Bird population of a cattle property near Paterson, NSW – an eleven year study.

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During an eleven year study between 1996 and 2007 involving surveys at three monthly intervals, 126 species of birds were recorded on a cattle property near Paterson in the Lower Hunter Region of New South Wales. The results demonstrate how a cattle property with about 15% remnant vegetation provides an important contribution to sustaining the diversity of bird populations.

A constant effort survey approach was used which involved estimating numbers of species, using the methods developed for the Birds Australia "Birds on Farms" project. Preliminary analysis of the results suggests that a number of species had declined when results for the first and second halves of the study were compared. Decline was most obvious for waterbirds and is attributed to abnormally low rainfall during the latter years of the study. The estimation of numbers of birds supported and strengthened conclusions drawn from variations in the frequency species were recorded based on presence and absence.

Explanations of the reasons for changes in population indicated by this study inevitably vary between species and involve environmental factors at the local, regional and national scale. Consequently this investigation has value both as an independent investigation and as part of a collaborative Birds Australia nationwide project.

INTRODUCTION

This study commenced as part of the "Birds on Farms" project run by Birds Australia. It was continued during the "New Atlas of Australian Birds" and the "Ongoing Atlas" projects which used compatible survey techniques. Bird surveys were conducted on a property at Butterwick (32º 39´ S 151º 38´ E) near Paterson in the NSW Hunter Valley between July 1996 and January 2007. The property which is run for cattle is on the edge of the Butterwick flood plain. Approximately 15 percent of the area surveyed is vegetated, primarily along the edges of Green Wattle Creek which flows through the property.

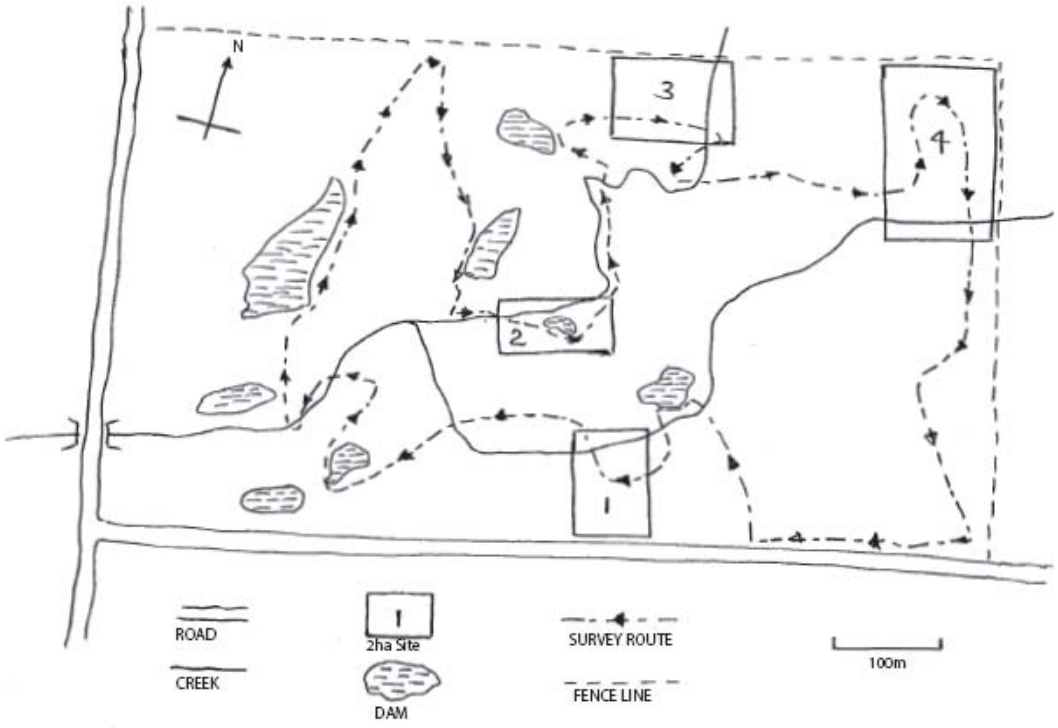
The intention of this paper is to demonstrate the importance of farms with remnant vegetation to the conservation of bird populations. The study also provides baseline data against which future population trends can be gauged. Discussion of changes during the present study is limited to examples where trends are obvious. A more detailed evaluation will be the subject of a subsequent paper as will variations in the sub-populations of different habitats sampled at the 2ha sites.

METHODS

Surveys were conducted unaccompanied at approximately three monthly intervals as close as practical to the 15th day of January, April, July, and October. All surveys were conducted within 21 days of the target date. Surveys took between three and four hours to complete, following the same route and adopting a constant survey effort approach to facilitate the comparison of results. Four sites each approximately 2ha in size and with different vegetation structure were surveyed for twenty minutes (**Figure 1**).

