies, also disappeared, suggesting a possible symbiotic relationship between these species.

In contrast to the Fuscous Honeyeater, numbers of the Yellow-faced Honeyeater have increased, indicating that for this species the woodland remains attractive habitat. Of the other increasing species the Lewin's Honeyeater, Eastern Whipbird, Brown Thornbill, White-browed Scrub-wren *Sericornis frontalis* and Variegated Fairy-wren are all species which are favoured by the increase in understorey vegetation.

The change in reporting rate has been included in **Table 6** primarily to demonstrate its limited usefulness and any differences in the direction of population change between the abundance and reporting rate data should be ignored. However for the three species with slightly lower reporting rate in the range 80 to 90 percent, namely the Eastern Spinebill, Noisy Miner and Black-faced Cuckoo-shrike, a meaningful change might be anticipated. For these species the variations in reporting rate were greater than ten percent and in each case the direction of the change coincided with that indicated by the abundance data. However none of these changes was statistically significant.

Variation in Less Frequently Recorded Species

For less frequently recorded species, particularly those which are recorded in small numbers, comparison of reporting rate becomes a useful indicator of population change as shown in **Table 7.** This table was compiled from the species listed in **Tables 3, 4** and **5** by selecting woodland species which had been reported on at least 13 percent of the surveys with a variation in reporting rate of greater than 20 percent between the two six-year periods. Variations in abundance similar to those shown in **Table 6** are included for comparison.

Most of the species in **Table 7** appeared to have declined, the decrease in reporting rate being highly significant in the case of the Painted Button-quail, Grey-crowned Babbler *Pomatostomus temporalis*, Crested Pigeon *Ocyphaps lophotes* and White-winged Chough (see the **Appendix** for further discussion). This is in contrast to the conclusion reached for the commoner species, which are predominantly resident and show a near equal tendency between increase and decline. In **Table 7** there are a number of instances where species which had been reported less frequently showed a modest increase in abundance. In most cases, for example the Brown-headed Honeyeater, Dusky Woodswallow and Varied Sittella, this is because the species occurs as a single flock and while flocks were encountered on fewer surveys towards the end of the study there was little variation in flock size throughout the surveys.

Four species, the Painted Button-quail, White-winged Chough, Buff-rumped Thornbill and Speckled Warbler all forage on the ground where there is sparse ground cover. Consequently the increase in ground cover following the cessation of grazing is a potential cause of decline. However Painted Button-quail, the species showing the most

Table 7. Variations in reporting rate and abundance for less frequently recorded species. Species ranked in decreasing order of change in reporting rate.

Species	Reporting Rate (%)	Change in Reporting Rate[1] (%)	Change in Abundance[1] (%)
Painted Button-quail [3]	14.1	-84	-71
Grey-crowned Babbler [3]	18.6	-82	-7
Crested Pigeon [3]	16.7	-75	-18
Brown-headed Honeyeater [2]	13.5	-64	9
White-winged Chough [3]	34.6	-62	11
Dusky Woodswallow	16.0	-53	12
Buff-rumped Thornbill	17.9	-38	-25
Rose Robin	22.4	-37	0
Magpie-lark	73.1	-23	-35
Fan-tailed Cuckoo	46.8	-30	-22
Speckled Warbler	71.8	-26	-64
Galah	44.2	-25	-31
Varied Sittella	35.9	-25	2
Australian King-Parrot	30.1	-20	-11
Scarlet Honeyeater	50.0	34	15
Little Lorikeet [2]	46.2	69	-28
Wonga Pigeon [2]	19.9	144	35

[1] Comparing 1997-2002 with 2003-2008. See Appendix for calculation method.
[2] Change in Reporting Rate Significant ($P<0.05$).
[3] Change in Reporting Rate Highly Significant ($P<0.01$).

marked decline, returned to the wood in 2008 after an absence of several years. This period of absence corresponded to drought conditions extending from 2002 to 2006 which was followed by high rainfall in 2007 and 2008. The timing of the reappearance of the Painted Button-quail suggests rainfall may be an important factor for this species, for instance influencing the generation of grass seed. While White-winged Choughs which formerly bred in the wood are no longer regularly seen, large flocks still frequent adjacent farmland and gardens and occasionally pass through the study area. The Buff-rumped Thornbill, another former breeding species, progressively moved to the edges of the area and has only been seen once recently. Speckled Warblers are still resident but have also become scarce with a marked decline in abundance. Like the Buff-rumped Thornbill they have become a bird of the edges because the interior of the wood is less suitable habitat now. While the decline in reporting rate for both these species is not statistically significant the magnitude of the change is sufficiently high to warrant concern.

Woodland birds which have declined include the Brown-headed Honeyeater (statistically significant), Dusky Woodswallow, Varied Sittella, Fan-tailed Cuckoo *Cacomantis flabelliformis*, and Rose Robin, the latter being a winter visitor. The first three species were noted to have declined during the New Atlas of Australian Birds (Barrett *et al.* 2003) and in other studies. Their decline may be associated with external factors affecting the species exacerbated by the poor connectivity of the Green Wattle Creek woodland to similar habitat. Numerous woodland species have declined in the past decade (Olsen 2008).

The decline of the Australian King-Parrot *Alisterus scapularis* may be a consequence of a substantial increase in residential development in the surrounding area where gardens and bird feeding provide superior foraging options outside the woodland habitat.

Grey-crowned Babblers, Crested Pigeons (both have highly significant declines), Magpie-lark and Galah are primarily species of the adjacent habitat and woodland edges rather than the woodland itself. The babbler and pigeon appear to have been particularly affected by the clearing of adjacent open bush habitat for low density housing.

Only three of the species in **Table 7** increased during the study, the most dramatic being the Wonga Pigeon *Leucosarcia picata* which increased by 144 percent. Presumably this species has benefited from the increased understorey vegetation since grazing ceased. It is often flushed

from Lantana thickets where it forages on the ground. The other two species which have increased, the Little Lorikeet and Scarlet Honeyeater show a remarkable correspondence in the timing of their episodic presence in the area (**Figure 2)**.

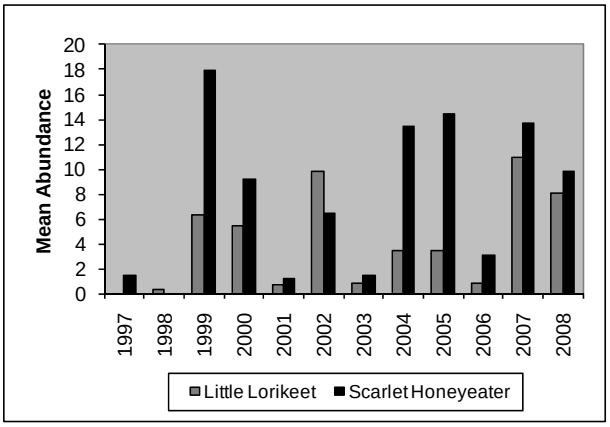

Figure 2. Variation in mean annual abundance of Little Lorikeet and Scarlet Honeyeater at Green Wattle Creek.

At times when the ironbarks are flowering they are among the most abundant species and breeding is suspected for both species based on nest hollow inspection and nest building respectively. Their increased use of Green Wattle Creek during 2003-2008 may reflect the decrease in food resources elsewhere during drought conditions between 2002 and 2006. The increased reporting rate of the Little Lorikeet in the second half of the study coincided with a decrease in the size of the flocks. It appears that the use of the area by Little Lorikeets has changed from the occasional presence of a single large flock to multiple smaller mobile flocks which appear to be more continuously present in the wood and surrounding areas.

Threatened Species

The Speckled Warbler and Little Lorikeet (recently listed) are the only species listed under the NSW Threatened Species Act which are recorded regularly at Green Wattle Creek. Both are classified as vulnerable. As discussed previously, although several pairs of Speckled Warbler appear to remain resident, its reporting rate and abundance declined during the study. This decline is attributed to an increase in ground cover and understorey vegetation since cattle grazing ceased. As the Green Wattle Creek woodland has limited connectivity to other woodland with Speckled Warbler populations appropriate fire management of the area is essential to ensure the viability of this population, which is located at the eastern extremity of its range in the Hunter Region. However it is probable that carefully controlled burns of small patches of the wood would benefit the species by creating areas with reduced ground cover which are favoured by the species. In 1993 a number of pairs of Speckled Warblers were fostering juvenile Black-eared Cuckoos for which the Speckled Warbler is a preferred host species. This is the only year the Black-eared Cuckoo, which is locally rare, has been recorded breeding in the east of the Hunter Region (Stuart 1995).

The Little Lorikeet, which is listed as vulnerable, appears to have increased in the study area and has also become quite numerous in the surrounding district.

The Brown Treecreeper is another woodland species which is classed as vulnerable. Although this species was only recorded during one survey it was seen regularly during winter between 1993 and 1995 (Stuart 1995) before the surveys started. It also favours woodland habitat with bare ground and fallen timber and superficially its habitat requirements are similar to those of the Speckled Warbler. However unlike the Speckled Warbler it does not appear to have been a breeding resident. Its former consistent appearance in winter, probably involving only one or two birds, is unusual as the literature does not suggest that this species is a migrant and no breeding populations in the vicinity of Green Wattle Creek are known. Its past occurrence in the area may have been anomalous and the study area is probably marginal habitat.

The Grey-crowned Babbler is another vulnerable species which has declined during the study. However ,as indicated previously, woodland is not the core habitat of this species. It is thriving in the adjacent Butterwick and Woodville areas where suburban gardens provide more suitable habitat, involving a park-like environment with a combination of trees for nesting and shrub beds and short grassland for foraging.

There is one tentative record of the Black-chinned Honeyeater which is also classified as vulnerable.

CONCLUSIONS

The Green Wattle Creek woodland at Butterwick is an important natural resource located on the edge of the Paterson River flood plain. In view of its limited size (approximately 120ha) and its relative isolation from similar low-lying woodland habitat the 144 species identified since 1993 is impressive.

Monthly surveys over a 13-year period have allowed changes in the reporting rate and abundance of individual species to be measured. For the 27 commoner species, which are mostly resident, there have been changes in the abundance of 18, which are statistically significant. Ten of these species have decreased and the other eight have increased, typically by more than 20 percent.

Most of the remaining species frequent the study area intermittently. Analysis of the reporting rate of the more regular of these visitors again indicates that some species have decreased and others increased, some at a statistically significant level. Species in the decreasing category dominate this group.

Among the declining species a cohort of ground-foraging species including the Speckled Warbler, Brown Treecreeper, Buff-rumped Thornbill and White-winged Chough stand out. The reason for their decline is attributed to the cessation of light cattle grazing shortly after the surveys commenced resulting in a progressive increase in understorey and ground cover vegetation making the wood less suitable for ground-foraging species. Of this group only the Speckled Warbler remains as a resident species and it is increasingly restricted to habitat at the edge of the woodland. In contrast the Lewin's Honeyeater has benefited from the increased understorey growth. The reasons for the decline of other species like the Fuscous Honeyeater are not clear and factors like variations in rainfall, illegal felling of mature ironbarks and the loss of connectivity to similar woodland habitat may be important.

The diversity of its bird population, the presence of threatened species, the use of the study area by migrants during migration and as a seasonal residence and nomads seeking drought refuge all make Green Wattle Creek an area requiring protection and management in a manner which is sympathetic to its natural assets. The Speckled Warbler, a declining resident species is a particularly important case. For instance an extensive fire could cause the local extinction of the species in view of the limited connectivity to similar woodland habitat.

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APPENDIX: Statistical Testing of Changes in Bird Population

Statistical tests were used to gauge the strength of the conclusions drawn from comparisons of the results for the periods 1997-2002 and 2003-2008. The methods used followed advice provided in "Statistics for Ornithologists" (Fowler & Cohen).

For the changes in the abundance of the 27 common species (see **Table 2** of the paper) the mean number of birds/survey over the two six-year periods was compared. The first step was to screen the data for each species using the F test to determine whether the variances of the two six-year samples belonged to the same population. Four species failed this test (Red-browed Finch, Noisy Miner, Grey Shrike-thrush and Black-faced Cuckoo-shrike). As the samples for each six-year period were large (>20) the z test was used to assess the differences in the means of the two samples for the remaining 23 species. The differences in the mean abundance for fourteen of these species were found to be highly significant with $P<0.01$ (i.e. a less than 1 in 100 probability of

the result occurring by chance). For the sample sizes used in this study it appears that any difference in abundance greater than 20 percent will be statistically significant provided the F test condition is passed.

The results for the four species which failed the F test were examined using the Mann-Whitney U-Test which involves comparing the medians of the annual mean abundances for each of the six-year periods. The Noisy Miner, Grey Shrike-thrush and Black-faced Cuckoo-shrike all passed this test with $P<0.05$ (i.e. a less than 1 in 20 probability of the result occurring by chance). The failure of the Red-browed Finch to pass the test despite the large (28 percent) increase is thought to be a consequence of the intermittent occurrence of very large flocks on the Equestrian Centre oval resulting in an unusually large variance of the count numbers.

For the less common species differences in the Reporting Rates between the two six-year periods were used as a measure of population change. The chi square test was used to assess the difference between the Reporting Rates for the two periods using Yates' correction because there was only one degree of freedom.

Based on the test procedures described above a number of population changes were found to be statistically significant. Where the test passes at the $P<0.05$ level (1 in 20 probability of occurring by chance) the outcome is described as significant in the text of the paper. If the more stringent condition of $P<0.01$ is passed the change is described as highly significant. For the sample sizes in this study only a change in reporting rate of greater than 50 percent was significant.

In **Tables 6** and **7** the changes in the abundance and reporting rates between the two periods 1997-2002 and 2003-2008 were calculated by comparing the difference between the second and first period with the magnitude of the first period. For example where the abundance or reporting rate increased in the second period 2003-2008 to double the magnitude for the first period the change in reporting rate is 100 percent.

Correspondingly where the abundance or reporting rate in the second period decreased to half the value in the first period the change in reporting rate is -50 percent.

Roosting and feeding behaviour of Pacific Golden Plover in the Hunter Estuary, NSW

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The Hunter Estuary hosts a significant proportion of the population of Pacific Golden Plover *Pluvialis fulva* in New South Wales (NSW). Although breeding in the northern hemisphere, these birds spend the majority of their time in the estuary, seven months of the year from mid-September to mid-April. Numbers have declined significantly from maximums of 700-800 birds during the 1980s to the present 2008/2009 season maximum of 180. Two distinct populations of Pacific Golden Plover were recognised: the North Arm population that roosted and foraged in the North Arm of the Hunter River upstream of Stockton Bridge; and a smaller population within Stockton Channel downstream of Stockton Bridge. The North Arm birds roosted mainly on the Kooragang Dykes during high tide and foraged during low tide on the North Arm Sandflats immediately opposite the dykes. Less used high-tide and intermediate-tide roosts were located on Ash Island and the Stockton Dunes. Subsidiary foraging areas were used in Fullerton Cove, Kooragang Dyke Ponds, North Arm Point Bar and Ash Island. The geographically separate Stockton Channel population roosted on the eastern shore of Stockton Channel and foraged upstream towards, but south of, Stockton Bridge. Rusting wrecks in the same area were used occasionally as an intermediate-tide or high-tide roost.

INTRODUCTION

Located about 120km north of Sydney, the Hunter Estuary is one of the larger estuaries on the New South Wales (NSW) coast and, despite being a major coal exporting port, is of great importance as a feeding and roosting ground for migratory shorebirds. Pacific Golden Plover *Pluvialis fulva* are migratory shorebirds that arrive in the estuary during September and depart for their northern hemisphere breeding grounds during March and early April. The most important habitats for Pacific Golden Plover in the estuary are in the North Arm of the Hunter River: Kooragang Dykes and Dyke Ponds; North Arm Sandflats; and Fullerton Cove intertidal mudflats (**Figure 1**). These areas are all reserved in the Hunter Estuary National Park (formerly Kooragang Nature Reserve), but are subject to human disturbance by the proximity of boats and fishermen. Two tidal cycles occur every 25 hours, exposing intertidal sandflats and mudflats that are suitable for foraging at least once during daylight hours. Their nocturnal foraging behaviour in the estuary was not investigated.

