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CONTENTS

**PETER F. WOODALL**

Distribution and Abundance of Common Starling *Sturnus vulgaris* and  
Common Myna *Acridotheres tristis* in South-East Queensland..... 1

**JO WIENEKE AND DAVID J. JAMES**

Populations of Indian Peafowl *Pavo cristatus* and Helmeted Guineafowl  
*Numida meleagris* in North-Eastern Queensland..... 15

**WAYNE HOUSTON, ROD ELDER, ROBERT BLACK  
AND JOHN MCCABE**

Conservation Significance of Coastal Wetland Habitats for Birds at  
Twelve Mile Creek, Fitzroy River, Central Queensland..... 20

**MAUREEN ALLOTT, MALCOLM ALLOTT  
AND NIKKI HATCHETT**

The Breeding Cycle of a Pair of Wedge-Tailed Eagles *Aquila audax* in  
South-East Queensland..... 37

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# THE SUNBIRD

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## **DISTRIBUTION AND ABUNDANCE OF COMMON STARLING *STURNUS VULGARUS* AND COMMON MYNA *ACRIDOTHERES TRISTIS* IN SOUTH-EAST QUEENSLAND**

PETER F. WOODALL

### **ABSTRACT**

The introductions of Common Starling *Sturnus vulgaris* and Common Myna *Acridotheres tristis* in south-eastern Queensland are described. The subsequent eastward movement of Common Myna from the inland release site into Brisbane and nearby coastal areas is described using available data from regional bird counts, atlasing and other sources. There were scattered coastal records of Common Mynas as early as 1965. Records over three decades since then show the movement and increase in the Common Myna population taking place in a 40 km corridor from Gatton to coastal suburbs of Brisbane. Seasonal patterns of percentage frequency and abundance are also presented.

### **INTRODUCTION**

The Common Starling *Sturnus vulgaris* and the Common Myna *Acridotheres tristis* have been introduced to, and successfully colonized, many countries including Australia (Long 1981). In Australia the introduction and spread of Common Mynas is well documented in New South Wales (Hone 1978) and Canberra (Gregory-Smith 1985, Veerman 2003) but not in Queensland. Detailed records of the introduction and spread of these two species are interesting historically and provide a basis for any future study of their biology and control, particularly since both have the potential to spread to much of eastern and south-eastern Australia (Martin 1996). As both species nest in hollows in trees there is concern that they may displace native birds which also use similar nest sites (Pell & Tidemann 1997).

Common Starlings were first shipped to Brisbane in 1869-70 by the State Acclimatization Society on the *Flying Cloud* (Chisholm 1919, Lavery 1974, Long 1981). Chisholm (1919) questions the survival of these birds and suggests that the species successfully spread from New South Wales into southern Queensland much later (e.g. records from Stanthorpe in 1919) by stating "I cannot find anyone who remembers the Starling and Sparrow in Queensland in other than recent years".

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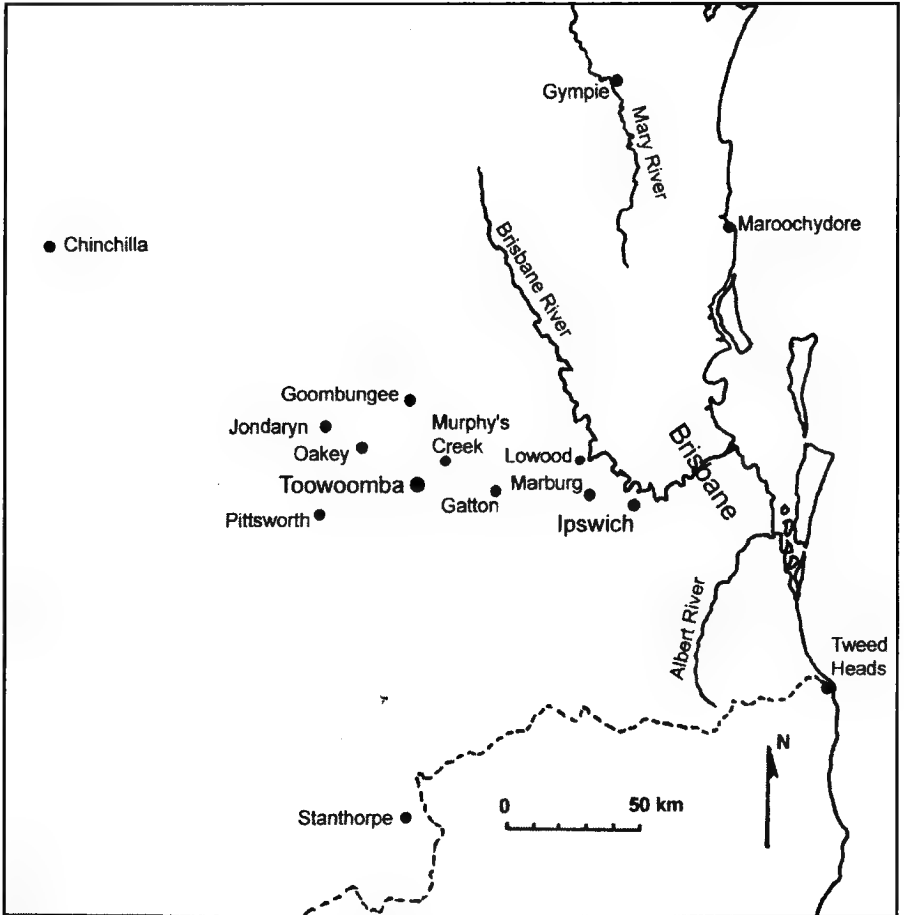
Lord (1956) reported that Starlings arrived at Murphy's Creek, east of Toowoomba "about thirty years ago" (circa 1926?), "being few at first but multiplying rapidly and large flocks were soon seen". By 1950 Common Starlings were common in Brisbane and had progressed further northward for 750 km up the Queensland coast to reach the town of Marlborough (Tarr 1950). Since then Starlings have been regarded as a "well established introduction, sometimes seen in very large flocks" (Jack 1963) in Brisbane and suburbs and "very common and widespread" (Roberts 1979).