Birds were identified visually and by call and the number of birds present was recorded. Surveys commenced between one and two hours after sunrise targeting the period of maximum bird activity. Separate records were kept for each of the four 2ha sites as well as for the total survey.

Fig.1. Survey Route and 2ha Sites



The study involved 44 surveys at approximately 3 monthly intervals. The eleven autumn surveys were conducted over a ten year span with two surveys in 2003 following abnormally low numbers during the first count. Both data sets have been included in the following analysis. Comparison of these two counts demonstrates the extent to which variation can occur between counts, which at least in part reflects the dynamic nature of the bird populations. For example the first count involved 125 birds and 36 species compared with 202 birds and 34 species in the latter survey.

In the following sections species have been classified according to the frequency and season in which they were recorded. The tabulated data includes a "change factor" which is the ratio of the number of surveys a species was recorded in the first half (i.e. the first 22 surveys) compared to second half (i.e. the second 22 surveys) of the study. Change factor values greater than 1 suggest the possibility that a species may have decreased during the study. For instance a change factor of 1.2 indicates that a species was recorded 20% more frequently in the first half of the study. Conversely a change factor of 0.8 indicates that a species has decreased being present 20% less frequently in the second half of the study.

Habitat Overview

A vegetation survey, with emphasis on the 2ha sites was made with the assistance of members of the Australian Plant Society, Maitland Branch.

Green Wattle Creek is a key feature of the property as much of the remnant vegetation is along or adjacent to its edges. However there are also a number of copses of trees, typically between one and two ha in size, providing shelter belts for the cattle. There is little under-storey vegetation other than along the creek edges. In addition to the creek system there are several dams, at least three of which always contain water. The creek flows intermittently but there are always some holes with water, often in the most densely vegetated areas. Along the creek edges the vegetation has a rainforest flavour. Several mature *Callistemon salignus* are an important

food resource when in flower. Extensive marshy areas and even ephemeral areas of flooded pasture form after periods of heavy rain. However during drought conditions these areas dry out completely.

Site 1 is a stand of trees dominated by *Angophora floribunda* and several species of eucalypt. Most of the trees are at least 20m in height but only three are mature enough to have nest holes. This site includes the creek on one side and borders an extensive area of woodland on the other side, from which it is separated by the unsealed and lightly used road. *Melaleuca nodosa* and *Melaleuca linariifolia* occur along the creek and together with some small shrubs along the road side provide cover for small bird species. There are a number of fallen limbs on the ground below the mature trees.

Site 2 is bounded by a heavily vegetated length of creek. The surrounding area is subject to intermittent flooding resulting in the formation of an ephemeral water pool surrounded by mature *Melaleuca stypheloides*. There is also an area of tussocks, and a patch of blackberry. Most of the vegetation is between 3 and 6m high and there are few large mature trees.

Site 3 is another copse of trees, typically taller than 15m and dominated by *Angophora floribunda* and *Eucalyptus paniculata*. An arm of Green Wattle Creek forms one edge for approximately 50m. There is very little under-storey vegetation other than that associated with the creek where there are small patches of blackberry. Unlike the other sites this copse of trees is isolated from extensive areas of woodland.

At site 4 a copse of trees, again typically taller than 15m, is dominated by two species of eucalypt, one an unidentified ironbark and *Corymbia maculata*. At one end a belt of a *Melaleuca* species borders an open paddock. Green Wattle Creek provides the opposite boundary. On another side within the property there is an extensive area of scrub in which several large eucalypts emerge above the canopy of a dense stand of approximately 4m high *Melaleucas*. The remaining boundary of site 4 is an extensive area of woodland outside the property which has not been grazed during the last eight years and, unlike site 4, has extensive under-storey vegetation.

The other major vegetation on the survey route is an extensive stand of *Casuarina glauca*, about 15m high, growing along a 100m section of the creek and an isolated stand of *Melaleuca nodosa.* During the study, other than the impact of grazing, there was no modification of vegetation on the property other than the establishment of one additional dam. On adjacent properties there was some clearing of trees but it did not substantially change the vegetation corridors linking the study area to areas of nearby woodland.

Factors Impacting on the Survey Data

The primary purpose of the surveys was to determine the presence and absence of species both at the four 2ha sites and for the total survey. However, 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. While this minimises the probability of the same birds being sampled at two sites it does not completely eliminate the possibility of this occurring, particularly outside the breeding season when woodland birds often form mobile mixed foraging flocks and where large birds are present.