The Hunter Estuary is one of the three main sites along the coast of NSW which support Pacific Golden Plover numbers in excess of 150 during the austral summer months. During the 2007/2008 summer the Richmond River hosted 246 birds, the Shoalhaven River 214 and the Hunter Estuary 194 birds (R. Clemens pers. comm.).

Count data from the 1970s to the present were used to assess population trends in the Hunter Estuary. These data include historical counts from the 1970s to the 1990s, including sporadic shorebird counts by individual observers, annual counts coordinated by the Australasian Wader Studies Group (AWSG) during the 1980s, regular monthly counts since April 1999 by the Hunter Bird Observers Club (HBOC) and weekly monitoring by the authors over the summer months from September 2006 to April 2009. The weekly counts between 2006 and 2009 were commissioned by Sydney Ports Corporation as part of a study of the Penrhyn Estuary in Botany Bay, NSW.

METHODS

Access to Pacific Golden Plover localities in the Hunter Estuary was either by foot, by car, or by small, outboard-powered boats. During monthly HBOC shorebird surveys, from April 1999 to April 2009, several groups carried out simultaneous observations at known roosting localities, usually within an hour either side of local high tide. In addition, from September 2006 to April 2009, the authors undertook weekly surveys, usually on Friday mornings, regardless of tide height. During the 2006/2007 season, the authors

searched the Hunter Estuary extensively for Pacific Golden Plover, to determine preferred roost sites. Apart from the occasional use of other areas by small numbers of birds, the main roosting and foraging locations were in the Hunter River North Arm at Stockton Channel, on Kooragang Dykes and North Arm Sandflats. In the 2007/2008 and 2008/2009 seasons, weekly observations were restricted to the North Arm and Stockton Channel as the birds rarely used other areas in significant numbers. All observations were carried out during daylight hours, with occasional dusk and early evening observations to determine the direction of flights to nocturnal roosts.

Historical records, including Holmes (1970), Gosper (1981), van Gessel and Kendall (1972a, b & c), Kingsford *et al*. (1998), the NSW Annual Bird Reports (Lindsey 1985, Cooper 1989, Morris & Burton 1992, 1993), Hunter Region Annual Bird Reports (Stuart 1993 to 2008) and the Australasian Wader Studies Group annual counts (1982-1992, provided by Wilma Barden) were consulted for the period 1970 to 1999.

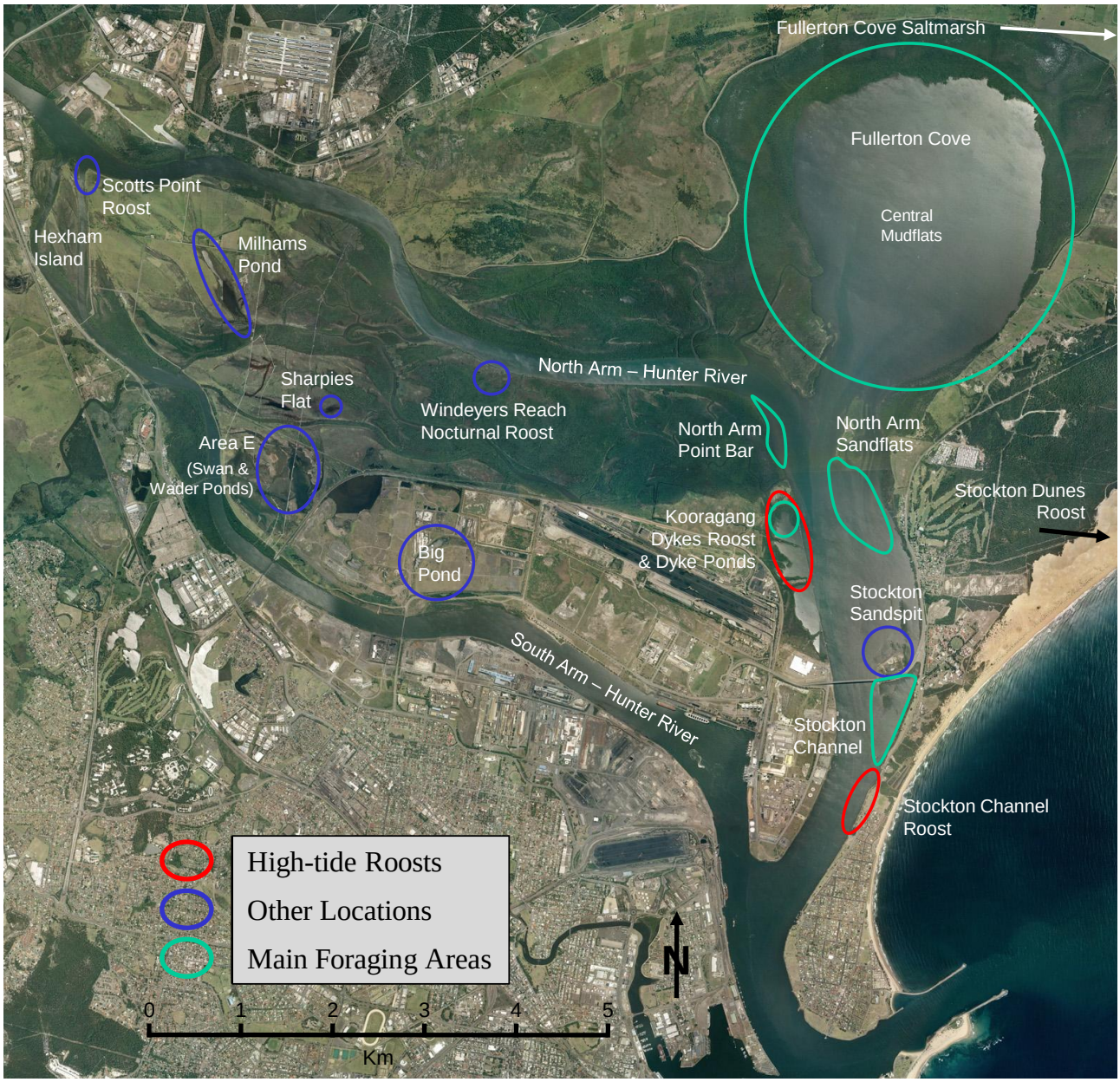

Figure 1. Pacific Golden Plover roosting and foraging sites in the Hunter Estuary.

RESULTS

Abundance

During the 1970s and 1980s from 350 to 800 Pacific Golden Plover were recorded in the Hunter Estuary (**Figure 2**). From the 1990s to April 2009, numbers have fluctuated between 100 and 300, with a maximum of 304 in February 2007.

Two populations of Pacific Golden Plover were recognised in the Hunter Estuary – the larger population of North Arm birds, north of Stockton Bridge (**Figure 3**), and the much smaller population of Stockton Channel birds, south of Stockton Bridge (**Figure 4**). There appeared to be little to no crossover of birds between these two populations. During the 2008/2009 summer season a maximum of 175 North Arm birds were present while only 5-6 Stockton Channel birds were recorded.

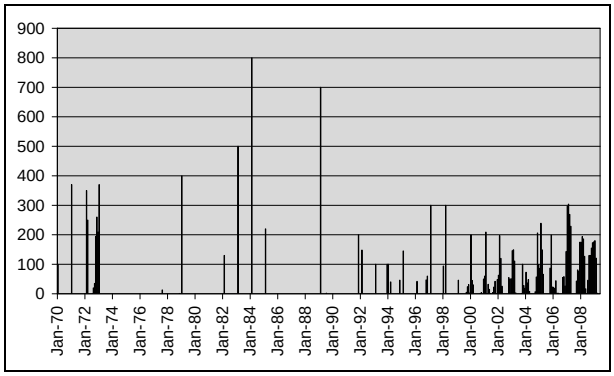

Figure 2. Historical counts of Pacific Golden Plover in the Hunter Estuary 1970s to 2009.

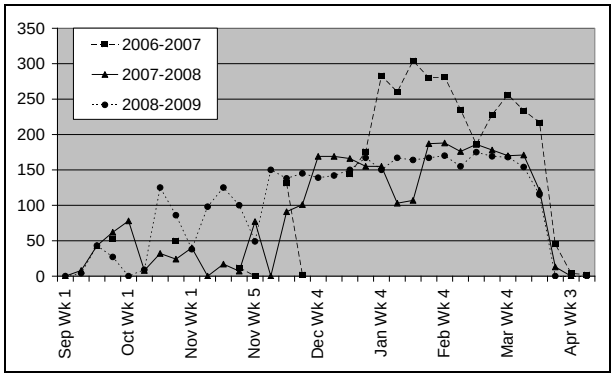

Figure 3. Weekly counts of North Arm Pacific Golden Plover for three consecutive summer seasons from 2006/07 to 2008/09.

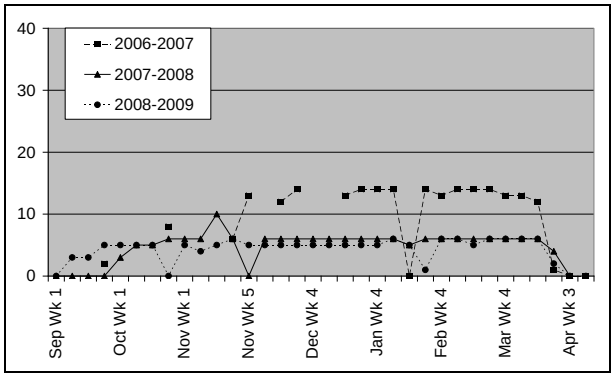

Figure 4. Weekly counts of Stockton Channel Pacific Golden Plover for three consecutive summer seasons from 2006/07 to 2008/09.

Between April 1999 and November 2005, the North Arm birds were recorded on both Ash Island and Kooragang Dykes, but since that time, Pacific Golden Plover were rarely observed on Ash Island (**Figures 5** and **6**).

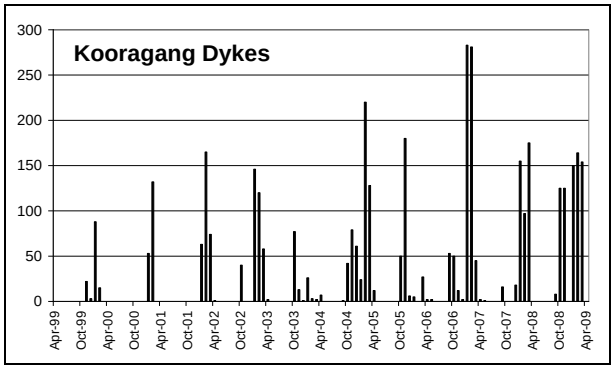

Figure 5. Kooragang Dykes monthly counts 1999/00 – 2008/09

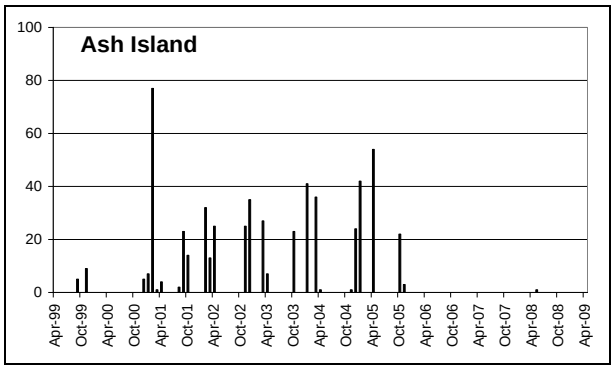

Figure 6. Ash Island monthly counts 1999/00 – 2008/09

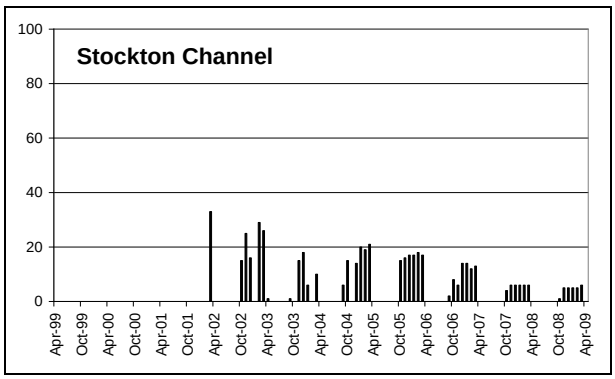

Figure 7. Stockton Channel monthly counts 1999/00 – 2008/09.

Monthly surveying of Stockton Channel commenced in March 2002 when 33 Pacific Golden Plover were recorded. Since then, the annual number has steadily decreased to only 5 to 6 birds in 2008/2009 (**Figure 7**).

Major Diurnal High-tide Roosts

Kooragang Dykes are the most important diurnal high-tide roost site for the North Arm population (**Plate 1**). The dykes are a series of low rock training walls, composed of blast furnace slag, extending approximately 1.6km along the eastern margin of Kooragang Island (**Figure 1**). Four intertidal ponds behind the dykes are separated by rock walls and sandspits (**Figure 8**). The dykes are about 3m wide and partly submerged at spring high tides. Birds roost on the top surface and down the exposed flanks to the waterline. For long periods, North Arm birds were faithful to certain sections of the dykes. Between April 1999 and December 2004, Pacific Golden Plover roosted mainly on Section 2 of the dykes. However, since March 2005 the birds roosted mainly on Section 4 and around the junction of Sections 3 and 4. On rare occasions when they have not been observed on the dykes, it is likely that the birds were still present in the estuary, but roosting at other locations, such as the nearby Stockton Dunes (see below).

The Stockton Channel birds roosted on boulders and logs along the eastern bank of Stockton Channel within a section extending about 100 metres downriver from a rocky point near a dilapidated jetty (**Figure 9** and **Plate 3**). They usually roosted as a loose group spaced a metre or two apart, but individuals were sometimes separated by about 30 metres (**Plate 4**).

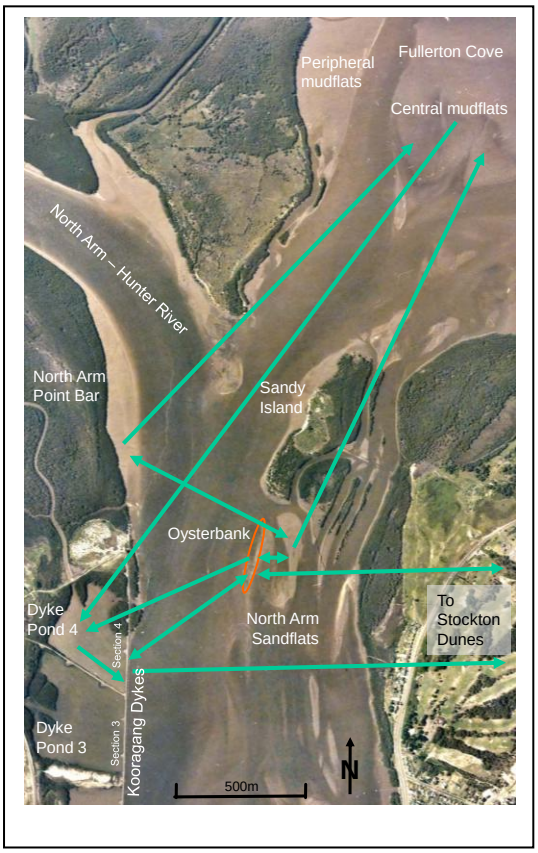

Figure 8. Habitat of the North Arm Pacific Golden Plover showing flight paths between roosting and foraging areas (green arrows).