Common Mynas from Melbourne were released on the Herbert and Johnstone Rivers and at Townsville around 1883 (Chisholm 1919). Walker (1952) reported that eight Common Mynas from Cairns were released at Toowoomba in early 1918 and later that year Mynas [the same group?] were nesting along a creek W of Oakey (Figure 1). He also believed that Common Mynas were introduced to the Biddlestone area, 16 km S of Oakey [date unknown] where the species was first reported nesting in 1921-22 (Walker 1952). The species soon spread from these locations to the neighboring towns of Jondaryn, Goombungee and Toowoomba (Walker 1952) and beyond. Forster (1951) had earlier recorded some birds 13 km S of Toowoomba on the Warwick Road. East of Toowoomba, at Murphy's Creek, Lord (1956) reported "the only local record"... "a few years ago ..." and in the eastern Darling Downs Storr (1973) reported them also "from Jondaryn and Goombungee south to Pittsworth and Clifton; casual in Chinchilla and upper Lockyer districts". Soon afterwards they became "mostly restricted to towns in upper Lockyer Valley (e.g. Gatton) and towns to the north, south to Gympie" Roberts (1979) and Storr (1984) again reported them from "the eastern Darling Downs", "... and now "east to Gatton".

Meanwhile Greater Brisbane (Jack 1963) and coastal southeast Queensland remained free of Common Mynas, even despite Roberts (1979) mistakenly quoting an attempt to introduce Common Mynas to Brisbane in 1912 based on Chisholm (1919). [Chisholm (1919) referred to introducing the "Indian Dove" (=Spotted Turtle-Dove *Streptopelia chinensis*), not Common Mynas. Long (1981) also cited Walker (1952) to (erroneously) conclude that the species was released at Cairns in 1918].

Both species have been present in south-east Queensland for at least 80 years but their initial sites of release and colonisation differ. This paper describes the changes in their distribution and abundance recorded in this region until now and, in particular, documents the eastwards spread of the Common Myna, using published and original material.

**Figure 1: South-east Queensland showing some of the localities mentioned in the text.**



## METHODS

The method of analysis combines both original and published information on both species from different sources. The records contributed to garden bird surveys by members of Birds Queensland (BQ), formerly Queensland Ornithological Society Inc. (QOSI), in 1979/80 (Woodall 1995) and 1999/2000 (Woodall 2002) were re-analysed to focus on the two species. In this re-analysis, records of these birds observed in three categories 'in gardens' (IN), in the 'next garden' (NG) and 'flying over' (FO) were summed and treated as single records. All previously published analyses included only 'in gardens' (IN) records. Additional records were obtained from systematic annual bird counts conducted (in October) from 1981 to 2004 in the Brisbane Valley (Danson *et. al.* 2005), other published surveys (e.g. Leach & Hines 1987), QOSI newsletters, the "WildNet" database (formerly 'Nature Search') of the Queensland Environmental Protection Agency (EPA) and from the Birds Australia *Atlas of Australian Birds*.