In addition to conducting surveys early, where possible days were selected with favourable weather conditions, namely without wind and rain. These considerations were particularly important as many species were identified by call. During the early stages of these studies the observer's call identification skills and intuitive knowledge of where to expect individual species increased making surveys in the later years of the study more comprehensiveIn the case of larger species like the waterbirds frequenting open areas the numbers provide an accurate measure of abundance and there is no bias associated with observer experience. For the smaller woodland birds particularly species of thornbill and pardalote size foraging in the crowns of tall trees the numbers are only an indication and indicate minimum numbers present, particularly where records are based on call.

RESULTS

Summary Statistics

The results are summarised in **Table 1** which provides a comparison of species and individual bird numbers between seasons. A total of 126 species were recorded during the surveys, with a further 5 species recorded at other times. The

greatest number of species was recorded in summer 94 and spring 90 with 62 species recorded in a single summer survey. However the average species diversity and abundance was highest in spring with 54.0 species and 290.5 birds/survey. Diversity was appreciably lower in autumn and winter with averages of 37.0 and 41.9/survey respectively, reflecting the absence of summer visitors. Abundance was lowest in autumn with an average 196.8 birds/survey. The corresponding winter numbers were surprisingly high at 270.8.

Table 1. Summary of Survey Statistics

	All Visits	Summer	Autumn	Winter	Spring
Species Recorded	126	94	80	82	90
Average/survey	45.3	48.4	37.0	41.9	54.0
Maximum	62	55	42	49	62
Minimum	34	39	34	34	41
Number of Birds	10665	2325	2165	2979	3196
Average/survey	249.1	238.1	196.8	270.8	290.5
Maximum	410	294	295	345	410
Minimum	125	186	125	239	234
Birds counted 2ha surveys	6846 (64%)	1580 (68%)	1461 (67%)	1817 (61%)	1988 (62%)

The time taken to conduct the four 20minute 2ha counts was approximately 40% of the total duration of the surveys. The importance of these 2ha plots, which were selected because of their habitat potential, is emphasised by the occurrence of 64% of the birds counted in these areas. A detailed analysis of these sub-counts is outside the scope of this paper.

Species Regularly Recorded Throughout the Year

The 19 species falling into this category as listed in **Table 2** are best described as very common on the property and many are resident. Indeed seven species were seen on every survey. Inclusion in this category is based on the species being recorded in 80% of the surveys. The change factor suggests that some of these species had decreased during the study and that none had increased. The indicated decline in all three species of waterbirds, Australian Wood Duck, Pacific Black Duck and Purple Swamphen is attributed to the drought conditions prevalent towards the end of the study.

The species listed in **Table 2** are a diverse mix reflecting three significant habitat types. The waterbirds frequent the dams and marshy areas, the parrots and Magpie-lark favour the open grazed areas and the passerines are found in the remnant vegetation along the creek. Superb Fairy-wrens and Yellow Thornbills were the most abundant species, while the less numerous and more elusive Brown Thornbill was a feature of the creek side vegetation.

Yellow-faced Honeyeaters were occasionally present in large numbers with a maximum count of 80. Fluctuations in numbers reflect both the presence of birds during migration and favourable feeding conditions along the creek provided by flowering vegetation. The Red-browed Finch also forms large flocks with a maximum count of 60.

Species Regularly Recorded in either Summer or Winter

The cut-off for inclusion in **Table 3** was that a species was recorded at least 4 times during either summer or winter and at least five times more frequently in summer than winter or vice-versa.

Of the 17 species listed in **Table 3** twelve occurred in summer and were absent in winter. The Sacred Kingfisher and Rufous Whistler were recorded on every summer count and represent the classical summer migrant which winters in northern latitudes. More surprising inclusions in this category were the Nankeen Night Heron and Royal Spoonbill which were flushed from remnant water pools along the creek in summer. Both these species and the Mistletoebird, which is also included in **Table 3** as a summer visitor, are recorded in NSW throughout the year (Barrett *et al.* 2003). Hence the occurrence of these species in summer is attributed to local movement in

Table 2. Species observed regularly in all seasons (present on at least 36 or 80% of surveys).