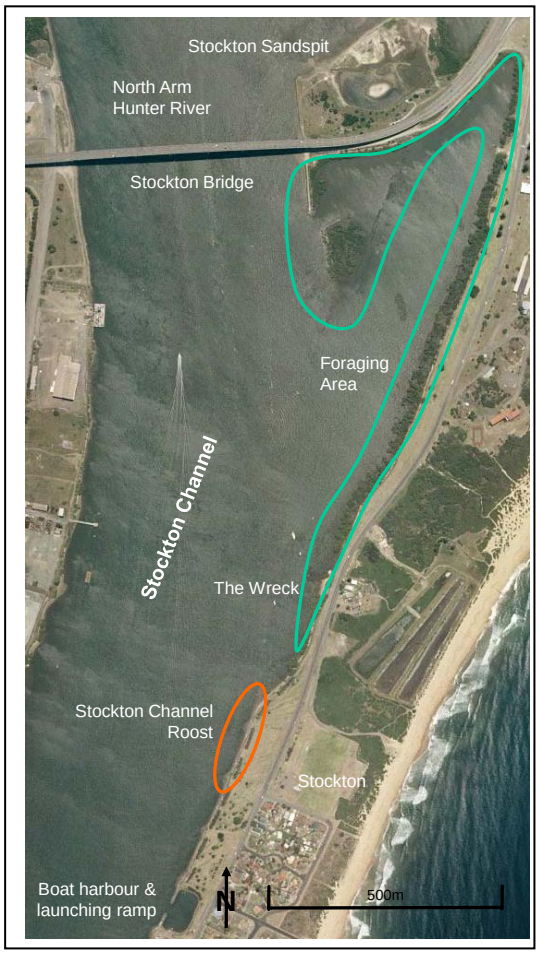

Figure 9. Habitat of the Stockton Channel Pacific Golden Plover showing the main high-tide roost and low-tide foraging area.

Other Diurnal High-tide Roosts

In addition to the Kooragang Dykes and Stockton Channel roosts, Pacific Golden Plover roosted, occasionally, at other locations in the Hunter Estuary, as discussed below. Except for Stockton Dunes, all these sites were included in monthly surveys by HBOC.

Stockton Dunes extend north from the mouth of the Hunter Estuary for approximately 30km along Stockton Bight. Only occasional observations were made in this area. Pacific Golden Plover have been observed roosting during the day in sparse spinifex grass on dune slopes and swales, between 50 and 300 metres from the beach. On several occasions in the last decade, one to 10 birds have been observed (Stuart 2001; L. Crawford pers. obs. on 3/4/2001 and on 7/12/2008), and on one occasion approximately 220 plovers were observed (S. Roderick in Stuart 2007). At various times during the last three years, all the North Arm birds have been observed flying towards the dunes from the Kooragang Dykes roost or from their foraging area on the North Arm Sandflats.

Scotts Point roost is a slag-boulder reinforced margin of the Hunter River on the northwestern tip of Ash Island (**Figure 1**). When disturbed from this site, the birds flew across the South Arm of the Hunter River to roost on a small beach on Hexham Island opposite Scotts Point. Small areas of saltmarsh adjacent to the river edge at Scotts Point are also occasionally used by the birds. The roost was not consistently used and then by only a few individuals. During HBOC monthly surveys, 28 birds were recorded in October 2001, 2 in November 2006 and 11 in December 2006. Other records include 48 birds during December 2001 (Stuart 2002). Pacific Golden Plover were found at Scotts Point on 26% (5 of 19) weekly surveys conducted from September to April 2006/2007, when 1 to 13 birds were present. Although weekly surveys were discontinued, monthly surveys failed to find any plovers at this site after December 2007 when 3 Pacific Golden Plover were recorded (N. McNaughton pers. comm.).

Milhams Pond is a shallow saltmarsh pond on Ash Island occasionally visited by Pacific Golden Plover. Four Pacific Golden Plover were recorded at Milhams Pond on 2 February 2007 (N. McNaughton pers. comm.).

Wader Pond is a mosaic of tidally-influenced saltmarsh ponds on Ash Island that have been used by small numbers (generally less than 23) of Pacific Golden Plover in recent years. However, a maximum of 77 Pacific Golden Plover was recorded in February 2001.

Swan Pond is a deeper saltmarsh pond adjacent to Wader Pond that has also been used by small numbers of Pacific Golden Plover. Two HBOC monthly counts recorded 9 and 14 Pacific Golden Plover in November 1999 and October 2001 respectively. Pacific Golden Plover were recorded in Area E (Swan and Wader Ponds) on 18% of monthly surveys over the September-April season.

Sharpies Flat, on Ash Island, is an ephemeral saltmarsh pond fed by occasional high spring tides and rainfall, and is sometimes used by Pacific Golden Plover when shallow water is present. During the weekly surveys for 2006/2007, Pacific Golden Plover were recorded on 3 out of 19 surveys (16%), with a maximum count of 12 birds. They roosted above the waterline on a raised part of the muddy margin of this wetland. However, they were not recorded at this location after December 2006.

All the Ash Island localities mentioned above were rarely used by the Pacific Golden Plover after the 2005/2006 season (**Figure 6**).

Stockton Sandspit is a complex habitat of shallow, tidally-influenced lagoon, saltmarsh, grass, bare sand and beach adjacent to Stockton Bridge. During the 1970s it was the most important roost site for Pacific Golden Plover (van Gessel & Kendall 1972a). More recently however, Pacific Golden Plover were only occasionally recorded at this site: on 18 February 2007 when 12 birds were seen roosting in saltmarsh and on 22 February 2009 when 14 birds were present (T. Clarke pers. comm.).

Big Pond was a significant roosting and foraging site for Pacific Golden Plover until drained as part of impending industrial development. Twenty four plovers were last recorded there in October 1999 (Herbert 2007).

Intermediate-tide Roosts

Several intermediate-tide roosts were used during falling and rising tides, usually immediately before or after foraging activity.

The North Arm Sandflats oysterbank roost is adjacent to the main daytime foraging area on the North Arm Sandflats (**Figure 8**, **Plate 5**). Pacific

Golden Plover used this roost at falling and rising tide immediately before and after foraging.

Two adjacent rusting hulks in Stockton Channel, known as "The Wreck", were occasionally used as a roost by the Stockton Channel birds at intermediate-tide levels, as was a rocky point immediately upstream of a dilapidated jetty (**Figure 9**).

Nocturnal High-tide Roosts

Geering and Winning (1993) noted that shorebirds did not roost on the Kooragang Dykes at night but instead flew to alternative nocturnal roosts. During this study, nocturnal high-tide roosts for the Pacific Golden Plover were inferred from observations of flocks flying from diurnal roosts and foraging areas at dusk or late in the afternoon. The location of these roosts was not verified because of the difficulty of observing in the dark. However, Pacific Golden Plover were observed flying from the Kooragang Dykes at dusk in three different directions: northwards, up-river towards Windeyers Reach nocturnal roost, which was used by most of the larger migratory shorebirds in the Hunter Estuary (Spencer 2009); northeast across the river, over Sandy Island, towards saltmarsh northeast of Fullerton Cove; and directly east towards the Stockton Dunes (**Figure 1**).

On three occasions, several flocks of plovers were observed late in the afternoon, on the rising tide, leaving the North Arm Sandflats oysterbank roost and flying east towards Stockton Dunes instead of the usual roost at Kooragang Dykes (which is in the opposite direction). It is probable that Stockton Dunes is a significant nocturnal roost site for Pacific Golden Plover using the Hunter Estuary. As mentioned previously the dunes are a proven diurnal roost.

Foraging Areas

Pacific Golden Plover used two separate foraging areas in the Hunter Estuary. North Arm birds foraged upstream of Stockton Bridge while Stockton Channel birds foraged downstream of Stockton Bridge (**Figures 8** & **9**). During the day, North Arm birds foraged primarily on the North Arm Sandflats immediately south of Sandy Island. They foraged and loafed there from about 3 hours before low tide to about 2 hours after low tide. During neap tides the North Arm birds foraged exclusively on the North Arm Sandflats. Only during spring low tides did the birds move into Fullerton Cove to forage on the central mudflats and/or peripheral mudflats near the mouth of Smiths Creek, having first foraged at the North Arm Sandflats. North Arm birds were also observed foraging on the North Arm Point Bar (**Plate 2**).

Stockton Channel birds foraged on mudflats and oysterbanks between their high-tide roost site and Stockton Bridge, apparently never venturing north of the bridge (**Figure 9**). They foraged along the muddy and, sometimes boulder-strewn, mangrove-lined eastern shoreline as far as a large oysterbank immediately south of Stockton Bridge.

Additional observations of small numbers of Pacific Golden Plover on Ash Island saltmarsh ponds such as Sharpies Flat, Wader Pond, Swan Pond, Milhams Pond and the shoreline near Scotts Point indicate that these areas may also be minor foraging locations.

DISCUSSION

Observations of Pacific Golden Plover have been recorded at three different time scales: sporadic yearly observations (1970-1999), monthly observations (1999-2009) and weekly observations (2006-2009). Each scale of observation reveals different insights regarding abundance, habitat preference, movement throughout the estuary and timing of arrival and departure, etc. The discussion below integrates the different scales of observations which are summarised in **Figures 2**, **3**, **4**, **5**, **6** and **7**.

Arrival, Departure and Abundance

North Arm Pacific Golden Plover began arriving in the Hunter Estuary from their northern hemisphere breeding grounds during the 2nd week of September (**Figure 3**). Rarely, a few may arrive as early as August (Stuart 2001). It is possible that, between September and December, many of the birds were staging in the Hunter Estuary during southward migration as shown by fluctuating numbers. The birds appeared to arrive and depart in groups of about 50 to 100 before progressively building up to a consistent maximum resident population during January and February. As many as 4 influxes were noted during the 2008/09 September to December period (**Figure 3**). Influxes and decreases observed during southward migration down the east coast at this time were also documented by Alcorn *et al.* (1994).

Numbers gradually declined during March as the birds started to migrate north. This was followed by a rapid decline in the last week in March and the first week in April as the majority of Pacific Golden Plover departed on northward migration (**Plate 6**). Any birds still present after the 2nd week in April left before the end of the month. Notable exceptions were two Pacific Golden Plover that were still present on 13 May 2006 (HBOC monthly survey), and one record of a single bird present in winter, 9 June 2001, on Stockton Sandspit (Stuart 2002). Apart from this one winter observation, Pacific Golden Plover generally did not overwinter in the Hunter Estuary.

While numbers varied from year to year there was an overall trend for maximum recorded numbers to increase between 1999/2000 and 2006/2007. A trend for decreasing maximum numbers was apparent from 2006/2007 to 2008/2009. The reasons for fluctuations in peak numbers are not clear but could be related to recruitment as a result of breeding success in the northern hemisphere or to movements between sites along the east Australian coast. The exceptional maximum number of 304 North Arm birds during February 2007 could have been caused by the addition of a number of birds in the process of migrating up the coast from more southerly locations (**Figure 3**). The latter is more likely at this time of year as Starks and Lane (1987) suggested that a significant proportion of Pacific Golden Plover moved northwards along the eastern coast on northward migration from as early as February. This is supported by additional records of peak numbers observed during February and March 2008 for the Manning River (Stuart 2008), during February 2002 for the Clarence Estuary and as early as mid-January for the NSW North Coast at Lake Cakora (Greg Clancy pers. comm.).

It is not known whether the sudden decrease in numbers recorded in the 1st and 2nd weeks of February 2008 (**Figure 3**) was due to migration movements or birds moving locally from monitored roost sites to the Stockton Dunes roost. The latter is considered more likely because, during that February, the river level was high with limited exposure of foraging areas on the 1st week and limited roosting areas on the 2nd week due to floodwaters affecting water levels in the river. In addition, Pacific Golden Plover were observed flying out of the estuary towards Stockton Dunes on 8 February 2008.

During 2007/2008 and 2008/2009, the smaller group of Stockton Channel birds reached and stabilised at their maximum number of 5-6 in late September to October, much earlier than numbers stabilised for the North Arm population (**Figure 4**). The increase from 6 to 10 Pacific Golden Plover on 16 November 2007 suggests the temporary addition of birds on southward passage. Overall, the North Arm and Stockton Channel birds arrived and departed at about the same times. The consistent number of Stockton Channel birds during each summer season together with their localised roosting and foraging behaviour suggests that they were a separate group from the North Arm birds. The constant and rapid decline in the number of Stockton Channel birds since monitoring began in April 2002 is of concern (**Figure 7**).

Foraging Activity

North Arm birds foraged mainly on the North Arm Sandflats and used Fullerton Cove as a supplementary feeding area only when tidal flats were exposed at spring low tides. Mudflats in Dyke Ponds 3 and 4 were also used for foraging during suitable tides. The ponds enclosed by Kooragang Dykes were fed by tidal inflow through narrow breaks in the dyke wall. These constrictions created a considerable lag between low tide in the estuary and low tide in the ponds. This provided additional foraging time in the ponds for shorebirds as the tide rose significantly later than in the open estuary. Recent observations revealed that the North Arm Point Bar (**Figure 8**) was also used to extend their foraging period.

Stockton Channel birds appeared to forage exclusively on the eastern shore of Stockton Channel downstream of Stockton Bridge towards their regular high-tide roost.

Our observations indicate that Pacific Golden Plover are visual feeders that walk or run short distances before pecking at the surface. Worms were the most common prey observed, with occasional crustaceans (small crabs and nippers), but most items were too small to be visible to observers with binoculars. When a worm was discovered, the bird slowly withdrew it from the substrate, often carrying it to a nearby puddle to wash it before eating. In the literature, they have been recorded eating molluscs, worms, insects, crustaceans, spiders and occasionally seeds, leaves, lizards, bird's eggs and small fish (Marchant & Higgins 1993, Kato *et al.* 2000).

Pacific Golden Plover were observed feeding at an average rate of 4 pecks/min (3¼ hrs of

observations), which was a much slower rate than observed for other shorebirds on the same tidal flat (e.g. Grey-tailed Tattler *Tringa brevipes*, Bar-tailed Godwit *Limosa lapponica* and Red-necked Stint *Calidris ruficollis*). Although these birds have different foraging methods, it is noteworthy that Thomas (1988) also found low rates of 12 pecks/minute for Pacific Golden Plover, compared to 38 pecks/minute for Grey-tailed Tattler, 13 pecks/minute for Bar-tailed Godwit and 59 pecks/minute for Red-necked Stint. Overall time spent foraging was also less than other shorebirds, with Pacific Golden Plover apparently spending a large amount of time loafing between desultory feeding bouts. A further apparent lack of interest for feeding during daylight hours was observed on several occasions when none of the birds moved off their day-time high-tide roosts at all during some entire neap low-tide periods! On another occasion, Pacific Golden Plover roosting on the Kooragang Dykes did not leave to forage on the North Arm Sandflats (although these were exposed), but instead delayed their foraging activity for a couple of hours and then moved only a short distance to the adjacent dyke ponds to forage for a relatively short period.

The slow pecking rate and short time spent foraging during the day together with the observation that, at times, the birds remained roosting during what was normally their low-tide foraging period, strongly suggest that Pacific Golden Plover fed more actively at night. This has not been verified by direct observation. However, in Europe, Golden Plover *Pluvialis apricaria* can find earthworms so successfully at nights near full moon that they can afford to sleep during the day (van de Kam *et al*. 2004, p.43).

Movements within the Hunter Estuary

Pacific Golden Plover moved around the Hunter Estuary in predictable directions according to the state of the tide and time of day or night. About 6 hours separated maximum high tide from dead low tide.

During daylight hours Pacific Golden Plover spent a large amount of time roosting over the high-tide period. At times they were present on the main Kooragang Dykes roost from 4.5 hours before high tide to 4.5 hours after high tide during spring tides and for an even longer period during neap tides. Also, during some daytime neap tides the birds have been observed to remain on their roost throughout the entire low-tide period without venturing out to forage.