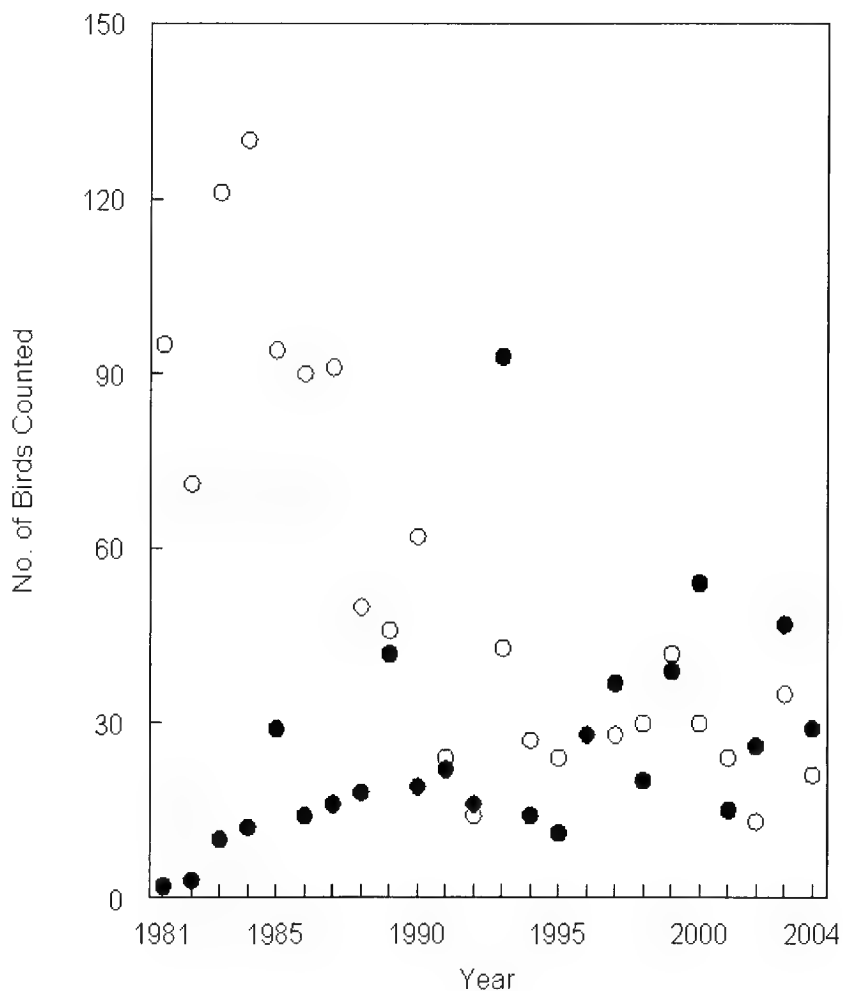
## RESULTS

Common Myna observations in 5 localities from Gatton (in the Lockyer Valley) to Brisbane collected by QOSI members during Annual Bird Counts from 1973 – 1982 as published in QOSI newsletters are presented in Table 1.

**Table 1: Common Mynas reported during QOSI bird counts adjacent to Brisbane.**

Year	Gatton (Area 10)	Bremer River (Area 9)	Brisbane Valley (Area 8)	Ipswich (Area 7)	Brisbane City (Area 2)
1973	6				
1974	48				
1975	14				
1976	98				
1977	77				
1978	107		3		
1979	49	1	9		3
1980	112		16		4
1981	74		2		
1982	104	4	3	2	

**Figure 2: Common Myna (●) and Common Starling (○) counts in the Brisbane Valley, 1981 to 2004 (Danson *et. al.* 2005).**





Common Mynas were initially rare in the Brisbane Valley (Figure 2), then became common in the mid-1980's and counts peaked at 90 in 1993 (Danson *et al.* 2005). By 1994 the recorded distribution of Common Myna east of the Brisbane Valley (Haigslea) in south-east Queensland had grown from isolated single records in the Historical Atlas (e.g. Maroochydhore in 1965/66, Gold Coast in 1970/71 and Tweed Heads in 1975 (Hone 1978)) to include much of south-east Queensland and many suburbs of Brisbane (Table 2). The great increase in the number of Common Myna records from 1990 to 1994 is shown in the uncorrected records from the WildNet database (Figure 3) followed by a marked drop in the number of records. A corrected index was obtained by expressing the number of Common Myna records as a percentage of the sum of Magpie-lark *Grallina cyanoleuca*, Australian Magpie *Gymnirhina tibicen* and Common Starling records. These three species were chosen because they have similar behaviour and occupy a similar habitat to that of the Common Myna. The corrected index shows an initial peak of records in 1990 and then increasing reports towards the end of the decade. From 1999 to 2001 the frequency of reports and the index are quite low but this is considered a bias of the data collection because at this time the Garden Bird Surveys indicated that Common Mynas were widespread in Brisbane (Table 2).

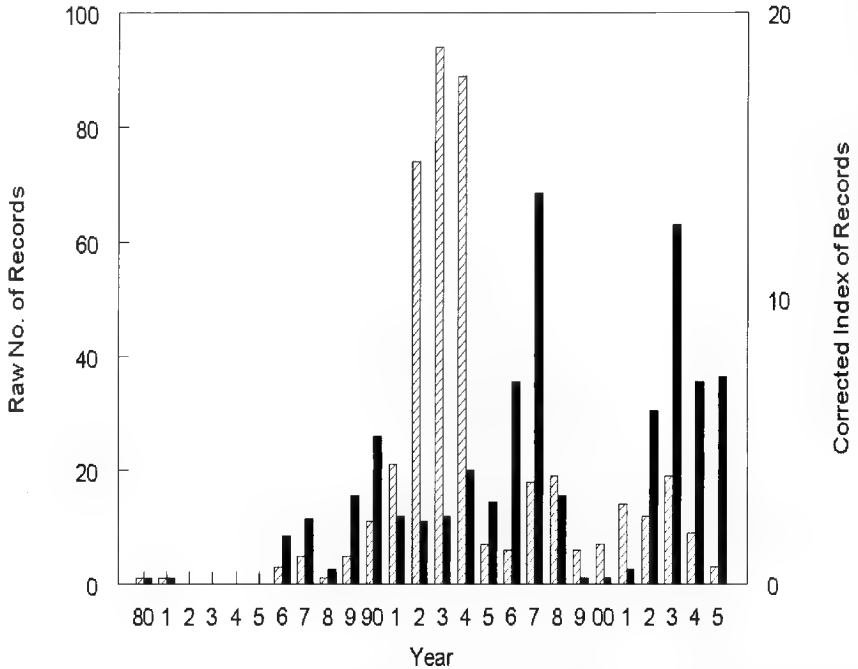
**Table 2: Localities of Common Myna records in south-east Queensland (E of Haigslea).**