Common Name	Scientific Name	Average Number Present [1]	Maximum Number Present	Number of Surveys Present	Change Ratio [2]
Australian Wood Duck	*Chenonetta jubata*	8.5	26	38	1.2
Pacific Black Duck	*Anas superciliosa*	5.3	20	40	1.2
Purple Swamphen	*Porphyrio porphyrio*	5.6	16	42	1.1
Galah	*Cacatua roseicapilla*	4.6	24	36	1.0
Eastern Rosella	*Platycercus eximius*	15.8	44	44	1.0
Laughing Kookaburra	*Dacelo novaeguineae*	4.2	8	43	1.1
Superb Fairy-wren	*Malurus cyaneus*	27.6	60	44	1.0
White-browed Scrubwren	*Sericornis frontalis*	3.1	8	39	1.1
Brown Thornbill	*Acanthiza pusilla*	5.3	14.0	44	1.0
Yellow Thornbill	*Acanthiza nana*	19.8	40.0	44	1.0
Noisy Miner	*Manorina melanocephala*	12.5	34.0	43	1.1
Yellow-faced Honeyeater	*Lichenostomus chrysops*	16.7	88.0	41	1.0
Magpie-lark	*Grallina cyanoleuca*	3.4	12.0	44	1.0
Grey Fantail	*Rhipidura fuliginosa*	8.3	18.0	44	1.0
Willie Wagtail	*Rhipidura leucophrys*	2.5	6.0	37	0.9
Grey Butcherbird	*Cracticus torquatus*	3.2	7.0	43	1.0
Australian Magpie	*Gymnorhina tibicen*	8.4	22.0	44	1.0
Australian Raven	*Corvus coronoides*	3.5	16.0	43	1.1
Red-browed Finch	*Neochmia temporalis*	13.6	46.0	41	1.1

[1] Average number seen on surveys when present

[2] Ratio of number of surveys in which species recorded during first half of study (1996-2000) are compared to the second half (2001-2007).

response to favourable seasonal conditions in the study area.

The Rose Robin is an altitudinal migrant breeding in the ranges and moving to coastal locations in winter. It was recorded in seven of the eleven winter surveys and presumably the same male bird was present annually in one of the 2ha survey sites.

The exceptionally high change ratio of 7 for the Mistletoebird and 2.5 for the Rose Robin may suggest a possible local decline in these species. The Mistletoebird is highly nomadic and changes in its presence would be expected to relate to the flowering of mistletoe.

Two honeyeaters (Noisy Friarbird and Red Wattlebird) were predominantly recorded in winter as opposed to summer, the former species exclusively so. Again this is interpreted as a consequence of local movement as both species occur throughout the year in the Hunter region (Barrett *et al.* 2003).

The occasional presence of Cattle Egrets and an Olive-backed Oriole in winter is consistent with their known tendency to breed in the area and partially disperse outside the breeding season.

The Black-faced Monarch and Rufous Fantail, summer migrants to the Hunter region (Stuart 2006), were absent in summer, but recorded on passage particularly in spring.

The change ratio of 0.3 for Latham's Snipe is fascinating as it suggests an increase at a time when other wetland species like the Purple Swamphen, Australian Wood Duck and Masked Lapwing appeared to decline. An explanation is that the muddy margins of the dams provide a drought refuge for this species when optimal habitat like the adjacent Butterwick flood plain dries out.

Table 3. Frequently Observed Summer and Winter Visitors
(Species recorded on at least 4 surveys (summer or winter) and at least 5 times more frequently in summer than winter or vice-versa).

Common Name	Scientific Name	Average Number Present [1]	Maximum Number Present	Number of Surveys Present	Number of Summer Records	Number of Winter Records	Change Ratio [2]
Cattle Egret	*Ardea ibis*	5.2	18.0	19	10	2	1.1
Nankeen Night Heron	*Nycticorax caledonicus*	1.4	3.0	9	6	0	0.8
Royal Spoonbill	*Platalea regia*	1.3	2.0	10	4	0	1.0
Latham's Snipe	*Gallinago hardwickii*	1.5	3.0	10	7	0	0.3
Common Koel	*Eudynamis scolopacea*	1.0	1.0	8	6	0	1.0
Channel-billed Cuckoo	*Scythrops novaehollandiae*	1.3	3.0	16	8	0	1.3
Sacred Kingfisher	*Todiramphus sancta*	4.6	10.0	22	11	0	1.0
Dollarbird	*Eurystomus orientalis*	3.3	9.0	21	10	0	1.1
White-throated Gerygone	*Gerygone olivacea*	5.0	14.0	23	10	0	0.9
Red Wattlebird	*Anthochaera carunculata*	2.2	8.0	25	1	8	0.7
Noisy Friarbird	*Philemon corniculatus*	5.0	12.0	9	0	5	0.5
Rose Robin	*Petroica rosea*	2.1	6.0	7	0	7	2.5
Rufous Whistler	*Pachycephala rufiventris*	5.1	12.0	28	11	0	0.9
Leaden Flycatcher	*Myiagra rubecula*	1.7	3.0	11	5	0	0.8
Cicadabird	*Coracina tenuirostris*	1.4	2.0	5	5	0	0.7
Olive-backed Oriole	*Oriolus sagittatus*	1.6	3.0	16	7	1	0.6
Mistletoebird	*Dicaeum hirundinaceum*	1.3	2.0	8	6	0	7.0

[1]Average number seen on surveys when the species was recorded.
[2]Ratio of number of surveys in which species recorded during first half of study (1996-2000) compared with second half (2001-2007).