During neap tidal cycles, after mid-falling tide, the North Arm birds flew from the Kooragang Dykes roost to the intermediate-tide North Arm Sandflats oysterbank roost where they waited until the tide exposed the adjacent sandflats. They then moved onto the North Arm Sandflats and commenced foraging and loafing until the subsequent rising tide induced the birds to return to the oysterbank roost. As the continually rising tide eventually threatened to inundate the oysterbank, the birds flew directly to Dyke Pond 4 or, occasionally, to Dyke Pond 3, where they resumed foraging or loafing. They ceased foraging in the dyke ponds as the tide rose, often staying to rest or loaf in shallow water. Eventually the rising tide forced the birds to fly onto the main Kooragang Dykes roost where they stayed until the tide receded again or flew off to a nocturnal roost if the high tide occurred during the evening.

North Arm birds also moved into Fullerton Cove to forage. They did so only after feeding on the North Arm Sandflats and usually only during spring low tides less than about 0.4m. The birds have also been observed to move from the North Arm Sandflats to forage on the North Arm Point Bar on the opposite side of the river, sometimes as a prelude for some to move into Fullerton Cove. When the tide rose the plovers returned to the Kooragang Dykes or dyke ponds.

In contrast the Stockton Channel birds confined their foraging activities downstream of Stockton Bridge. After about mid-falling tide they moved upstream from their high-tide roost to forage and loaf on mudflats along the eastern side of Stockton Channel as far upstream as a large oysterbank immediately south of Stockton Bridge.

CONCLUSIONS

The Hunter Estuary hosts a significant proportion of the population of Pacific Golden Plover that use the New South Wales coast. Although they are international travellers that breed in eastern Siberia and Alaska, the majority of their time, seven months of each year, is spent in the Hunter Estuary. However, numbers have decreased significantly from the maximums of 700-800 recorded during the 1980s to less than 200 in 2008/2009, perhaps stabilizing at around 200 for the last decade.

Fluctuating numbers recorded during the first 2-3 months of their arrival in the estuary, indicate that the birds are staging and moving on through the

estuary during southward migration. This indicates that many more Pacific Golden Plover use the Hunter Estuary on southward migration than are recorded at any one time. Although regular monitoring of the Stockton Channel birds did not commence until 2002 the steady decline in their number is evident and of concern. Is this decline due to changes in the over-wintering locality in the Stockton Channel or is it related to changes in the breeding ground or at other localities along the East Asian-Australasian Flyway?

It is acknowledged that there are many problems, mainly loss of habitat, along the flyway, that may be contributing to population declines in south-eastern Australia. However, loss of habitat in the Hunter Estuary has been, and still is, a major problem affecting shorebird numbers locally. It is vital to preserve all remaining shorebird habitat in the estuary and minimise human disturbance at roost sites and foraging areas.

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Plate 1. Roosting on the Kooragang Dykes.

Plate 2. Foraging on North Arm Point Bar.

Plate 3. Stockton Channel roost.

Plate 4. Roosting at Stockton Channel.

Plate 5. North Arm Sandflats oysterbank roost.

Plate 6. V-formation practice days before departure.

Early Hunter Region avian records
Part 1. 1901-1925 Articles in *The Emu*

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Articles about 1901-1925 Hunter Region birdlife appearing in *The Emu* are reviewed. A full bibliography is included, and the birds of six nominal sub-areas within the Region - Upper Hunter, Lower Hunter, Gloucester/Comboyne, Port Stephens, Great Lakes/Taree, and Offshore - are discussed separately. The distribution or abundance of many species appears to have changed in the past 100 years, with several of them having contracted in range while others surprisingly were absent or rarely recorded in 1901-1925. 204 species are documented to have been present, with breeding records for 81 of them.

INTRODUCTION

Ornithology in the Hunter Region has a long history dating from at least the early 1830s, when Charles Coxen (John Gould's brother-in-law) began to be active in the Upper Hunter (and NSW more widely). Gould himself spent a considerable time in the Region in 1839-40, and described several Australian species from specimens taken locally (Albrecht & Albrecht 1992).

Presumably the documentation of avian records continued in the post-Gould years. If so, the reports are difficult to come by without a laborious search through the archives in miscellaneous libraries. Fortunately, in 1901 the (Royal) Australasian Ornithologists Union[1] (RAOU, now Birds Australia) began publishing *The Emu*, which appeared quarterly and comprised an eclectic mixture of learned articles, short notes, snippets from members, RAOU meeting minutes, etc. Thus, *The Emu* became a collection house for new knowledge about Australasian ornithology[2].

In this paper, I review articles in *The Emu* about the Hunter Region in 1901-25. My intention, in time, is to produce two additional papers (dealing with 1926-50 and 1951-75). Sources other than *The Emu* should also prove valuable, and my hope is that, eventually, they too will be reviewed.

[1] The Australasian Ornithologists' Union (AOU) gained a royal charter in 1910 and became the RAOU.

[2] Tables of Contents for every issue can be accessed at www.publish.csiro.au/nid/97.htm

Approach Taken

One approach considered for this series was to discuss articles in chronological order. While this is appealing, in that it lays out the development of knowledge over time, the discontinuities of visits to particular districts could cause important links to be overlooked.

Other possible approaches included considering records for different types of habitat or discussing the various guilds of birds separately. However, habitats were not always described, and many papers were quite broad in terms of the species they discussed.

Most of the articles from the overall 75 years were clearly connected with one of five main parts or districts of the Hunter Region: Upper and Lower Hunter, Gloucester/Comboyne, Great Lakes/Taree, and Port Stephens. The latter included reports for land and sea birds. There were also articles specifically about seabirds, mainly about visits to offshore islands. Therefore, the approach taken is to group the articles for each district, and to discuss all seabird records (including those in articles about Port Stephens) under "Offshore". The geographical limits for the districts are indicated in **Figure 1**. The boundaries are arbitrary but convenient. Parts of the Hunter Region lie outside these areas, but there seem to be no articles in *The Emu* appertaining to them.

Nomenclature

This paper uses the Christidis and Boles (2008) nomenclature, with appropriate amendment to the names used in the original articles. At times, it was quite difficult to decode those names. Australian ornithology has progressed substantially since the early 1900s and some names (scientific and common English) have changed considerably. **Appendix 1** illustrates some of the significant

changes that have occurred to the common English names of Hunter Region birds.

THE 1901-1925 LITERATURE

Upper Hunter

Although it did not take long for the first Hunter article to appear (White 1904), it was another four years before any substantial paper was published (Jackson 1908). It described a December 1907 trip from Scone to Belltrees/Ellerston, with visits to Segenhoe, Dartbrook, Yarrundi and Aberdeen *en route*. At Belltrees, Jackson stayed with the White family which led to a close collaboration with H.L. White, who was a prominent (and wealthy) ornithologist of the era. (His egg collection, covering around 800 species, was especially famous and is now housed in Museum Victoria).

John Gould had visited the same places in 1839-40. Jackson made interesting comparisons, for example about the rarity by then of Australian Bustard *Ardeotis australis* and a decline in raptor numbers. He named 61 species (15 breeding) and implied that others were present (presumably, species he considered common). He noted the abundant woodswallows (discussed further below) with many nests at Belltrees, and the "plentiful" Banded Lapwings *Vanellus tricolor* which were nesting in the area.

Jackson (1909) reported a 20 acre (8 ha) survey at Belltrees in June 1909. The paper listed 35 species including 13 not mentioned in his first paper, notably Regent Honeyeater *Anthochaera phrygia* and Southern Whiteface *Aphelocephala leucopsis*. The list included White-winged Triller *Lalage sueurii*, not recorded in the Hunter Region in winter now.

H.L. White himself did not write many major papers about birdlife of the Upper Hunter (nor of the Region more generally) but often reported interesting local records. Collectively these paint a picture of birdlife in the Upper Hunter in the period from around 1907 onwards. Amongst many short notes in *The Emu*, he mentions first-time or rare records for species such as Paradise Riflebird *Ptiloris paradiseus* at Stewarts Brook and Apostlebird *Struthidea cinerea* and Buff-banded Rail *Gallirallus philippensis* at Belltrees (the latter also recorded there by Jackson in 1907). His articles provide many breeding records; one listed 26 species breeding within 50 yards (45 metres) of his office (White 1915b).

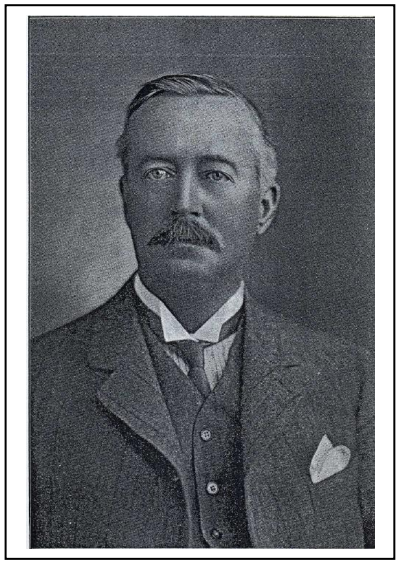

Plate 1. H.L.White, ornithologist of the early 1900s.

White (and also Jackson, shortly after) noted the presence of thousands of Masked (*Artamus personatus*) and White-browed (*A. superciliosus*) Woodswallows in 1907, with both species breeding (White 1908). In perhaps his most notable local record, given its present status as a Threatened Species, he described Regent Honeyeaters as being present "in thousands" at Belltrees in August 1909, with many pairs breeding (White 1909). He commented "one hears their peculiar notes all day long".

In his one major paper, White (1916a) noted the northern race of Eastern Rosella *Platycercus eximius elecica* had displaced the southern race *P. e. eximius* in the Upper Hunter during his lifetime. Initially the southern limit of the range was Scone; he later found *elecica* some 100km further east, nearly at the coast (White 1916b). Nowadays, *eximius* is once again the race found throughout the Hunter Region.

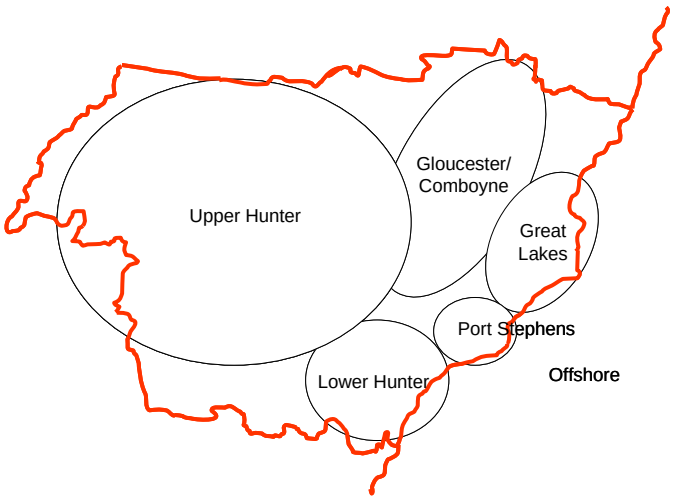

Figure 1. Nominal sub-areas of the Hunter Region

The Bettington family near Merriwa provided snippets about local birdlife in the 1920s, such as breeding records for Plum-headed Finch *Neochmia modesta*, miscellaneous raptors, and sightings of Orange Chat *Epthianura aurifrons* and Crimson Chat *Epthianura tricolor* (the latter breeding). Wedge-tailed Eagles *Aquila audax* were very successful because of the large rabbit population; the many pairs in the Merriwa area had more than 200 nests over a ten year period (Bettington 1924).

In 1925, RAOU members made an excursion to the Wallarobba area near Dungog as part of a push (eventually successful) by the RAOU to have the area preserved (Cayley 1926). *The Emu* article lacks a bird list but noted that they failed to find Plains-wanderer *Pedionomus torquatus*, a species recorded there previously (a surprising record, from a modern perspective).

Lower Hunter

This area was well settled by 1901 but there were few articles about it in *The Emu*[3]. In a 1914 train journey, H.L. White noted large numbers of White-necked Heron *Ardea pacifica* and Straw-necked Ibis *Threskiornis spinicollis* near Singleton and "thousands" of Nankeen Night-Herons *Nycticorax caledonicus* east of Maitland in swamps alongside the railway lines (White 1915c). White was aware this record was exceptional. In response, W.J. Enright of West Maitland noted small numbers of Night-Herons were common in trees along the river locally and other "wading-birds", including bitterns and herons, had increased in numbers in 1915 (Enright 1915).

Independently, S.A. Hanscombe of Seaham noted many Night-Herons resident between Maitland and Bulahdelah, and that good rains in 1914 had brought large numbers to nearby swamps (Hanscombe 1915a).

Hanscombe reported in detail his observations of Buff-rumped Thornbills *Acanthiza reguloides* raising a young Shining Bronze-Cuckoo *Chalcites lucidus* in the Seaham area in November 1914 (Hanscombe 1915b).

Gloucester/Comboyne

In broad terms, the geographic spread for the Gloucester/Comboyne part of the Hunter Region is the area encompassing Gloucester and Barrington Tops and associated lower altitude forests, and countryside of similar longitude, extending to the northern boundary of the Hunter Region (**Figure 1**). The only relevant article for 1901-1925 described a visit to Barrington Tops in late December 1915 by the Maitland District Scientific and Historical Society (Anon. 1916). The list of 37 species included Satin Flycatcher *Myiagra cyanoleuca*, which seems plausible, and Singing Honeyeater *Lichenostomus virescens*, which is surprising[4]. Little Crow *Corvus bennetti* was the only corvid recorded, probably a misidentification (the Little Crow at the time was considered a bird of the inland (for example, see Leach 1926, p.188), as is still the case). Nowadays Little Raven *C. mellori* and Torresian Crow *C. orru* are the corvids present in Barrington Tops[5].

Port Stephens

There were no specific articles about visits to Port Stephens over 1901-25. The notes discussed above from White, Enright and Hanscombe all mentioned a very large breeding colony of Nankeen Night-Herons in the Port Stephens area. Confusingly, they named the location as Cabbage Tree Island; nowadays this name is used solely for an offshore island. A.F. Basset Hull (1911b) clarified the actual location as on Schnapper (now Snapper) Island within Port Stephens ~12 miles (19 km) from the harbour entrance. At the time, this island was called Cabbage Tree by some locals.

Basset Hull visited the Night-Heron colony in December 1910 and saw hundreds of nests (Basset Hull 1911a). In a January 1911 return visit many young birds were present but unfortunately he also found evidence of damage by shooters (Basset Hull 1911b).

Basset Hull made several passages through Port Stephens but his focus was offshore island seabirds (see later). Importantly, he did note breeding pairs of a small tern on a sandspit near the harbour

[3] The report of a 1904 visit by RAOU members to Tuggerah Lakes (Mellor 1905) is quite useful as it provides insights that probably are relevant for the Lower Hunter. Birds seen at Tuggerah Lakes, which is immediately to the south of the Hunter Region, that were not mentioned in any Hunter Region *Emu* articles are contained in **Table 1** as Supplementary List 1.

[4] McAllan (2001) noted that books of that era had a flawed illustration, such that Yellow-faced Honeyeater *Lichenostomus chrysops* and Singing Honeyeater misidentifications could occur.

[5] Little Raven was not listed as a distinct species until 1969 (M. Cameron pers. comm.).

entrance and also breeding Red-capped Plover *Charadrius ruficapillus* there (Basset Hull 1911a). The former is probably the first breeding record for the Hunter Region of the Little Tern *Sternula albifrons*, although he named the birds as Fairy Tern *Sternula nereis*. The two species were often confused by early ornithologists (Sharland 1938).