Year	Source*	Locality / Suburb
1965/66	A	Maroochydhore
1970/71	W	Gold Coast
1978	A	Burleigh
1979	A	Coomera
1980	A	Brisbane, Cleveland, Toorbul
	G	Kenmore
1980/81	A	Burleigh
	W	MacGregor
1986	W	Bundamba, Ipswich
	B	Bundamba
1987	W	Ipswich, Moggil, Peak Crossing, Yamanto
	B	Moggil, Yamanto
1988	W	Ipswich
1989	W	Coopers Plains, Jindalee
	B	Jindalee

Year	Source*	Locality / Suburb
1990	W	Brighton, Chelmer, Corinda, Enoggera, Goodna/Redbank, Indooroopilly, Kholo Creek/Mt Crosby, Logan Reserve, Loganlea.
	B	Chelmer, Graceville, Indooroopilly, Kedron Brook, Logan Reserve, Loganlea.
1990/91	W	Swanbank.
1991	W	Bellbird Park, Bundamba, Cleveland, Corinda, Deception Bay, Denmark Hill, Eight Mile Plains, Ipswich, Logan Reserve, Pallara, Redbank Plains.
	B	Corinda, Logan Reserve, Pallara.
1991/92	W	Currumbin, Jamboree Heights, Karalee, Riverview.
1992	W	Bald Hills, Beaudesert, Beenleigh, Bethania, Bremer River, Calamvale, Cleveland, Currimundi, Daisy Hill, Deagon, Deception Bay, Eatons Hill. Esk, Inala, Kholo Crossing, Logan River, Mt Crosby, Pine Rivers, Raceview, Redbank Plains, Southbank Parklands, Sunnybank Hills, Warrill View, Woodend.
	B	Bald Hills, Eatons Hill, Beaudesert, Cleveland, Inala, Redbank Plains, Sherwood, Southbank Parklands.
1993	W	Bald Hills, Bannockburn, Bellbird Park, Bellbowrie, Bethania, Boonah, Calamvale, Caloundra. Carsbrook, Collingwood Park, Coolangatta, Corinda, Deception Bay, Doboy, Eatons Hill, Esk, Flinders View, Goodna, Greenbank, Greenslopes, Hemmant, Hendra, Indooroopilly, Ipswich, McLeod, Moggil, Oxley, Redbank Plains, Redlands, Sapling's Pocket, Strathpine, Sunnybank Hills, Toohey Forest, Westlake, Yeronga, Zig Park.
	B	Bald Hills, Bellbowrie, Calamvale, Eatons Hill, Greenbank, Hemmant, Hendra, Strathpine, Sunnybank Hills, Toohey Forest, Yeronga.
1994	W	Albert, Algester, Amberley, Calamvale, Caloundra, Carbrook, Chuwar, Clontarf, Daisy Hill, Denmark Hill, Downfall Creek, Eastern Heights, Golden Beach, Goodna, Greenbank, Indooroopilly, Ipswich, Jindalee, Mary Cairncross Park, Minnippi, Mt Marrow, Oxley Creek, Redbank Plains, Rosewood, Runcorn, Sapling Pocket, Savages Crossing, Sheldon, Sherwood, Tennyson, Wavell Heights, Woogarra Creek.
	B	Geebung, S. Gateway Bridge, Wavell Heights.

\*Sources: A = Birds Australia Atlases (Blakers *et. al.* 1984, Barrett 2003); B = Birds Queensland Newsletters, G = Birds Queensland Garden Birds Survey (Woodall 1995); W = Queensland Environmental Protection Agency's WildNet Database.

**Figure 3: Common Myna records (□=actual, ■=corrected index) reported in S-E Queensland 1980—2005 (source: WildNet database).**



Common Mynas were rare in south-east Queensland during the 1979/80 garden bird survey and were reported only from three gardens on the Darling Downs (one in Pittsworth and two in Toowoomba); and a single record from a garden in Greater Brisbane (Kenmore, May 1980) (Tables 2 & 3). Twenty years on, the 1999/2000 garden bird survey showed they were present in all areas of Brisbane and much of south-east Queensland (Table 3). Interestingly, its abundance remained low in the first occupied suburbs (Kenmore) west of Brisbane but increased quickly in the coastal eastern and northern suburbs and again more slowly in southern suburbs (Table 3).

Common Starlings were reported from over 90% of gardens from all areas of Brisbane in the 1979/80 garden bird survey (Table 4) and showed slight increases in the 1999/2000 garden bird survey.

Common Mynas showed no clear seasonal pattern in percentage frequency of occurrence in Brisbane gardens during 1999-2000 (Figure 4) but an increase across the 14-month survey period, which probably reflects their expansion into Brisbane in this period.