Species Often Recorded

The 39 species in this category (**Table 4**) were recorded during between 20% and 80% of the surveys. Again a broad range of species are involved, many of which are normally vocal and conspicuous (e.g. White-winged Chough) suggesting that they are only intermittently present in the study area.

The change factor indicates that five of the six species of water bird had declined, particularly the Masked Lapwing. In contrast the Straw-necked Ibis was recorded more frequently in the second half of the study. Its increased occurrence probably reflects the extremely difficult inland conditions associated with the drought.

Red-rumped Parrots were not recorded in the first half of the study but were present in small numbers on 41% of the surveys in the second half, usually in the vicinity of a dam established during the study near a house. The house and associated cattle holding pens were also the focal point for the two invasive species, the Common Starling and the Common Myna which occurred in small numbers. They were absent from the rest of the property.

Evidence for decline in the passerine species listed in **Table 4** is strongest for the Speckled Warbler, Grey-crowned Babbler, Pied Butcherbird and Welcome Swallow. Both the Speckled Warbler and the Grey-crowned Babbler are listed as vulnerable species in NSW (Stuart 2006). The Speckled Warbler was primarily sighted near the 2ha survey site 4 adjacent to extensive woodland where this species has also declined following an increase in sub-storey vegetation following the cessation of light grazing, which is known to be beneficial to Speckled Warblers (Barrett *et al*. 2002). The features of site 4 which favour this species are the presence of fallen debris and a lack of extensive under-storey vegetation. The Butterwick area is an acknowledged stronghold of the Grey-crowned Babbler which was often present in substantial numbers with 24 recorded on one occasion. The decline in the Pied Butcherbird is in contrast to the Grey Butcherbird which was present on 98% of the surveys.

Species which showed the most marked increase in presence during the second half of the study included Bar-shouldered Dove, Striated Pardalote, Lewin's Honeyeater, Eastern Spinebill and Varied Sittella.

Table 4. Species often observed and present in all seasons
(recorded on between 9 (20%) and 35 (80%) of the 44 surveys).

Common Name	Scientific Name	Average Number Present [1]	Maximum Number Present	Number of Surveys Present	Change Ratio [2]
Grey Teal	*Anas gracilis*	2.2	4	12	1.4
Chestnut Teal	*Anas castanea*	2.6	8	13	1.2
Little Pied Cormorant	*Phalocrocorax melanoleucos*	1.2	2	17	1.8
White-faced Heron	*Egretta novaehollandiae*	2.1	5	26	1.6
Straw-necked Ibis	*Threskiornis spinicollis*	5.4	24	11	0.8
Masked Lapwing	*Vanellus miles*	2.8	7	31	2.1
Crested Pigeon	*Ocyphaps lophotes*	3.9	24	32	1.1
Bar-shouldered Dove	*Geopelia humeralis*	1.7	3	18	0.4
Long-billed Corella	*Cacatua tenuirostris*	5.8	40	13	1.6
Sulphur-crested Cockatoo	*Cacatua galerita*	1.8	8	13	2.3
Little Lorikeet	*Glossopsitta pusilla*	6.6	20	9	0.8
Australian King-Parrot	*Alisterus scapularis*	2.7	11	14	1.0
Red-rumped Parrot	*Psephotus haematonotus*	2.9	6	9	0.0
Fan-tailed Cuckoo	*Cacomantis flabelliformis*	1.1	2	9	0.8
Shining Bronze-Cuckoo	*Chrysococcyx lucidus*	1.6	5	11	1.2
White-throated Treecreeper	*Cormobates leucophaea*	1.5	4	29	0.8
Spotted Pardalote	*Pardalotus punctatus*	5.2	17	34	0.9
Striated Pardalote	*Pardalotus striatus*	2.6	6	27	0.6
Speckled Warbler	*Chthonicola sagittata*	1.9	5	10	2.3
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	7.1	25	17	1.1
Striated Thornbill	*Acanthiza lineata*	8.8	25	29	0.8
Lewin's Honeyeater	*Meliphaga lewinii*	2.3	5	25	0.5
Eastern Spinebill	*Acanthorhynchus tenuirotris*	2.7	11	19	0.6
Scarlet Honeyeater	*Myzomela sanguinolenta*	7.9	23	18	0.8
Jacky Winter	*Microeca fascinans*	2.5	6	20	0.7
Eastern Yellow Robin	*Eopsaltria australis*	2.5	8	35	0.8
Grey-crowned Babbler	*Pomatostomus temporalis*	5.2	24	29	1.4
Varied Sittella	*Daphoenositta chrysoptera*	7.2	18	14	0.4
Golden Whistler	*Pachycephala pectoralis*	2.9	10	31	1.2
Grey Shrike-thrush	*Colluricincla harmonica*	1.5	3	21	1.3
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	3	6	31	0.8
Pied Butcherbird	*Cracticus nigrogularis*	1.9	4	35	1.5
Pied Currawong	*Strepera graculina*	1.9	8	13	0.9
White-winged Chough	*Corcorax melanorhamphos*	11.2	36	15	1.5
Satin Bowerbird	*Ptilonorhynchus violaceus*	2.5	16	15	1.1
Welcome Swallow	*Hirundo neoxena*	3.2	12	21	2.0
Silvereye	*Zosterops lateralis*	10	32	22	1.2
Common Starling	*Sturnus vulgaris*	3.1	12	24	1.0
Common Mynah	*Acridotheres tristis*	2.4	6	17	0.9