Great Lakes/Taree

The RAOU camped at Wallis Lake near Forster for 10 days in 1921 (S.A. White 1922) and recorded 116 species, and another two not able to be specified). Little Terns (correctly identified) were nesting near the lake's entrance and other gulls and terns were recorded but not the Common Tern *Sterna hirundo* or the Gull-billed Tern *Gelochelidon nilotica*. Peaceful Doves *Geopelia striata* and Emerald Doves *Chalcophaps indica* were common, and several shorebirds were present including Black-tailed Godwit *Limosa limosa*. All three local scrubwrens were recorded, with Yellow-throated Scrubwren *Sericornis citreogularis* present in good numbers and several pairs nesting. The group also found Pale-yellow Robins *Tregellasia capito* ("not at all plentiful") in the area - this suggests a range contraction has occurred as there are no modern near-coastal records for the Hunter Region. Surprisingly, some families (for example, ducks) are missing from the list. Large-tailed Nightjar *Caprimulgus macrurus* was reported; the modern range is restricted to northern Queensland (Higgins 1999). Most likely, this was a misidentification of the White-throated Nightjar *Eurostopodus mystacalis* for which there are no 1901-1925 records for the Hunter Region in *The Emu* but which was known to be at Gosford in summer (Jackson 1914).

Apart from the misidentified nightjar, two other records stand out in the 1921 Wallis Lake list:

- A party of Speckled Warblers *Chthonicola sagittata* ("very tame, hopping about on the ground on the bank of the lake"). It seems the sole observer therefore had good views. It is an unusual record, by modern expectations - the species is now found only in the central and western parts of the Hunter Region. It is difficult to suggest an alternative, except perhaps Chestnut-rumped Heathwren *Hylacola pyrrhopygia*, but such misidentification seems improbable.

- Confusingly, a gerygone named as "Brown Fly-eater *Gerygone fusca*", was reported present and breeding. In modern nomenclature *G. fusca* is the Western Gerygone, a bird of the central and western parts of the Hunter Region. The evolution of the taxonomy of the gerygones is convoluted[6]; the record is almost certainly the Brown Gerygone *G. mouki.*

The same year, H. Gogerley gave some breeding records from Cape Hawke, near Forster (Gogerley 1922a). His article is mainly on Eastern Whipbirds *Psophodes olivaceus* but he noted six other species breeding, including Chestnut-rumped Heathwren, Australian Logrunner *Orthonyx temminckii* and Spotted Quail-thrush *Cinclosoma punctatum*. The latter suggests a much drier area then. This might also explain the records for Speckled Warbler and Diamond Firetail *Stagonopleura guttata* at Wallis Lake.

In 1922, S.W. Jackson surveyed at Wootton and Wallis Lake. No formal record of his observations appeared until his diaries were reviewed after his death (Chisholm 1958). At Wootton, he recorded Paradise Riflebird, Varied Triller *Lalage leucomela*, Spectacled Monarch *Symposiarchus trivirgatus* and Eastern Bristlebird *Dasyornis brachypterus*. The latter does not appear on the modern Hunter Region checklist (Stuart 2008). At Wallis Lake he joined forces with Gogerley; the focus of their searching, intriguingly, was to find eggs of the Ground Parrot *Pezoporus wallicus*. This search was unsuccessful. It is unclear if there were any prior records for the area or if the searchers just decided that the habitat seemed prospective.

Associated with Jackson's visit, Gogerley found Striped Honeyeater *Plectorhyncha lanceolata* breeding in the Forster area. He described it as a regular summer visitor (Gogerley 1923) – whereas nowadays the species is considered to be resident.

In November 1923, Gogerley succeeded in finding Ground Parrots at a swamp at Cape Hawke, including two nests with eggs (Gogerley 1924d). His article also discussed the unsuccessful search with Jackson. In a recently burnt area they had found several remnant nests which they suspected were those of Ground Parrot but were unable to confirm this. (It seems Gogerley was certain, but Jackson was not). Gogerley also commented that several years before he had heard a Ground Parrot calling at Cape Hawke.

[6] Gould used *fusca/fuscus* for two different birds at different times: for what is now Western Gerygone in 1838 and for what is now Brown Gerygone in 1846 (W. Boles pers. comm.)

Ground Parrot is not on the modern Hunter checklist but there are populations further north and in southern New South Wales (Higgins 1999). It seems plausible that they were in the Hunter Region 100 years ago.

Gogerley also reported the presence of thousands of Topknot Pigeons *Lopholaimus antarcticus* around Wallis Lake, and breeding, in June-October 1923 (Gogerley 1925). There are no modern records of this species breeding within the Hunter Region, but this is probably an oversight.

Offshore

In the early 1900s, knowledge about seabirds off the NSW coast was incomplete, and was heavily dependent on information collected at breeding grounds on the offshore islands and from beach-cast birds. A.F. Basset Hull, who later became President of the RAOU, was a leading light in such studies. Between 1907 and 1915 he made numerous visits to offshore islands, collecting specimens and eggs. The findings are summarised in a series of three articles about the avifauna of NSW islands and two earlier short articles. Of the major articles, Part 2 is mostly about Montague Island near Nowra and Part 3 mostly about the Sydney area, but both make brief mention of the Hunter Region's islands. Part 3 contains a seabird list for Sydney that presumably would closely reflect the situation for the Hunter Region. The seabirds that were not mentioned in any Hunter Region *Emu* articles are shown in **Table 1** as Supplementary List 2.

Basset Hull first visited islands off Port Stephens in October 1910 (Basset Hull 1910a). Wedge-tailed Shearwater *Ardenna pacificus* was breeding on all islands except Boondelbah (which had no seabirds). He "re-discovered" Gould's Petrel *Pterodroma leucoptera* on Cabbage Tree Island and found Little Penguins *Eudyptula minor* breeding (at that time, the most northerly record). Broughton Island had "thousands" of White-faced Storm-Petrel *Pelagodroma marina* burrows. The breeding season was almost over; only a few young birds remained.

Locals had advised Basset Hull that Gould's Petrel and White-faced Storm-Petrel bred on Shark Island (situated just off Broughton Island). He did not find any (only Wedge-tailed Shearwater burrows) but located two nests of Eastern Reef Egret *Egretta sacra*, one with eggs; this species still occurs along the Hunter Region's coast but there are no recent breeding records.

On Cabbage Tree Island, Basset Hull collected a specimen he considered novel and named Solitary Petrel *Puffinus intermedius* (Basset Hull 1911a). On subsequent visits, no similar birds were found and no similarly named species appears in the modern Australian checklist. From the description, the bird may have been an unusual morph of the Wedge-tailed Shearwater.

Basset Hull made more visits in 1911, mainly finding Wedge-tailed Shearwater burrows and nestlings. In January 1911, he collected the first NSW land record for Sooty Shearwater *Ardenna grisea*, taken from a burrow on Broughton Island (Basset Hull 1911b). This is thought to have been a non-breeding bird due to the lateness in the season (Keast & McGill 1948). He did not find Sooty Shearwaters on subsequent visits; however, E.S. Rohu collected specimens and eggs on Broughton Island in December 1914 (Rohu 1914).

Occasionally, Basset Hull briefly mentioned non-seabird records. In 1911 at Cabbage Tree Island he collected a Barred Cuckoo-shrike *Coracina lineata* (Basset Hull 1911b) which now is considered an accidental visitor to the Hunter Region (and has only been recorded at Harrington).

F.C. Morse visited Cabbage Tree and another (un-named) island in March 1918, and found adult and young birds "caught in the Pisonia seeds" (Morse 1918). This may be the first documentation of the serious impacts to Gould's Petrel from seeds of the Bird-lime Tree *Pisonia umbellifera*.

DISCUSSION

Changes in Distribution & Abundance

It is interesting to consider how the distribution and abundance of species have changed in the Hunter Region. It seems appropriate to link the two – the optical equipment of the early observers was of relatively low quality (by modern standards) and there were no field guides. It is easy to suppose that when they surveyed an area, they might have overlooked some less abundant species. A positive identification often required that the bird be shot and examined.

A striking feature of the 1901-1925 articles is the absence of records for introduced species. There was scarcely any mention of them even when a full species list was included with the paper. The exception is Common Starling *Sturnus vulgaris*, noted present at Belltrees in 1909 and in very large

numbers between Muswellbrook and Quirindi in 1921 (Anon. 1922). By 1925 there were at least 11 introduced species in New South Wales (E.C. Chisholm 1926). Perhaps the other species were yet to penetrate far into the countryside of the Hunter Region, although this seems unlikely given that substantial clearing and development had occurred. Another hypothesis is that introduced species were ignored by the early ornithologists.

There were relatively few waterbird records; most notably an absence of egrets and many ducks that nowadays are common[7] (in particular, no reports of Chestnut Teal *Anas castanea*, for which the Region is presently a stronghold). Similarly, Australian White Ibis *Threskiornis molucca*, now common, is not mentioned in any article. The December 1904 (Mellor 1905) visit to Tuggerah Lakes (immediately south of the Hunter Region and hence informative) recorded Black Swan *Cygnus atratus*, Pacific Black Duck *Anas superciliosa* and Grey Teal *Anas gracilis*, all in abundance, but no other ducks, pelicans, ibis or grebes. Three cormorant species were recorded (no Little Black Cormorant *Phalacrocorax sulcirostris*) and the Intermediate Egret *Ardea intermedia* was the only egret species. White (1915c) noted large numbers of White-necked Heron in swamps near Maitland. Jackson (1908) reported Australian Wood Ducks *Chenonetta jubata* in the Upper Hunter and White-faced Heron *Egretta novaehollandiae* and Straw-necked Ibis, but no other waterbirds excepting plovers and dotterels (including, surprisingly, Red-capped Plover near the river). H.L. White (1919) reported the drought they were experiencing had led to increased numbers of Eastern Great Egret and that the species normally was very uncommon in the Upper Hunter. Most telling is the 1921 RAOU visit to Wallis Lake - swans, pelicans and cormorants were recorded (Australian Pelican *Pelecanus conspicillatus* "not in any great numbers") but no ducks or any white egrets. The only grebe recorded was Great Crested Grebe *Podiceps cristatus*. Conversely, there was "a fair number" of dark phase Eastern Reef Egrets, which now is uncommon.

The absence of records for many waterbirds that now are common is intriguing. The absence was not a widespread phenomenon, since many contemporaneous reports from regions outside the Hunter usually described such waterbirds as common (see for example, S.A. White 1912, Stone 1913, Cheney 1915).

Changes to the distribution and abundance of parrots and their allies are apparent. Turquoise and Red-rumped Parrots (*Neophema pulchella*, *Psephotus haematonotus*) were common inland. Rainbow Lorikeet *Merops ornatus* was never mentioned. Musk, Little and Scaly-breasted Lorikeets (*Glossopsitta concinna*, *G. pusilla*, *Trichoglossus chlorolepidotus*) were recorded, the latter not at Wallis Lake in 1921 where, now, sightings are the norm. Galah *Eolophus roseicapillus* was not reported in the Upper Hunter district (the only area where it might then have been expected). Nor were corellas (but, probably, inland habitats visited were unsuitable for Little Corella *Cacatua sanguinea*).

Of the finches, Red-browed Finch *Neochmia temporalis* and Diamond Firetail were commonly recorded; the latter distributed far more widely than nowadays (coastal records from Wallis Lake and Tuggerah Lakes). Neither Zebra Finch *Taeniopygia guttata* nor Double-barred Finch *T. bichenovii* are mentioned in the 1901-1925 papers.

Nankeen Night-Heron was abundant in the eastern part of the Hunter Region in early 1900s, with a large breeding colony at Port Stephens and perhaps others in the Maitland area. Conversely, there were no records of White-breasted Woodswallow *Artamus leucorynchus* including surveys of coastal areas in summer, where sightings are now normal.

Regent Honeyeaters were abundant in the Upper Hunter. In contrast, there were no records of Emu *Dromaius novaehollandiae*, which it seems was already rare in the Upper Hunter.

Many other species on the modern Hunter Region check list were not recorded in 1901-1925 (or at least, were not mentioned in *Emu* articles). There is not space to discuss every absence; readers are referred to **Table 1** for a complete list of species mentioned in *Emu* articles of the period.

Rare and Unusual Records

Some of the species listed below are considered rare or accidental visitors to the Hunter Region. The other species (indicated with #) do not appear on the modern Hunter Region checklist (Stuart 2008) because their validity is uncertain. Perhaps some day the doubtful species will be reported again and can become confirmed additions to the checklist:

[7] John Gould found ducks to be plentiful in the Upper Hunter in 1839-40. Perhaps the widespread habit of shooting caused numbers to plummet as the Hunter Region became more populated?

- Large-tailed Nightjar[#]: a bird was reported from Wallis Lake in 1921.

- Australian Little Bittern *Ixobrychus dubius*: near West Maitland early 1915 (possibly, more than one sighting). There were also records for Australasian Bittern *Botaurus poiciloptilus* at this location in 1915.

- Australian Bustard[#]: in 1908 was considered still present in the Upper Hunter, but rare. Cayley (1926) reported a bird near West Maitland (the year was not given).

- Ringed Plover[#] *Charadrius hiaticula*: Chisholm (1924b) mentions a specimen collected at Port Stephens. The year was not given; probably it was pre-1901.

- Plains-wanderer[#]*:* Reported as present in the Wallarobba area during the early 1920s (the record predated the 1925 visit by RAOU members).

- Little Curlew *Numenius minutus*: a pair was at Belltrees in October 1911 (and were "not at all timid").

- Fairy Tern[#]: reported breeding in Port Stephens in 1911.

- Budgerigar *Melopsittacus undulatus*: present at Belltrees in 1908, and "in thousands" in 1918 (in both cases, linked with inland drought). Chisholm (1924a) noted it as a species whose numbers at Belltrees had increased substantially.

- Ground Parrot[#]: birds, and nests with eggs, were at Cape Hawke in 1924 and probably birds were recorded in the Wootton area prior to 1922.

- Eastern Bristlebird[#]: reported near Wootton in 1922.

- Southern Whiteface: reported at Belltrees in 1909 (and probably common 1901-1925) and at Wallarobba in 1925.

- Singing Honeyeater: reported at Barrington Tops in December 1915.

- Orange Chat[#]: a group of 5-6 birds including two males reported near Merriwa in November 1924.

- Crimson Chat[#]: reported breeding near Merriwa in November 1924 and to have been in the same general area in 1914.

- Barred Cuckoo-shrike: a specimen collected at Cabbage Tree Island in 1911.

- Little Crow[#]: reported at Barrington Tops in December 1915.

- Apostlebird[#]: a group of four birds reported at Belltrees in September 1920.

Species List

The main list in **Table 1** is a composite prepared from *Emu* articles relating to the Hunter Region in 1901-1925. For completeness, all cited species are listed, including some that perhaps were misidentifications. The first supplementary list to the Table shows additional species recorded at Tuggerah Lakes in 1904 which may reasonably be expected to have also been present in the Hunter Region. The second supplementary list contains some additional seabirds recorded off Sydney (between Broken Bay and Botany Bay) over 1910-15 and which may reasonably be expected to have also been present off the Hunter coastline.

CONCLUSIONS

By the early 1900s, ornithologists were surveying well beyond Newcastle and the Lower Hunter, at places less developed and thus with a greater abundance (and variety) of native bird life. In the period 1901-1925, there were expeditions to the Upper Hunter, Barrington Tops, Port Stephens and Great Lakes areas, and offshore islands, with accounts in *The Emu*. Many opportunistic sightings from the Hunter Region also were reported. From these articles, 204 species were reported as present in the Region (a small number of those being dubious) and a further 8-10 seabird species can additionally be assumed to have been offshore at times. There were documented breeding records for 81 species.

Not unexpectedly, there have been changes to the documented distribution and/or abundance of many species since 1901-1925. The families Ducks, Grebes and Egrets seem to have been uncommon then, and there were no reports of the modern summer visitors White-breasted Woodswallow and Common Tern, or of any introduced species except Common Starling. Other differences include that Nankeen Night-Herons

were present in large numbers in the Lower Hunter, and that Diamond Firetails, Peaceful Doves and Emerald Doves were much more widespread than nowadays.

The 1901-1925 list of 204 species for the Hunter Region is ~48% of the 424 species on the modern list. The latter includes 40-50 pelagic seabirds not expected near the coast. Allowing for this, barely half the species in the Hunter Region were recorded during 1901-1925. Reasons for the difference perhaps include better equipment now available, superior field guides and more highly developed field identification skills, more observers, more intensive data collection, greater access to "remote" areas, and changes to range. Probably a combination of all of these factors leads to the modern list being so much larger.