**Table 3: Change in Common Myna presence in gardens over 20 years**  
(source: Garden bird surveys).

REGION	BY GARDEN		BY WEEK (NO. OF RECORDS)	
	1979/80	1999/2000	1979/80	1999/2000
West Brisbane	1/20 = 5%	1/14 = 7%	1/534 = 0.2%	24/514 = 4.7%
North Brisbane	0/19 = 0%	7/26 = 27%	0/500 = 0.0%	93/751 = 16.3%
South Brisbane	0/17 = 0%	8/19 = 42%	0/481 = 0.0%	19/514 = 3.7%
East Brisbane	0/10 = 0%	10/15 = 67%	0/250 = 0.0%	139/333 = 41.7%
<b>Bris. combined</b>	<b>1/66 = 1.5%</b>	<b>26/74 = 35%</b>	<b>1/1765 = 0.1%</b>	<b>275/2112 = 13%</b>
Gold Coast	0/8 = 0%	0/8 = 0%	0/275 = 0.0%	0/240 = 0%
Ipswich-Darling Downs	3/5 = 60%	9/11 = 82%	136/251 = 54.2%	208/348 = 59.8%

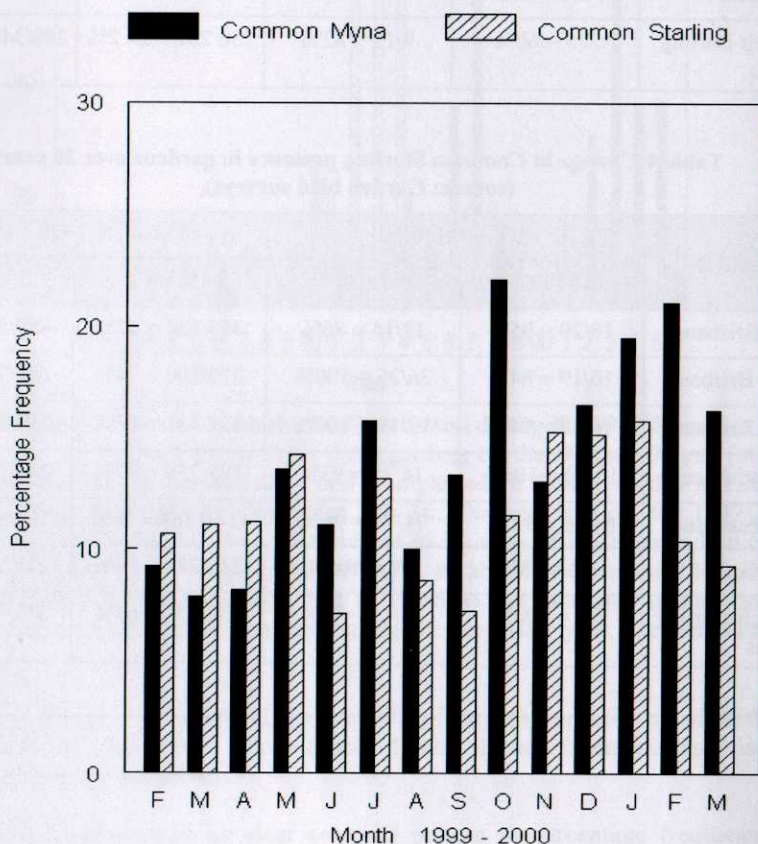
**Table 4: Change in Common Starling presence in gardens over 20 years**  
(source: Garden bird surveys).

REGION	BY GARDEN		BY WEEK (NO. OF RECORDS)	
	1979/80	1999/2000	1979/80	1999/2000
West Brisbane	19/20 = 95%	12/14 = 86%	355/534 = 67%	459/514 = 89%
North Brisbane	16/19 = 84%	26/26 = 100%	370/500 = 74%	651/751 = 87%
South Brisbane	16/17 = 94%	19/19 = 100%	324/481 = 67%	392/514 = 76%
East Brisbane	10/10 = 100%	14/15 = 93%	192/250 = 77%	248/333 = 74%
<b>Bris. combined</b>	<b>61/66 = 92%</b>	<b>71/74 = 96%</b>	<b>124/1765 = 70%</b>	<b>1750/2112 = 82%</b>
Gold Coast	7/8 = 88%	8/8 = 100%	218/275 = 79%	218/240 = 91%
Ipswich-Darling Downs	5/5 = 100%	10/11 = 91%	159/251 = 63%	317/348 = 91%