[1]Average number seen on surveys when species recorded.
[2]Ratio of number of surveys in which species recorded during first half of study (1996-2000) compared with second half (2001-2007).

Table 5. Species seen infrequently and classed as either uncommon or rare
(species recorded on less than 8 or 20% of the 44 surveys).

Common Name	Scientific Name	Average Number Recorded [1]	Maximum Number Recorded	Number of Surveys Recorded	Change Ratio [2]
Brown Quail	*Coturnix ypsilophora*	3.0	3	1	0.0
Australasian Grebe	*Tachybaptus novaehollandiae*	1.0	1	1	0.0
Little Black Cormorant	*Phalocrocorax sulcirostris*	1.2	2	5	0.7
Great Cormorant	*Phalocrocorax carbo*	1.0	1	1	0.0
Australian Pelican	*Pelecanus conspicillatus*	1.0	1	1	NR
White-necked Heron	*Ardea pacifica*	1.5	2	2	1.0
Great Egret	*Ardea alba*	1.0	1	1	0.3
Australian White Ibis	*Threskiornis molucca*	1.0	1	2	1.0
Pacific Baza	*Aviceda subcristata*	1.0	1	1	NR
Black-shouldered Kite	*Elanus axillaris*	1.0	1	3	2.0
Whistling Kite	*Haliastur sphenurus*	1.0	1	5	NR
Brown Goshawk	*Accipter fasciatus*	1.3	2	4	0.3
Grey Goshawk	*Accipter novaehollandiae*	1.0	1	2	1.0
Collared Sparrowhawk	*Accipter cirrhocephalus*	1.3	2	3	0.5
Wedge-tailed Eagle	*Aquila audax*	1.5	4	8	1.7
Brown Falcon	*Falco berigora*	1.0	1	3	0.5
Australian Hobby	*Falco longipennis*	1.0	1	1	0.0
Nankeen Kestrel	*Falco cenchroides*	1.0	1	1	0.0
Baillon's Crake	*Porzana pusilla*	1.0	1	1	0.0
Dusky Moorhen	*Gallinula tenebrosa*	1.0	1	4	NR
Spotted Turtle-Dove	*Streptopelia chinensis*	1.0	1	3	2.0
Wonga Pigeon	*Leucosarcia melanoleuca*	1.0	1	1	NR
Topknot Pigeon	*Lopholaimus antarcticus*	3.5	6	2	NR
Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*	3.0	3	2	NR
Little Corella	*Cacatua sanguinea*	3.8	9	4	0.3
Rainbow Lorikeet	*Trichoglossus haematodus*	3.0	6	6	0.0
Musk Lorikeet	*Glossopsitta concinna*	3.0	3	1	NR
Pallid Cuckoo	*Cuculus pallidus*	1.0	1	6	1.0
Brush Cuckoo	*Cacomantis variolosus*	1.0	1	1	0.0
Pheasant Coucal	*Centropus phasianinus*	1.0	1	1	NR
Southern Boobook	*Ninox novaeseelandiae*	2.8	5	4	1.0
Australian Owlet-nightjar	*Aegotheles cristatus*	1.0	1	1	0.0
White-throated Needletail	*Hirundapus caudacutus*	26.0	50	2	1.0
Variegated Fairy-wren	*Malurus lamberti*	3.1	5	7	2.5
Brown Gerygone	*Gerygone mouki*	1.7	2	3	2.0
Buff-rumped Thornbill	*Acanthiza reguloides*	2.7	3	3	NR
Striped Honeyeater	*Plectorhyncha lanceolata*	1.0	1	1	0.0
Blue-faced Honeyeater	*Entomyzon cyanotis*	2.3	8	8	1.0
Brown-headed Honeyeater	*Melithreptus brevirostris*	4.3	8	7	0.8
White-naped Honeyeater	*Melithreptus lunatus*	3.2	5	5	0.3
Eastern Whipbird	*Psophodes olivaceus*	1.0	1	3	0.0
Black-faced Monarch	*Monarcha melanopsis*	1.2	2	5	0.7
Spectacled Monarch	*Monarcha trivirgatus*	1.0	1	1	NR
Restless Flycatcher	*Myiagra inquieta*	1.0	1	1	0.0
Rufous Fantail	*Rhipidura rufifrons*	1.2	2	6	1.0
White-bellied Cuckoo-shrike	*Coracina papuensis*	1.0	1	4	0.3
White-winged Triller	*Lalage sueurii*	1.0	1	1	NR
Double-barred Finch	*Taeniopygia bichenovii*	17.7	50	3	0.5
Tree Martin	*Hirundo nigricans*	3.2	2	8	7.0
Fairy Martin	*Hirundo ariel*	2.7	6	3	NR
Rufous Songlark	*Cinclorhamphus mathewsi*	1.0	1	1	0.0