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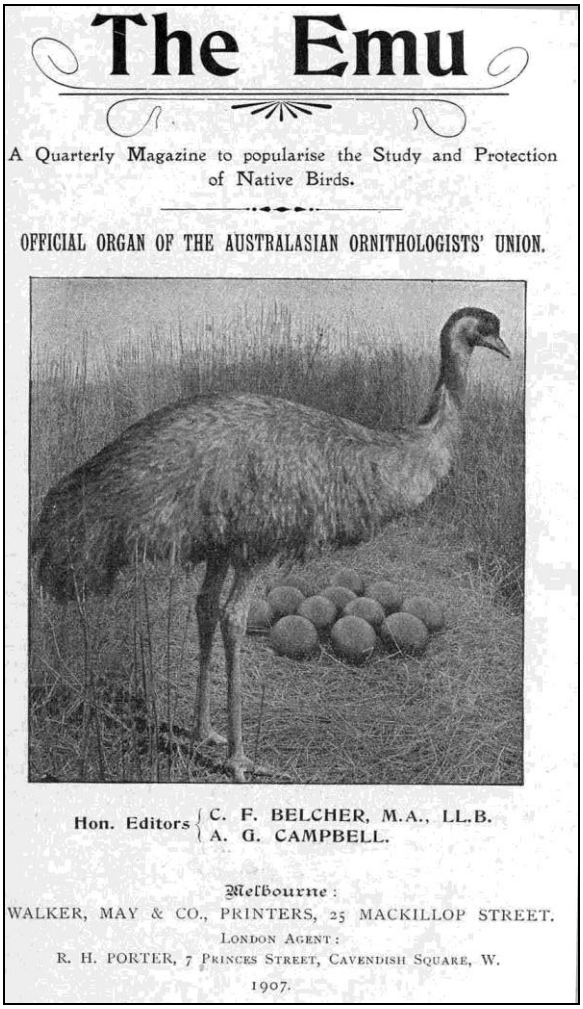
The Emu

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Plate 2. *The Emu*, journal of RAOU (Birds Australia)

Table 1. Birds Recorded in the Hunter Region 1901-1925 *(Species confirmed breeding are indicated in **Bold**)*

Australian Brush-turkey *Alectura lathami*
Black Swan *Cygnus atratus*
Australian Wood Duck *Chenonetta jubata*
Pacific Black Duck *Anas superciliosa*
Great Crested Grebe *Podiceps cristatus*
White-headed Pigeon *Columba leucomela*
Brown Cuckoo-Dove *Macropygia amboinensis*
Emerald Dove *Chalcophaps indica*
Common Bronzewing *Phaps chalcoptera*
Peaceful Dove *Geopelia striata*
Wonga Pigeon *Leucosarcia melanoleuca*
Rose-crowned Fruit-Dove *Ptilinopus regina*
Topknot Pigeon *Lopholaimus antarcticus*
Tawny Frogmouth *Podargus strigoides*
Large-tailed Nightjar *Eurostopodus macrurus*
White-throated Needletail *Hirundapus caudacutus*
White-faced Storm-Petrel *Pelagodroma marina*
Wedge-tailed Shearwater *Ardenna pacificus*
Sooty Shearwater *Ardenna grisea*
Solitary Petrel *Puffinus intermedius*
Gould's Petrel *Pterodroma leucoptera*
Little Penguin *Eudyptula minor*
Australasian Gannet *Morus serrator*
Little Pied Cormorant *Microcarbo melanoleucos*
Great Cormorant *Phalacrocorax carbo*
Little Black Cormorant *Phalacrocorax sulcirostris*
Pied Cormorant *Phalacrocorax varius*
Australian Pelican *Pelecanus conspicillatus*
Australasian Bittern *Botaurus poiciloptilus*
Australian Little Bittern *Ixobrychus dubius*
White-necked Heron *Ardea pacifica*
Eastern Great Egret *Ardea modesta*
Striated Heron *Butorides striata*
White-faced Heron *Egretta novaehollandiae*
Eastern Reef Egret *Egretta sacra*
Nankeen Night-Heron *Nycticorax caledonicus*
Straw-necked Ibis *Threskiornis spinicollis*
Black-shouldered Kite *Elanus axillaris*
White-bellied Sea-Eagle *Haliaeetus leucogaster*
Whistling Kite *Haliastur sphenurus*
Brown Goshawk *Accipiter fasciatus*
Collared Sparrowhawk *Accipiter cirrocephalus*
Grey Goshawk *Accipiter novaehollandiae*
Spotted Harrier *Circus assimilis*
Swamp Harrier *Circus approximans*
Wedge-tailed Eagle *Aquila audax*
Nankeen Kestrel *Falco cenchroides*
Brown Falcon *Falco berigora*
Buff-banded Rail *Gallirallus philippensis*
Eurasian Coot *Fulica atra*
Australian Bustard *Ardeotis australis*
Australian Pied Oystercatcher *Haematopus longirostris*
Sooty Oystercatcher *Haematopus fuliginosus*
Pacific Golden Plover *Pluvialis fulva*
Ringed Plover *Charadrius hiaticula*

Red-capped Plover *Charadrius ruficapillus*
Black-fronted Dotterel *Elseyornis melanops*
Banded Lapwing *Vanellus tricolor*
Masked Lapwing *Vanellus miles*
Plains-wanderer *Pedionomus torquatus*
Black-tailed Godwit *Limosa limosa*
Bar-tailed Godwit *Limosa lapponica*
Little Curlew *Numenius minutus*
Red-necked Stint *Calidris ruficollis*
Sharp-tailed Sandpiper *Calidris acuminata*
Brown Skua *Stercorarius antarcticus*
Arctic Jaeger *Stercorarius parasiticus*
Little Tern *Sternula albifrons*
Fairy Tern *Sternula nereis*
Caspian Tern *Hydroprogne caspia*
Crested Tern *Thalasseus bergii*
Silver Gull *Larus novaehollandiae*
Glossy Black-Cockatoo *Calyptorhynchus lathami*
Yellow-tailed Black-Cockatoo *Calyptorhynchus funereus*
Sulphur-crested Cockatoo *Cacatua galerita*
Cockatiel *Nymphicus hollandicus*
Scaly-breasted Lorikeet *Trichoglossus chlorolepidotus*
Musk Lorikeet *Glossopsitta concinna*
Little Lorikeet *Glossopsitta pusilla*
Australian King-Parrot *Alisterus scapularis*
Crimson Rosella *Platycercus elegans*
Eastern Rosella *Platycercus eximius*
Red-rumped Parrot *Psephotus haematonotus*
Budgerigar *Melopsittacus undulatus*
Turquoise Parrot *Neophema pulchella*
Ground Parrot *Pezoporus wallicus*
Pheasant Coucal *Centropus phasianinus*
Eastern Koel *Eudynamys orientalis*
Channel-billed Cuckoo *Scythrops novaehollandiae*
Black-eared Cuckoo *Chalcites osculans*
Shining Bronze-Cuckoo *Chalcites lucidus*
Pallid Cuckoo *Cacomantis pallidus*
Fan-tailed Cuckoo *Cacomantis flabelliformis*
Powerful Owl *Ninox strenua*
Southern Boobook *Ninox novaeseelandiae*
Laughing Kookaburra *Dacelo novaeguineae*
Sacred Kingfisher *Todiramphus sanctus*
Rainbow Bee-eater *Merops ornatus*
Dollarbird *Eurystomus orientalis*
Superb Lyrebird *Menura novaehollandiae*
White-throated Treecreeper *Cormobates leucophaea*
Brown Treecreeper *Climacteris picumnus*
Green Catbird *Ailuroedus crassirostris*
Regent Bowerbird *Sericulus chrysocephalus*
Satin Bowerbird *Ptilonorhynchus violaceus*
Superb Fairy-wren *Malurus cyaneus*
Variegated Fairy-wren *Malurus lamberti*
Southern Emu-wren *Stipiturus malachurus*
Eastern Bristlebird *Dasyornis brachypterus*
Yellow-throated Scrubwren *Sericornis citreogularis*

White-browed Scrubwren *Sericornis frontalis*
Large-billed Scrubwren *Sericornis magnirostra*
Chestnut-rumped Heathwren *Hylacola pyrrhopygia*
Speckled Warbler *Chthonicola sagittata*
Brown Gerygone *Gerygone mouki*
White-throated Gerygone *Gerygone albogularis*
Striated Thornbill *Acanthiza lineata*
Yellow Thornbill *Acanthiza nana*
Yellow-rumped Thornbill *Acanthiza chrysorrhoa*
Buff-rumped Thornbill *Acanthiza reguloides*
Brown Thornbill *Acanthiza pusilla*
Southern Whiteface *Aphelocephala leucopsis*
Spotted Pardalote *Pardalotus punctatus*
Striated Pardalote *Pardalotus striatus*
Eastern Spinebill *Acanthorhynchus tenuirostris*
Lewin's Honeyeater *Meliphaga lewinii*
Yellow-faced Honeyeater *Lichenostomus chrysops*
Singing Honeyeater *Lichenostomus virescens*
White-eared Honeyeater *Lichenostomus leucotis*
White-plumed Honeyeater *Lichenostomus penicillatus*
Noisy Miner *Manorina melanocephala*
Little Wattlebird *Anthochaera chrysoptera*
Regent Honeyeater *Anthochaera phrygia*
Red Wattlebird *Anthochaera carunculata*
Orange Chat *Epthianura aurifrons*
Crimson Chat *Epthianura tricolor*
White-fronted Chat *Epthianura albifrons*
Scarlet Honeyeater *Myzomela sanguinolenta*
Tawny-crowned Honeyeater *Glyciphila melanops*
New Holland Honeyeater *Phylidonyris novaehollandiae*
White-cheeked Honeyeater *Phylidonyris niger*
Brown-headed Honeyeater *Melithreptus brevirostris*
White-naped Honeyeater *Melithreptus lunatus*
Blue-faced Honeyeater *Entomyzon cyanotis*
Noisy Friarbird *Philemon corniculatus*
Striped Honeyeater *Plectorhyncha lanceolata*
Grey-crowned Babbler *Pomatostomus temporalis*
Australian Logrunner *Orthonyx temminckii*
Spotted Quail-thrush *Cinclosoma punctatum*
Eastern Whipbird *Psophodes olivaceus*
Varied Sittella *Daphoenositta chrysoptera*
Black-faced Cuckoo-shrike *Coracina novaehollandiae*
White-bellied Cuckoo-shrike *Coracina papuensis*
Barred Cuckoo-shrike *Coracina lineata*
Cicadabird *Coracina tenuirostris*
White-winged Triller *Lalage sueurii*
Varied Triller *Lalage leucomela*
Crested Shrike-tit *Falcunculus frontatus*
Golden Whistler *Pachycephala pectoralis*
Rufous Whistler *Pachycephala rufiventris*
Grey Shrike-thrush *Colluricincla harmonica*
Olive-backed Oriole *Oriolus sagittatus*
Masked Woodswallow *Artamus personatus*
White-browed Woodswallow *Artamus superciliosus*
Dusky Woodswallow *Artamus cyanopterus*
Grey Butcherbird *Cracticus torquatus*
Pied Butcherbird *Cracticus nigrogularis*
Australian Magpie *Cracticus tibicen*
Pied Currawong *Strepera graculina*
Spangled Drongo *Dicrurus bracteatus*
Rufous Fantail *Rhipidura rufifrons*
Grey Fantail *Rhipidura albiscapa*
Willie Wagtail *Rhipidura leucophrys*
Australian Raven *Corvus coronoides*
Little Crow *Corvus bennetti*
Leaden Flycatcher *Myiagra rubecula*
Satin Flycatcher *Myiagra cyanoleuca*
Restless Flycatcher *Myiagra inquieta*
Black-faced Monarch *Monarcha melanopsis*
Spectacled Monarch *Symposiarchus trivirgatus*
Magpie-lark *Grallina cyanoleuca*
White-winged Chough *Corcorax melanorhamphos*
Apostlebird *Struthidea cinerea*
Paradise Riflebird *Ptiloris paradiseus*
Jacky Winter *Microeca fascinans*
Scarlet Robin *Petroica boodang*
Flame Robin *Petroica phoenicea*
Rose Robin *Petroica rosea*
Hooded Robin *Melanodryas cucullata*
Pale-yellow Robin *Tregellasia capito*
Eastern Yellow Robin *Eopsaltria australis*
Horsfield's Bushlark *Mirafra javanica*
Australian Reed-Warbler *Acrocephalus australis*
Rufous Songlark *Cincloramphus mathewsi*
Silvereye *Zosterops lateralis*
Welcome Swallow *Hirundo neoxena*
Fairy Martin *Petrochelidon ariel*
Tree Martin *Petrochelidon nigricans*
Common Starling *Sturnus vulgaris*
Mistletoebird *Dicaeum hirundinaceum*
Plum-headed Finch *Neochmia modesta*
Red-browed Finch *Neochmia temporalis*
Diamond Firetail *Stagonopleura guttata*
Australasian Pipit *Anthus novaeseelandiae*
SUPPLEMENTARY LIST 1 (BIRDS AT TUGGERAH LAKES)
Fork-tailed Swift *Apus pacificus*
Australasian Darter *Anhinga novaehollandiae*
Intermediate Egret *Ardea intermedia*
Spotted Harrier *Circus assimilis*
Eastern Curlew *Numenius madagascariensis*
Painted Button-quail *Turnix varius*
Azure Kingfisher *Ceyx azurea*
Forest Kingfisher *Todiramphus macleayii*
Rockwarbler *Origma solitaria*
Bell Miner *Manorina melanophrys*
Little Raven *Corvus mellori*
SUPPLEMENTARY LIST 2 (SEABIRDS OFF SYDNEY)
Wilson's Storm-Petrel *Oceanites oceanicus*
Wandering Albatross *Diomedea exulans*
Shy Albatross *Thallassarche cauta*
Yellow-nosed Albatross *Thallassarche chlororhynchos*
Southern Giant-Petrel *Macronectes giganteus*
Short-tailed Shearwater *Ardenna tenuirostris*
Little Shearwater *Puffinus assimilis*
White-fronted Tern *Sterna striata*

Appendix 1. Changes in common English bird names

Some early *Emu* articles are daunting, with references to species such as Blood-Birds and Grey Jumpers interspersed with names that are quite familiar to us now. Some name changes are minor, involving hyphens and/or capital letters inserted into names that we can still easily recognise (for example, Butcher-Bird). But, other names are distinctly different to modern usage and require translation. The list below illustrates some of the changes for birds of the Hunter Region, and may assist any reader choosing to tackle the early literature.