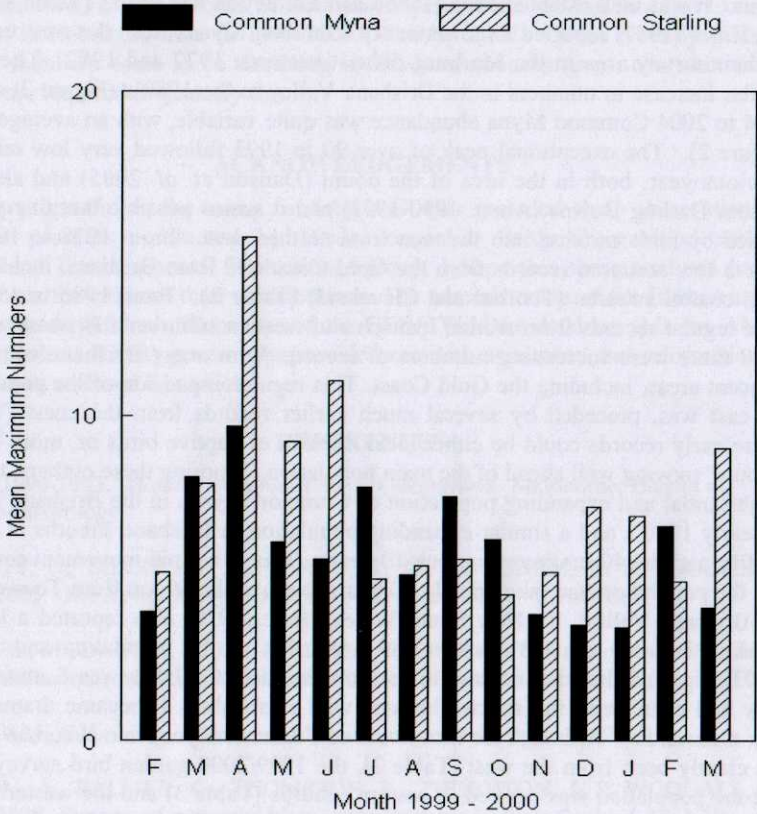
Common Starlings showed a seasonal peak in percentage frequency of occurrence in summer (November, December and January) and winter minima (June, August and September) (Figure 4). In June, July and August large winter flocks form in rural rather than suburban habitats (Woodall 1999).

The monthly mean maximum numbers of Common Mynas per garden showed little seasonal variation (Figure 5) with highest means in March and April and lowest means in November, December and January. Common Starlings showed greater seasonal variation with peak numbers in March, April, May and June and lowest mean numbers in October (Figure 5).

**Figure 4: Seasonal variation in the percentage of gardens in which Common Mynas and Common Starlings were recorded in 1999/2000.**



**Figure 5: Seasonal variation in the mean maximum numbers of Common Mynas and Common Starlings in gardens in 1999/2000.**



**DISCUSSION**

Given the rapid rate of spread late last century of Common Starling populations it is most likely they were self introduced to south-east Queensland from northern New South Wales as Chisholm (1919) concluded. Comparisons between the first and second Atlas of Australian birds showed no significant variation in reporting rate overall but there was a >20% decrease in the south-east Queensland bioregion (Barrett *et. al.* 2003). Danson *et. al.* 2005 showed their abundance declined in the Brisbane Valley between 1981 and 2004 (Figure 2) but across south-east Queensland the garden bird surveys showed Common Starlings were a common feature of the suburban avifauna with little change between 1979/80 and 1999/2000 (Table 4).

Australia-wide, the Common Myna showed no regional variation and a significant increase in the reporting rate between the first and second Atlas of Australian birds (Barrett *et. al.* 2003). In south-east Queensland there has been a clear easterly expansion of the population from its initial introduction to Toowoomba and nearby towns. It was well established in Gatton and Laidley in the 1970's (Table 1). Leach and Hines (1987) reported a movement of Common Mynas from the west to the east of their survey area in the Marburg district between 1977 and 1982. There was a similar increase in numbers in the Brisbane Valley in the 1980's (Figure 2) and from 1994 to 2004 Common Myna abundance was quite variable, with an average of c. 30 (Figure 2). The exceptional peak of over 90 in 1993 followed very low rainfall the previous year, both in the area of the count (Danson *et. al.* 2005) and also in the Eastern Darling Downs (Anon. 1990-1993) and it seems possible that this peak was caused by birds moving into the area from further west. From 1978 to 1981 there were a few scattered records from the Gold Coast and from Brisbane, including two from coastal suburbs (Toorbul and Cleveland) (Table 2). From 1986 to 1989 there were regular records from around Ipswich and western suburbs of Brisbane and from 1990 there were increasing numbers of records from many Brisbane suburbs and adjacent areas, including the Gold Coast. This regular expansion of the population to the east was, preceded by several much earlier records from the coast (Table 2). These early records could be either local releases of captive birds or, more likely, of "scouts" moving well ahead of the main population. Ignoring these outliers, there was a substantial and expanding population of Common Mynas in the Brisbane Valley in the early 1980's and a similar expanding population in Brisbane suburbs in the early 1990's, and the 40 km invasion took 10 years. This is a rapid movement considering that the population had taken nearly 60 years to move the 60 km from Toowoomba to the Brisbane Valley. In New South Wales, Hone (1978) also reported a long time elapsing between the introduction and expansion of the population and Veerman (2003) reported that the increase in the population in Canberra was "...initially quite slow and even, until the species became well established. It became dramatic from year 6 onwards." Although the movement of Common Mynas into suburban Brisbane has clearly been from the west (Table 2), the 1999/2000 garden bird survey showed that the population was centred in eastern suburbs (Table 3) and the western suburbs had comparatively small populations. This may reflect differences in habitat between the two areas, with the eastern suburbs generally being less treed and more open (pers. obs.) and thus more suitable for the Common Myna. Seasonal changes in Common Myna abundance (Figure 5) may reflect the annual cycle of young birds entering the population in autumn after summer breeding. Veerman (2003) found a similar pattern with minima in the months of October and November, the start of Common Mynas breeding in Canberra.