[1]Average number seen on surveys when recorded.
[2]Ratio of number of surveys seen in first half of study (1996-2000) compared with the second half (2001-2007).
A value of zero indicates the species was not recorded in the first half of the study while NR indicates the species was not recorded in the second half.

Species Recorded Occasionally

The 51 species listed in **Table 5** occurred occasionally being recorded in less than 20% of the surveys. The change ratio in **Table 5** should be interpreted with caution because of the small number of sightings.

Ten species of raptors were recorded, all in the occasional category, the Wedge-tailed Eagle and the Whistling Kite being the species most frequently recorded.

The Dusky Moorhen was surprisingly scarce, only being recorded on four surveys. Presumably the dams are too small to support this species permanently.

One of three occurrences of the Double-barred Finch involved approximately 50 birds, an unusually large number for a species which has become increasingly scarce in the Butterwick area during the last decade.
All three records of the Fairy Martin were in the first half of the study with the last records in 1999. At that time two colonies were nesting in culverts under roads within approximately 1km of the study area. Both these breeding colonies became extinct about the time records ceased in the study area.

The Australian Owlet-nightjar was not recorded until the final survey when one was flushed from a 1.5 m high hollow stump at site 4.

The record of the Spectacled Flycatcher occurred during the spring migration when a single bird was resident for several days on the creek indicating the importance of the remnant vegetation to migrant birds on passage. Spectacled Flycatchers are seldom recorded in the Lower Hunter.

The summer record of Baillon's Crake was made on a dam which had reed covered fringes and muddy margins. This species, possibly the same bird, subsequently occurred on a similar dam in the author's garden approximately 1km from the study area.

A further five species were recorded outside the surveys. Single Yellow-billed Spoonbill *Platalea flavipes* and Crimson Rosella *Platycercus elegans* were seen on several occasions. An eleventh raptor species, the White-bellied Sea-Eagle *Haliaeetus leucogaster* was also recorded on one occasion. Historical records include a flock of White-browed Woodswallow *Artamus superciliosus* in the spring of 1994 (Stuart 1995) and a Black-necked Stork *Ephippiorhynchus asiaticus* seen by the owners of the property. In addition a large rail, almost certainly a Buff-banded Rail *Gallirallus philippensis*, was seen flying over a marshy area during a survey but this is an unconfirmed record.

Examples of Population Change

In the previous discussion the ratio of the frequency of presence of species in the first 22 surveys compared with the following 22 surveys was used as an indication of population change. A number of possible instances of change have been highlighted in the previous sections. In most instances the evidence involves small samples and merely provides the focus for further investigation.

Where a species is resident and the species is always recorded the change ratio based on frequency of presence is always 1 and hence of no use as an indicator of population change. However, in such cases the comparison of the abundance of a species based on the average number of birds seen on a survey is a more helpful indicator. In **Table 6** the change ratio based on average numbers is compared for a few species selected to provide examples of population change.

As indicated previously a number of waterbirds were less frequently observed during the second half of the study. Examination of **Table 6** shows that in each instance, except for the Grey Teal, the decrease in presence of the seven species of waterbirds coincided with a decrease in the average number of birds observed (i.e. these species were seen less frequently and in lower numbers during the second half of the study). The most dramatic change was in Australian Wood Duck numbers which were 90% higher during the

first period. Variation in rainfall is an obvious cause of variation in waterbird numbers and based on annual data the second period was on average 19.6% dryer than the first half (Gillespie 2007). However it remains to be explained why some species of waterbirds, particularly the Australian Wood Duck show a much greater decline in abundance than others. A possible explanation lies in the proliferation of nearby rural subdivisions with small dams and irrigated pasture which provide superior grazing for this species under drought conditions. The Purple Swamphen is another species which grazes over an extended area adjacent to reed edged dams, where it breeds. Purple Swamphens were a breeding resident until the last seven months of the study. During the last three surveys only one bird was observed, in October, despite good rainfall one month earlier which had replenished the dams. The local movement of Purple Swamphens from the area also occurred at the author's property, 1km away, where the species was absent during January 2007 for the first time in fourteen years. Again abnormal rainfall provides a possible explanation in that the annual rainfall for the Paterson area of 618mm in 2006 was the lowest level since 1991 and 36.4% lower than the long term average for the area. In addition 161.4mm or 26.1% of the 2006 annual rainfall occurred during September while all other months recorded well below average rainfall (Gillespie 2007).