2008 name	Other name(s) used in 1901-25
Emerald Dove	Little Green Pigeon
Common Bronzewing	Bronze-winged Pigeon
Peaceful Dove	Ground-Dove
Rose-crowned Fruit-Dove	Red-crowned Fruit-Pigeon
White-throated Needletail	Spine-tailed Swift
Fork-tailed Swift	White-rumped Swift
Wedge-tailed Shearwater	Wedge-tailed Petrel, Mutton-Bird
Sooty Shearwater	Sombre Petrel
Gould's Petrel	White-winged Petrel
Little Pied Cormorant	Little Cormorant
Great Cormorant	Cormorant, Black Cormorant
Intermediate Egret	Plumed Egret
Striated Heron	Little Mangrove-Bittern
White-faced Heron	White-fronted Heron
Whistling Kite	Whistling Eagle
Swamp Harrier	Swamp Hawk
Brown Falcon	Brown Hawk
Buff-banded Rail	Land Rail, Pectoral Rail
Red-capped Plover	Red-capped Dotterel
Banded Lapwing	Black-breasted Plover
Masked Lapwing	Spur-winged Plover
Little Curlew	Little Whimbrel
Sharp-tailed Sandpiper	Sharp-tailed Stint
Painted Button-quail	Painted Quail
Brown Skua	Sea-Hen, Sea-Hawk
Arctic Jaeger	Skua, Richardson's Skua
Little Tern	White-shafted Ternlet
Glossy Black-Cockatoo	Leach Black Cockatoo
Sulphur-crested Cockatoo	White Cockatoo
Cockatiel	Cockatoo-Parrakeet
Crimson Rosella	Crimson Parrot
Eastern Rosella	Rosella Parrot, Rosella, Yellow-mantled Rosella
Red-rumped Parrot	Red-backed Parrot, Red-rumped Parrakeet
Turquoise Parrot	Red-shouldered Grass Parrot
Horsfield's Bronze-Cuckoo	Narrow-billed Bronze-Cuckoo
Shining Bronze-Cuckoo	Bronze-Cuckoo
Azure Kingfisher	Blue Kingfisher
Laughing Kookaburra	Great Brown Kingfisher, Laughing Jackass
Rainbow Bee-eater	Rainbow-bird
Dollarbird	Roller
Noisy Pitta	Dragoon-Bird
Superb Fairy-wren	Blue Wren-Warbler, Blue Wren
Variegated Fairy-wren	Variegated Wren

2008 name	Other name(s) used in 1901-25
Speckled Warbler	Little Field-Wren
Brown Gerygone	Brown Fly-eater
Striated Thornbill	Striped Tit
Yellow Thornbill	Little Tit, Yellow-breasted Tit
Yellow-rumped Thornbill	Yellow-rumped Tit, Yellow-tailed Tit-Warbler
Buff-rumped Thornbill	Buff-tailed Tit-Warbler
Brown Thornbill	Brown Tit
Striated Pardalote	Red-tipped Diamond-Bird
Lewin's Honeyeater	Yellow-eared Honey-eater
Little Wattlebird	Brush Wattle-Bird
Regent Honeyeater	Warty-faced Honey-eater
White-fronted Chat	White-fronted Bush-Chat
Scarlet Honeyeater	Blood-Bird
Noisy Friarbird	Leatherhead
Eastern Whipbird	Coachwhip-Bird
Cicadabird	Jardine's Caterpillar-Eater, Great Caterpillar-Eater
White-winged Triller	White-shouldered Caterpillar-Eater
Crested Shrike-tit	Yellow-bellied Shrike-Tit
Golden Whistler	White-throated Thickhead
Rufous Whistler	Rufous-breasted Thickhead
Grey Shrike-thrush	Harmonious Thrush
Pied Butcherbird	Black-throated Butcherbird
Australian Magpie	Black-backed Magpie
Pied Currawong	Pied Bell-Magpie, Northern Bell-Magpie, Pied Crow-Shrike
Rufous Fantail	Rufous-fronted Fantail
Grey Fantail	White-shafted Fantail
Willie Wagtail	Black and White Fantail, Shepherd's Companion
Little Crow	Short-billed Crow
Black-faced Monarch	Black-faced Flycatcher
Spectacled Monarch	Spectacled Flycatcher
Magpie-lark	Peewit, Pied Grallina
Apostlebird	Grey Jumper
Jacky Winter	Brown Flycatcher
Scarlet Robin	Scarlet-breasted Robin
Flame Robin	Flame-breasted Robin
Rose Robin	Rose-breasted Robin
Eastern Yellow Robin	Yellow-breasted Robin
Silvereye	White-eye
Bassian Thrush	Ground-Thrush
Diamond Firetail	Spotted-sided Finch
Australasian Pipit	Ground-Lark

Notes on an old Upper Hunter egg collection

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Most of our knowledge of the birds in the Upper Hunter Region in the early 20th Century stems from the publicly available literature published in *The Emu* (Stuart 2009). Previously unpublished information about Upper Hunter birds from the periods 1918-1921 and 1927-1928 forms the basis for the material below. In those years, Eric McPhee, an uncle of Greg Newling (GN) worked at Belltrees as an assistant to H.L. White. McPhee started an egg collection and his records (since passed to GN) included where the eggs originated. Many eggs were taken from nests at locations in the Upper Hunter – principally Belltrees, also Moonan Flat, Stewarts Brook and Broke.

The collection included eggs from 67 species in the Upper Hunter. Many of these were known from *The Emu* to breed locally (Stuart 2009). The following additional species are from McPhee's notes; those shown in **bold** font are additions to the list of known Hunter Region birds of that era (Stuart 2009). **Stubble Quail** *Coturnix pectoralis*; **Brown Quail** *Coturnix ypsilophora*; **Australasian Grebe** *Tachybaptus novaehollandiae*; **Tawny Frogmouth** *Podargus strigoides*; White-faced Heron *Egretta novaehollandiae*; Nankeen Kestrel *Falco cenchroides*; Eurasian Coot *Fulica atra*; **Bush Stone-Curlew** *Burhinus grallarius*; Black-fronted Dotterel *Elseyornis melanops*; **Red-backed Kingfisher** *Todiramphus pyrrhopygius*; Speckled Warbler *Chthonicola sagittata;* White-throated Gerygone *Gerygone albogularis*; Striated Pardalote *Pardalotus striatus*; Olive-backed Oriole *Oriolus sagittatus*; Pied Butcherbird *Cracticus nigrogularis*; Australian Magpie *Cracticus tibicen*; Grey Fantail *Rhipidura albiscapa*; Australian Raven *Corvus coronoides*; White-winged Chough *Corcorax melanorhamphos*; Hooded Robin *Melanodryas cucullata*; Horsfield's Bushlark *Mirafra javanica*; Rufous Songlark *Cincloramphus mathewsi*; **Brown Songlark** *Cincloramphus cruralis*; **White-backed Swallow** *Cheramoeca leucosterna*; Mistletoebird *Dicaeum hirundinaceum*; **Zebra Finch** *Taeniopygia guttata*; **Double-barred Finch** *Taeniopygia bichenovii*; **European Goldfinch** *Carduelis carduelis*.

McPhee named the Striated Fieldwren *Calamanthus fuliginosus* as breeding at Belltrees (in records for August 1921 and December 1927). This is considerably beyond the modern range for that species and we have interpreted the records to be for Speckled Warbler, which in that era was commonly called the Little Fieldwren. There were two breeding records for the Red-backed Kingfisher (at Belltrees in December 1919 and Moonan Flat in January 1920) – this species is now considered to be an accidental visitor to the Region. There was also a Crimson Chat *Epthianura tricolor* nest at Belltrees in September 1919, which complements a breeding record from Merriwa in 1924 and birds present there in 1919 (Stuart 2009).

McPhee's notes about the Upper Hunter egg collection extend the known Hunter Region list for the early 20th Century to 215 species. There are now confirmed breeding records for 109 of them.

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Some observations on the behaviour of the Australian Painted Snipe

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The Australian Painted Snipe, *Rostratula australis*, formerly *Rostratula benghalensis*, was described as a separate species in 2000 (Lane & Rogers 2000, p.26). Other than this reference, the information cited in this short note was written before the Australian Painted Snipe was considered a separate species. The Australian Painted Snipe is listed as "endangered" under the NSW Threatened Species Conservation Act 1995 and "vulnerable" under the federal Environment Protection and Biodiversity Conservation Act 1999.

Records of the Australian Painted Snipe come from shallow, fresh or brackish wetlands over most of Australia, but it is the least known of the resident shorebirds and may be overlooked because of its cryptic plumage and occurrence in habitat in which it is difficult to observe the bird. Although considered secretive, most records are of motionless, unobtrusive birds in open areas (Lane & Rogers 2000, p.29). When disturbed it relies on freezing for concealment (Lowe 1963, p.232).

The Australian Painted Snipe has been known to breed in the Hunter Region. In 1972 seventeen individuals and two nests with three and four eggs were found at Minmi (Rogers 1973). Since 1993 most records in the Lower Hunter Estuary have come from Irrawang Swamp near Raymond Terrace, Ash Island and the accessible western (Minmi) and eastern (Hexham) sides of Hexham Swamp (Stuart 1994-2008).

Increased surveying of the eastern side of Hexham Swamp 32°51'S 151º41'E has led to two sightings of this species. On the 6 January 2009 a group of Hunter Bird Observers Club members were searching for Pectoral Sandpipers *Calidris melanotos* which had been seen a few days earlier. One of the group, Grant Brosie, suddenly exclaimed that he could see a snipe. Closer observation revealed two birds, a male and a female Australian Painted Snipe standing side by side on bare ground shaded by a clump of reeds on the edge of an open expanse of dried out wetland. The birds were clearly visible and remained motionless for the next 30 minutes as the group continued to search for other species. They were still in the same position when we left the area.

On the 19 February, early in the morning, I drove onto the maintenance track of the Hunter Water Corporation's water pipeline and immediately saw a male Australian Painted Snipe standing in the open on the track in a pool of water left after 140mm of rain on the 13,14,15 February. It stood there for several minutes occasionally dipping its bill into the water. It quietly moved off the track into a muddy drain on the eastern side of the track. The drain was narrow – about a metre wide, half a metre deep and approximately four metres long. The drain was bordered by thick grasses on three sides but terminating at a lay-by which was free of vegetation at its southern end. Water pooled in the mud at the bottom of the drain. I drove very slowly alongside the bird which was standing completely still apart from one moment when it briefly opened and closed its wings and lowered the head and upper part of its body in what was probably a truncated threat display. Australian Painted Snipe have two threat displays, a frontal and a lateral display which can be provoked by the presence of humans. I apparently observed an incomplete frontal display which is described as "the head forward and low with both wings fully extended and fanned, and tail raised and spread" (Marchant & Higgins 1993, p.662). I observed the bird for ten minutes taking several photographs during which time, apart from the brief display, it stood completely still. At this point I was only three metres away. I drove another 20 metres forwards and continued to observe the bird which had by this time moved into a larger more open pool of muddy water with thick vegetation on one side and the open lay-by on the other.

The snipe commenced feeding, moving unhurriedly in all directions about 66 cm at a time. It

dipped its bill vertically into the water to a depth of approximately a quarter of its bill length rapidly opening and almost, but not completely, shutting it so that the bill looked open all of the time. This action took place whilst the bill was in the water. When the bird moved to another position, it repeated the action. I did not see the bird take any obvious food item and I did not see it swallow or perhaps I did not recognize that it swallowed. Eventually the bird moved into the dense wet vegetation and I lost sight of it.

Very little is known concerning the food and foraging behaviour of the Australian Painted Snipe. Johnsgard (1981) describes *Rostratula* feeding by probing in mud and ooze for worms, insects, molluscs and crustaceans, and it also eats some vegetable matter such as grains and weed seeds. Foraging is typically done by probing and by a lateral scything movement of the bill in shallow water, like that of an avocet. Subsequent overview publications (Marchant & Higgins 1993, Cramp 1983) do not provide additional information. My observations did not involve the movement of the bill with a scything action and appear distinct from the prior literature. However, it is possible that a mechanism involving the transport of water droplets up the bill by capillary action is involved as has been described for the Red-necked Phalarope *Phalaropus lobatus* (Rubega & Obst 1993).

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Australian Painted Snipe feeding with open bill as discussed (A. Lindsey)

An opportunistic observation of cooperative mobbing behaviour

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INTRODUCTION

This note places on record an opportunistic observation of cooperative mobbing behaviour involving an intruder, Koala *Phascolarctos cinereus*, and the aggressors, White-winged Chough *Corcorax melanorhamphos* and Blue-faced Honeyeater *Entomyzon cyanotis*. A reason for the observed behaviour is proposed.

The single incident took place in April 2009 in a patch of remnant Spotted Gum *Corymbia maculata*, Ironbark *Eucalyptus* sp. woodland at Duns Creek, New South Wales (32° 38' 14" S, 157° 37' 34" E). The habitat consists of degraded woodland dominated by mixed age Spotted Gum with some Ironbark and a noticeable absence of understorey species. The ground cover is comprised of both grazed and ungrazed native and introduced grasses interspersed with patches of leaf litter. It is the leaf litter that provides foraging habitat for the White-winged Choughs.

The observation site is about three kilometres from a known area of Koala habitat in the adjacent locality of Butterwick where Koalas have been reported regularly, although they have been seen at the observation site on only three occasions since 1987. On each occasion the mammals used a Spotted Gum as a day-time resting place and were present for less than 24 hours. A bellowing Koala was heard at night on one occasion. The presence of Koalas at the observation site could be regarded as a rare event having been known to occur only four times in the previous 22 years.

White-winged Choughs are a gregarious species characterised by long curved bills, strong legs, a full mobile tail and white patches on the flight feathers, which are conspicuous only in flight. These birds display intraspecific cooperative behaviour during incubation and when feeding young birds. They are regular visitors to the observation site as a flock of eight to ten birds. Four individuals exhibit the conspicuous red eye indicative of older birds while the remainder have brown eyes. White-winged Choughs usually breed in the Hunter Region in the latter half of the year (Stuart 2007) and during breeding will defend a territory. Neither intraspecific nor interspecific aggressive behaviour has been observed within this flock previously.

Blue-faced Honeyeaters are regular visitors to the site as a flock of up to eight birds. The local Blue-faced Honeyeaters are typical in that they have been observed to display pugnacious/aggressive behaviour toward other species, including the ever-present Noisy Miner *Manorina melanocephala* population.

Mobbing is generally an obvious behaviour engaged in by birds to defend members of the same species, their offspring or nests from predation. Additionally mobbing may play a role in protecting the food resource and may have social implications of status and partition of labour (Arnold 2005). Mobbing behaviour comprises alarm calls, visual display and flying at an intruder to distract its attention with the harassment often continuing until the intruder is evicted. Mobbing behaviour has been recorded in a wide range of species, it usually commences with several birds but the activity often attracts large numbers of birds, which may include more than one species. The term cooperative mobbing refers, in this context, to the aggressive behaviour of the two different avian species simultaneously directed at the intruding Koala.

OBSERVATIONS

Mid-morning a solitary Koala was observed walking across a grassed area before climbing 10 to 15 metres into a Spotted Gum. It remained in this tree for two hours before relocating to an adjacent Ironbark where it settled five metres

above ground level amongst the tree's relatively dense branches. The regularly visiting flock of White-winged Choughs flew 30 metres from their foraging site to initiate a mobbing attack on the Koala about one hour after the Koala had moved to the Ironbark. A short time after the attack had been initiated six Blue-faced Honeyeaters joined the White-winged Choughs in harassing the koala. The honeyeaters had not been observed in the vicinity prior to the initiation of the attack. The estimated duration of the mobbing was five minutes.

The mobbing behaviour of the White-winged Choughs consisted of continuous grating alarm calls, hopping strongly along and between branches, short flights within the tree and several metres from the tree. Activity was most intense in close proximity to the Koala (~1m) but contact with the Koala was not observed. The white wing patches were conspicuous as the birds spread their wings, contrasting strongly with the otherwise black bird. When in contact with the branches the mobile tails moved rapidly and repeatedly through an estimated angle of 45 degrees to the horizontal in both an upwards and downwards direction thus producing an angle of deflection approximating 90 degrees. (This tail motion may be associated with the retention of balance on the branches of relatively small diameter rather than as a component of the display). The general impression was of noise, rapid movement and contrasting colour.

The Blue-faced Honeyeaters repeatedly flew between the branches, where possible, emitting loud alarm calls. Flights were often initiated from nearby trees and the attack was more direct than that of the White-winged Choughs. Contact with the Koala was not observed.

With the exception of one defensive swiping arm motion the Koala remained motionless during the mobbing. Both species of bird gradually reduced the intensity of the harassment before dispersing. The White-winged Choughs resumed foraging within 50 metres of the Koala while the Blue-faced Honeyeaters left the area. The Koala was undisturbed for the remainder of the day.