Common Starling abundance peaked in autumn/winter and was at its lowest in October (Figure 5). Veerman (2003) also found minimum numbers of Common Starlings in October and peaks in summer and autumn in Canberra. They are well known to form large flocks in winter (Veerman 2003, Woodall 1999) but these mainly occur away from suburban gardens and were largely missed in these surveys.

Twenty-one years of results from the Canberra Garden Bird Survey showed a fairly steady decline in the numbers of Common Starlings (Veerman 2003), and the increase in Common Myna numbers was suggested as a possible cause for this. Similar changes in the two species were found in the Brisbane valley counts (Figure 2) but in the garden bird survey, records of Common Mynas increased but those of Common Starlings had changed little in 1999/2000 (Woodall 2002). More recently Common Starling numbers seem to be declining in Brisbane suburbs (pers. obs.) but further surveys are required to quantify this.

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**POPULATIONS OF INDIAN PEAFOWL *PAVO CRISTATUS* AND  
HELMETED GUINEAFOWL *NUMIDA MELEAGRIS* IN  
NORTH-EASTERN QUEENSLAND**

JO WIENEKE AND DAVID J. JAMES

**ABSTRACT**

Populations of Indian Peafowl *Pavo cristatus* and Helmeted Guineafowl *Numida meleagris* are currently established at several sites in north-eastern Queensland. Both species occur in semi-rural districts as disjunct, free-ranging and self-sustaining feral populations originating from captivity. Reports of these domesticated species forming feral populations are increasing but wild breeding is rarely reported.

**INTRODUCTION**

Marchant & Higgins (1993) reported long established feral populations of Indian Peafowl *Pavo cristatus* which usually occurred on offshore islands e.g. Rottneest Is., Western Australia, Three Hummock Is., Tasmania, and formerly Heron Is., Queensland. Other populations both deliberately introduced and escapees from captive flocks have survived for a while before dying out. Since 1993 there have been scattered records of peafowl in Queensland from Daintree south to the Gold Coast and west to Mt Isa, with breeding recorded for several established apparently wild populations.

Helmeted Guineafowl *Numida meleagris* was not considered by Marchant & Higgins (1993) to have any self-sustaining and viable populations in Australia. It was subsequently relegated to the 'Supplementary List' in the Birds Australia Checklist of Australian Birds (Christidis & Boles 1994). Queensland locations for recent records in the Atlas of Australian Birds include the Archer River, Cape York Peninsula south to the Gold Coast and west to Chillagoe.

Reports of breeding and apparently self-sustaining populations of both species from north-east Queensland are described.

**OBSERVATIONS**

**Indian Peafowl**

Free-ranging peafowl were reported to the Second Atlas of Australian Birds from Kelso 19°23'18"S 146° 43' 04"E, an outer suburb of Townsville fringing bushland along Ross River. This population dates back to the 1980s, and originated from a captive flock allowed to range freely (D.Glasgow, pers. com.). Since 2000 the local council has responded to complaints by residents and most of the population has been 'removed' (Thuringowa City Council spokesperson, pers. com.). Birds have also colonised rarely visited bushland on the southern side of Ross River in the Australian Defence Department's Mt Stuart Training Area, where they were reported in 1997

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(C&B 1997). The size of this flock is unknown.

Two males were in grassy woodland at the 584m summit of Mt Stuart 19°22'44"S 146° 46'33"E, near Townsville, about 2 km from the nearest dwellings. These birds were reported by DJJ during the Second Atlas of Australian Birds in 1989 and locals claimed that they had been present for some time. A male and three females were seen there by JW in October 2003. This flock may have originated from the Kelso flock, which is approximately 6 km west of Mt Stuart.

In September 2003 a flock of 30-40 peafowl was reported from Oak Valley 19° 24'36"S 146°49'08"E, a rural residential area 10 km SSE of Mt Stuart and adjoining Mt Stuart Training Area (I.Protheroe, pers. com.). Breeding had been recorded with seven eggs in one nest found near a creek and later young birds were observed in the company of adult birds.

On Magnetic Island the proprietors of a beach resort at Radical Bay 19°06'40"S 146° 52'28"E, kept a flock of peafowl which became feral when the resort was abandoned in the mid 1990s (JW, pers. ob.). The birds then relocated to Horseshoe Bay, 19° 07'30" 146°50'59"E, a nearby area of farmland, residential development and remnant bushland. Culling efforts, instigated by some Island residents, were the subject of controversy in the community but birds from this flock have survived. A hen with five chicks was observed near the old school building on February 8<sup>th</sup> 2006 (H.O. McColl, pers. com.).

Near Majors Creek, 19°37'36"S 146°57'28"E, approximately 35 km SW of Townsville in early 1994 (DJJ) observed a flock of 20 adults and chicks crossing a power line access track in savannah woodland approximately 3 km from the nearest dwelling.

In 1997 DJJ saw free-ranging birds at Alligator Creek, 19°25'57"S 146°56'45"E, 22 km south-east of Townsville. They were inhabiting riparian bushland bordering a rural residential development, and clearly had originated from local captive populations. Whether or not they were still partially domesticated was not ascertained. At Chillagoe 17°09' 18" S Longitude 144°31' 28" E captive birds were released in the bush and in 1997 several females and two males. were observed in shrub country west of the town. Other birds were seen near the old mine workings close to the town (R. Mackay, pers. com.).