Table 6. Comparison of Change Ratios based on Presence and Abundance

Common Name	**Scientific Name**	**Surveys Present First Half**[1]	**Surveys Present Second Half**	**Change Ratio**[3] **Presence**	**Average Number First Half**[2]	**Average Number Second Half**	**Change Ratio**[4] **Average Numbers**
Australian Wood Duck	*Chenonetta jubata*	21	17	1.2	10.2	5.3	1.9
Pacific Black Duck	*Anas superciliosa*	22	18	1.2	5.3	4.5	1.2
Grey Teal	*Anas gracilis*	7	5	1.4	1.7	2.0	0.9
Chestnut Teal	*Anas castanea*	7	6	1.2	2.6	2.3	1.2
White-faced Heron	*Egretta novaehollandiae*	16	10	1.6	2.3	1.9	1.2
Purple Swamphen	*Porphyrio porphyrio*	22	20	1.1	5.7	4.8	1.2
Masked Lapwing	*Vanellus miles*	21	10	2.1	2.8	2.6	1.1
Superb Fairy-wren	*Malurus cyaneus*	22	22	1.0	28.2	24.6	1.1
Noisy Miner	*Manorina melanocephala*	22	21	1.0	12.6	11.2	1.1
Grey Fantail	*Rhipidura fuliginosa*	22	22	1.0	8.0	8.0	1.0
Double-barred Finch	*Taeniopygia bichenovii*	1	2	0.5	25.0	1.5	16.7
Red-browed Firetail	*Neochmia temporalis*	21	20	1.1	15.0	10.6	1.4

[1] 22 surveys were conducted in each half of the study.
[2]Average numbers reported for surveys when species present.
[3]Ratios greater than 1 indicate that a species was less frequently present in the second half of the study.
[4]Ratios greater than 1 indicate that a species was less abundant in the second half of the study.

Superb Fairy-wren and Grey Fantail, species recorded on every survey, showed little variation in abundance. Noisy Miner numbers were on average 10% higher in the first half of the study and it was absent during one survey in the latter period. The Red-browed Finch is another species which is commonly present and fairly abundant but in this case a marked decline in abundance is apparent, average values being 40% higher during the first period. The Double-barred Finch, which is occasionally recorded on the property, may be experiencing a similar decline in numbers with the only large flock occurring during the first period, but its presence is too infrequent for a firm conclusion to be drawn.

The above examples demonstrate the advantage of monitoring species numbers when assessing change in bird populations. A more detailed analysis of trends will be the subject of a subsequent paper.

CONCLUSIONS

126 species of birds were recorded during 44 surveys over an eleven year period with a further five species recorded at other times. The total of 131 species is an impressive demonstration of the important contribution working cattle properties with remnant vegetation make to sustaining bird diversity. The composition of the species list is consistent with status of species listed in the Annual Bird Reports for the Hunter Region of New South Wales (Stuart 2006). The limited extent of continuous woodland and lack of cereal crops explain the absence of the Common Bronzewing *Phaps chalcoptera* (Barrett *et al*. 2002).

Counting the numbers of birds present proved beneficial in assessing change and complemented an analysis based on the frequency of presence. While a three monthly survey interval provided useful information additional surveys, for instance monthly, would be more beneficial in view of the variation which occurred when a count was repeated. Surveys conducted in January are difficult because the birds are less active and difficult to hear when cicadas are calling. Early December would be a better time to survey the summer population when all migrants are present and conditions are cooler. Collection of breeding information was superficial because of the need to conduct surveys with a constant effort approach in order to facilitate the evaluation of population change. Hence only obvious instances of breeding behaviour were recorded.

A superficial examination of population change based on the frequency of presence suggests that a number of species were less plentiful during the second half of the study. This indication was supported by a corresponding decrease in the numbers of birds observed. The decline in the waterbirds as a group is attributed to drought conditions at the end of the study. This decline was dramatic in the case of the Australian Wood Duck and the Purple Swamphen. In contrast Latham's Snipe was observed more frequently under drought conditions. The underlying reasons for these population changes probably involve a combination of environmental factors at local, regional and national scale. Consequently studies of this type provide important land management information both as independent investigations and as part of national Birds Australia collaborative projects.

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