DISCUSSION

The behaviour on this occasion involved two different species mobbing an intruder at the same time and as such has been considered cooperative. Although the Blue-faced Honeyeaters appeared to respond to the calls of the White-winged Choughs, it might be interpreted that the honeyeaters were simply "joining in" as a reflection of their generally pugnacious responses rather than participating in a fully "cooperative" act with the choughs. An additional consideration would be as to their level of involvement in the mobbing in the absence of the auditory and visual display provided by the choughs. More important, perhaps, is the reason for the attacking behaviour in this instance.

The primary value of mobbing behaviour lies in the prevention of predation and protection of the food resource. In this case it appears that the Koala would offer no threat in terms of nest predation (the birds were not breeding at the time) or depletion of the food resource (absence of common food requirements), facts which bring into question the reason for mobbing behaviour in this instance. In a study of group mobbing behaviour of the Noisy Miner it was found that the number of birds that mobbed an experimental model was not a simple reflection of the potential nature of the threat (Arnold 2005). Arnold proposed that the response to nest predators, such as raptors, may be a reflection of rarity, in addition to threat. This insight, together with the previously established rarity of Koala visits to the site, prompts the proposal that rarity may have been a major contributing factor in this example of cooperative mobbing behaviour.

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Shorebird prey item for Eastern Osprey

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The Eastern Osprey *Pandion cristatus* is commonly regarded as a fish-eating raptor (**Plate 1**). However, it is noted in HANZAB (Marchant & Higgins 1993) that some 2-3% of the typical diet may be non seafood. Several species of seabird have been named as prey items for Eastern Osprey, also quails and pigeons. HANZAB does not document any instances of shorebirds being the prey.

On 5 September 2009, I was carrying out one of my regular surveys for shorebirds at Mudbishops Point near Old Bar (31º 56.95'S 152º 36.41'E). Pandemonium broke out some 30-40m in front of me, when an Eastern Osprey lunged into a group of small shorebirds roosting in front of the dunes. Ten Red-necked Stints *Calidris ruficollis* flew away, making alarm calls, and the Osprey lifted off clutching a small bird in its left foot. I am not absolutely certain it was a Red-necked Stint that it was holding as there also were some Red-capped Plovers *Charadrius ruficapillus* in the same area. However, although they seemed agitated, these birds did not fly away. I strongly suspect that the Osprey struck into the flock of stints.

The Osprey flew slowly away at low altitude, continuing to clutch the bird in its left foot. It landed in a swale several hundred metres from me, out of sight. About five minutes later, it reappeared, no longer carrying the prey, and landed on a fence post about 100m from me where it perched during the remaining 5-10 minutes of my survey.

I regularly encounter Eastern Ospreys at Mudbishops Point and often see them taking fish from the estuary there. I had previously noted that they sometimes fly over the adjacent sand dunes and beach – it now seems that they may be hunting when they do that. Many shorebirds roost at Mudbishops Point and there is also an important breeding colony for Little Tern *Sternula albifrons*. There would seem to be ample opportunities for the Eastern Osprey to supplement its predominant diet of fish when it so chooses.

REFERENCE

Marchant, S. and Higgins, P.J. (1993). 'Handbook of Australian, New Zealand and Antarctic Birds'. (Oxford University Press: Melbourne, Australia.)

Plate 1. Eastern Osprey
(Photo: Dan Herbert)

Curlew Sandpiper predated by a Black Falcon

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Over 800 Sharp-tailed Sandpiper *Calidris acuminata*, 13 Curlew Sandpiper *Calidris ferruginea* and two Red-necked Stint *Calidris ruficollis*, feeding on a drying ephemeral wetland with muddy edges adjacent to the Morpeth Wastewater Treatment Works (MWTW), 32º44' S 151º37' E were disturbed by a Black Falcon *Falco subniger*. The majority of the Sharp-tailed Sandpipers took flight and settled as a dense flock in the centre of the remaining water. The Black Falcon turned and made a low-level pass at a small number of waders which continued feeding near a line of fence posts at the edge of the water and took one of these birds about one to two metres from the ground as it flushed. The Black Falcon then flew to an adjacent dried-out pond where it landed briefly before it took off, circled and departed in an easterly direction still holding its prey.

A series of photographs were taken during this sequence of events. Examination of these digital images confirmed, as anticipated, that the species taken was a Curlew Sandpiper based on the length, shape and black colour of the bill, the black legs and white underparts.

A previous paper (Newman & Lindsey 2007) reviewed the status of the Black Falcon in the Lower Hunter Valley and indicated that this species was often seen in areas like the MWTW, Ash Island and the Hexham Swamp where there is potential to prey on flocks of migratory waders. While we have previously seen a Black Falcon make a pass at flocks of waders this is the first time a kill has eventuated.

Many aspects of these observations represent the classical strategy of an attacking raptor and the defensive tactics of a flocking prey species. While the initial pass of the Black Falcon at about 25 m above the ground disturbed many of the waders it allowed the falcon to identify the most vulnerable birds, which continued to feed adjacent to fence posts near a dyke separating the ephemeral wetland from a dry pond. The falcon turned over the dry pond before making a low-level pass over the dyke wall and ambushed the small waders feeding by the fence posts, which would have had an obscured view of the falcon's approach. The majority of the waders immediately formed a dense flock at a point which afforded excellent 360 degree visibility when they became aware of the falcon's presence. It is difficult for a falcon to single out an individual bird for attack when this strategy is adopted.

It was predictable that the bird taken would be one of the less numerous species feeding with the Sharp-tailed Sandpipers even though they represented < two percent of the waders feeding on the wetland. The minority species are essentially outsiders which tend to feed separately from or at the extremity of the bulk of the flock and are less synchronised with the defence responses of the majority species when attacked.

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Grey Goshawks – seasonal abundance

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The Grey Goshawk *Accipiter novaehollandiae*, although not a common species in the Hunter Region, appears to be seen more often at particular times of the year (**Plate 1**). In order to verify this impression the Hunter Region Annual Bird Reports (Stuart 1994-1998) were examined for records of Grey Goshawk. Annual reports for 1993-1995 contain all reported sightings submitted to the Hunter Bird Observers Club (HBOC). Stuart (pers. comm.) supplied all records of sightings that were not included in reports for the years 1996 and 1997. Sightings were then collated for each month over the period 1993 to 1997 and a chart constructed (**Figure 1**). Later annual reports from 1998 onwards contained only sightings of two or more birds, therefore, the data was not included in the chart. However, a similar trend to that discussed below was evident in the data.

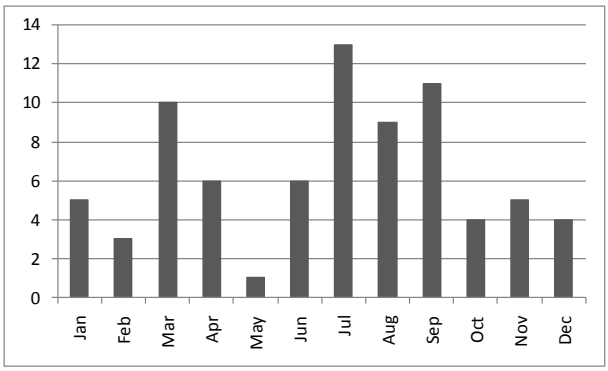

Figure 1. Total number of Grey Goshawk observations in the Hunter Region for each month for the period 1993-1997. As this chart represents a frequency of sightings each observation of one or more birds is counted as one observation.

Figure 1 shows that Grey Goshawks were recorded in the Hunter Region more often during late winter and early spring, peaking in July (43% of the records were from July to September). There is an additional a peak in March. The Chi square test confirms that the data is clumped as opposed to randomly distributed and the conclusion that the reporting rate in the July to September period is anomalously high is therefore supported at the >95% confidence level. In addition, a Hunter Region garden bird survey, covering the period September 1992 to June 1993, tends to confirm the pattern of observations discussed above (McLauchlan 1994). Although the winter months of July and August were not included, it is evident that the number of garden observations of Grey Goshawks increased sharply into autumn and early winter.

How can this be the situation for a bird that is regarded as a year-round sedentary resident? Marchant and Higgins (1993) state that Grey Goshawks are apparently resident throughout their range, but that non-established individuals and immature birds are dispersive. The March peak in observations may show, not only that there are more birds post-breeding, but that in "…autumn and winter, [there] is dispersal outside the breeding range…" (Marchant & Higgins 1993, p.125) thereby increasing their visibility.

"Dispersal also may occur within the breeding range during [the] non-breeding season, leading to local winter-spring influxes…" towards coastal areas of Queensland and New South Wales (Marchant & Higgins 1993, p. 125, Longmore 1978, Debus 1982). This may explain the July to September peak in observations. In addition, dispersing birds often move into more open habitats than those occupied by established sedentary pairs such as more densely wooded and forested coastal and near-coastal areas. Thus dispersive birds would be more visible to casual observers leading to increased observation rates. At this time of the year, before egg-laying commences, aerial courting displays (Marchant & Higgins 1993, p. 127) may also enhance the visibility of potential breeding pairs.

Conversely, lower reporting rates are evident for the late spring-summer period and, especially so, for May (**Figure 1**). Baker-Gabb and Steele (1999) also noted the apparent absence of Grey Goshawks in coastal areas during the summer breeding season (egg-laying, September to December). They suggested that it simply reflects an absence of the

more visible dispersing birds and the difficulty in observing the more secretive breeding birds. In addition, many of the dispersing birds, by then, may also have settled into their less visible breeding mode.

The May minimum is a little harder to explain. However, the March, post-breeding dispersal of goshawks away from the coastal breeding areas, where most observations are recorded, could afterwards lead to a paucity of recorded observations in that area during May as shown in **Figure 1**.

While it is obvious why some bird species are more often seen at particular times of the year (e.g. migratory species), it is more challenging to determine whether other species are more or less visible or are, in fact, present or absent. Collating our own HBOC records in the Hunter Region Annual Bird Report allows us to answer some of these questions.

ACKNOWLEDGEMENTS

Thanks to Alan Stuart for producing the HBOC Annual Bird Reports and for providing extra unpublished observation data. Mike Newman kindly carried out the statistical calculations to determine the confidence level of conclusions drawn from the data set.

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Plate 1. Grey Goshawk carrying prey, probably a lizard, Lockhart River.
(Photo: Dan Herbert)

The *Whistler* – Instructions to Authors

The *Whistler* is an occasional publication of the Hunter Bird Observers Club Inc. (HBOC), which is based in Newcastle. HBOC members are active in observing birds and monitoring bird populations in the Hunter Region. This journal-style publication is a venue for publishing these regionally significant observations and findings. The journal publishes three types of articles:

1. **Contributed Papers**
2. **Short Notes**
3. **Book Reviews**

The Whistler Sub-committee requests that authors consider the appropriateness of their study to this publication. The publication is suitable for studies geographically limited or related to the Hunter Region and papers attempting to address data and issues of a broader nature should be directed to other journals, such as Corella, Australian Field Ornithology and Emu. Contributed papers should include analyses of the results of detailed ecological or behavioural studies or syntheses of the results of bird monitoring studies and/or comprehensive annotated species lists of important bird areas and habitats. These data would then be available for reference or further analysis in the many important issues of bird conservation in the Hunter Region. Communication of short notes on significant bird behaviour is also encouraged as a contribution to extending knowledge of bird habits and habitat requirements generally. Reviews of bird books that members have enjoyed or disliked are also being solicited to provide a guide for other readers on their usefulness regionally and more broadly.

General

- Manuscripts must be submitted electronically; please attach your manuscript to an email as a Microsoft Word document. Charts should be submitted as an Excel file.
- Introduce species using English and scientific names.

Contributed Papers

- Manuscripts should be formatted as per the instructions below.
- Up to 12 pages in length (longer in exceptional circumstances) and of factual style.
- Provide a summary of approximately 250 words.
- Introduction/Background introduces the aims of and rationale for the study and cites other similar work that stimulated initiation of or is relevant for comparison with the study.
- Methods describes the location of the study, citing map co-ordinates or including a map, how observations were made and data were collected and analysed.
- Results of the data analyses include description and/or analysis of data highlighting trends in the results, divided into subsections if more than one body of data is presented; use of photos, drawings, graphs and tables to illustrate these is encouraged.
- Discussion and Conclusions should indicate the significance of the results locally and regionally; comparison with national and international work is optional, as is the discussion of possible alternative conclusions and caveats with the study; suggestions for future extension of the work are encouraged.
- Appendices of raw data and annotated lists of bird species and habitats can be included in tabular form at the end of the article.
- References should be cited within the text of the article with the last names of the authors and the year of publication in parenthesis unless there are more than two authors, in which case the first author's last name can be used followed by '*et al.*' for the others. References should be listed at the end of the text after any Acknowledgements and before Appendices and Annotated Lists and should be formatted as per the instructions below.

Short Notes

- Up to 4 pages of descriptive or prosaic style.
- Provide an adequate description of the location of observations, a rationale for documenting the observations, an entertaining and cogent description of observations; relevance to similar observations should be cited with references if appropriate.
- References should be cited and listed as for contributed papers.

Book Reviews

- Approximately 2 pages of critical assessment and/or appreciation.
- Introduce topics and aims of the book as you understand them, analyse thoroughness and rigour of content (chapter by chapter or topic by topic), and conclude with comments on the effectiveness and originality of the book in meeting its aims, particularly for birdwatchers in Hunter Region area if appropriate.
- References should be cited and listed as for contributed papers.

Formatting Instructions

Although not necessary, where possible, authors are asked to format their manuscripts as follows:

1. A4 size page, portrait layout except for large tables or figures;
2. Margins of 2 cm top, bottom, left and right;
3. Title in bold Arial font, 16 pt size, centred;
4. Authors names in Arial font, 12 pt size, centred;
5. Affiliations or addresses of authors in Arial font, 12 pt size, centred;
6. Section headings capitalized in bold Arial font, 12 pt size, left justified;
7. Sub-section headings not capitalized in bold Arial font, 12 pt size, left justified;
8. First line of each paragraph should not be indented and one line should be left between paragraphs;
9. Typescript should be Times New Roman, 11 pt, except methods and acknowl-edgements which are 10 pt;
10. Figures and Tables to be included at the end of the document in Times New Roman font, 10 pt minimum size, title left justified, below figures and above tables with "**Figure x.**" or "**Table y.**" heading the title;
11. Nomenclature and classification of bird species should follow Christidis, L. and Boles, W.E. (2008). 'Systematics and Taxonomy of Australian Birds'. (CSIRO Publishing, Collingwood, Victoria) or latest edition of this work; the scientific names of all bird species should be shown in italics after the first mention of their correct English name in the text. Scientific names should also be included after the first mention of the bird in the summary.
12. References to be cited in the text in parenthesis as close as possible to the information taken from the paper: for one author (Smith 2000), two authors (Smith & Jones 2001b) and more than two authors (Smith *et al.* 2002) with the authors listed in the order they are listed on the original paper;
13. References should be listed in alphabetical order and secondarily by year of publication; if published in the same year then in alphabetical order with an a, b, or c after the year to indicate which paper is being cited in the text (see below); each reference should form a separate paragraph.

Reference Format

Journal articles:
Jones, D.N. and Wieneke, J. (2000a). The suburban bird community of Townsville revisited: changes over 16 years. *Corella* **24**: 53-60.

Edited book Chapters:

Lodge, D.M. (1993). Species invasions and deletions: community effects and responses to climate and habitat change. In 'Biotic interactions and Global change' (Eds. P.M. Karieva, J.G. Kingsolver and R.B. Huey) Pp. 367-387. (Sinauer Associates, Sutherland, MA.)

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Green, R. (1980). 'Ecology of native and exotic birds in the suburban habitat'. Ph.D. Thesis, Monash University, Victoria.

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Twyford, K.L., Humphrey, P.G., Nunn, R.P. and Willoughby, L. (2000). Investigations into the effects of introduced plants and animals on the nature conservation values of Gabo Island. (Dept. of Conservation & Natural Resources, Orbost Region, Orbost.)

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