L. Ezzy (pers. com.) reported small numbers of individuals near the Burdekin Dam, 20°38'27"S, 147°08'45"E, to the Second Atlas of Australian Birds in 2000. These birds were originally owned by the Dam Manager but were roaming freely in the bush 2 km from the dam.

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### Helmeted Guineafowl

Britten & Britten (2000) reported that a self-sustaining population had been present in and around the outskirts of Charters Towers 20°04'35"S 146°15'41"E, for at least 20 years. Successful breeding was noted in April 94, May 98, January 99 and December 99. In February 2000 there were 17 birds in this population and frequent road kills appeared to exert a regulatory control on numbers. Britten & Britten also noted a discrete population of six birds living 9 km north-east of Charters Towers. In February 2001 we made enquiries with local residents, several of whom were aware of the long-term presence of free-ranging guineafowl.

On Magnetic Island, a flock of Helmeted Guineafowl has been present at Horseshoe Bay since at least 1980 (JW, pers. ob.). Though probably of local domestic origin, the flock now ranges freely in areas of cleared weedy grassland. Birds also frequent the yards of a horse-riding establishment where (B. Way pers. com.) compared them with those he had seen feeding around villages and cattle in Africa. In a particular dry period in November 2002, residents, concerned about the possible displacement of the numerous Bush Stone-curlews *Burhinus grallarius*, reported that numbers of guineafowl had grown from a flock of a dozen to over 30.

Helmeted Guineafowl were also introduced near the Burdekin Dam Township when the Dam was under construction about 30 years ago. A small flock now roams freely in open grassland within a 2 km radius of the township (L. Ezzy pers. com.).

### DISCUSSION

Indian Peafowl and Helmeted Guineafowl have successfully established populations in other countries, either through deliberate introduction, or from captive flocks (Long 1981). Both species are found in a variety of habitats and are well adapted to living near human habitation. They are omnivorous and eat a wide range of plant material as well as insects and other invertebrates. In their native ranges both species are found near human habitation. The climate and vegetation found in the dry tropics of North Queensland are similar to those in their native ranges and conducive to establishment of free-ranging populations.

In India, native peafowl are found in a wide range of habitats, such as open forest with shrubby undergrowth, secondary vegetation, orchards and cultivation near villages (del Hoyo *et. al.* 1994). In Africa, native Helmeted Guineafowl inhabit a wide variety of habitats mainly in open country, ranging from forest edge through savannah woodland to thorn scrub, steppe and semi-desert. They are particularly common in savanna interspersed with areas of cultivation, but their local distribution is limited by availability of drinking water and suitable roosting sites in trees or shrubs (del Hoyo *et. al.* 1994).

The feral populations described here differ from populations of most other feral birds in Australia, eg. House Sparrow *Passer domesticus* and Common Myna *Acridotheres tristis*, because they occur in small discrete groups as abandoned free-ranging

domestic flocks, rather than wide-ranging, continuous populations.

There are few records of foxes in north Queensland and apart from Dingos *Canis lupus dingo* and Feral Dogs *Canis familiaris*, Indian Peafowl would have few predators. Their continued existence probably depends on the tolerance shown by local residents.

On Magnetic Island there are no foxes, and dogs are now strictly controlled by Townsville City Council regulations and no road-kills have been reported. The guineafowl population size may be limited on Magnetic Island by Wedge-tailed Eagles *Aquila audax* that have been observed preying on them (G. Ryan pers. com.).

### ACKNOWLEDGEMENTS

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**CONSERVATION SIGNIFICANCE OF COASTAL WETLAND  
HABITATS FOR BIRDS AT TWELVE MILE CREEK,  
FITZROY RIVER, CENTRAL QUEENSLAND**

WAYNE HOUSTON, ROD ELDER, ROBERT BLACK  
AND JOHN MCCABE

**ABSTRACT**

A survey of wetland-associated birds was conducted in 100 ha of wet saltmarsh and its associated ecotonal areas at Twelve Mile Creek from September 2004 to April 2006. The hydrological changes from the seasonal flow of tides and fresh water across the saltmarsh and its surrounds are described. The resulting dynamic mosaic of complex wetland habitats supported many aquatic species and one of the three known small regional subpopulations of the Endangered Capricorn subspecies of the Yellow Chat *Epthianura crocea macgregori* (Houston et. al. 2004a).

The survey yielded 64 bird species, including 31 migratory species, mainly present during the wet season (December to March). They included specialised terrestrial and wetland-associated species and some that use both fresh or saline habitats. Five rare or threatened species (Radjah Shelduck, Cotton Pygmy-goose, Black-necked Stork, Capricorn Yellow Chat, Glossy Black Cockatoo) used the wetlands, or the adjacent woodlands, some raising their young. Fifteen species of migratory waders used the area and, on one occasion, the numbers of Sharp-tailed Sandpipers present during their northward migration reached the criterion for significant flyway staging habitat. Terrestrial species records included the Bar-breasted Honeyeater which extended its breeding range south.

The diversity of rare or threatened species and migratory species within the study area confirms Twelve Mile Creek wetland as important habitat for birds and of high conservation significance. This result enhances the intrinsically high conservation value of the unique structural complexity of its saltmarsh vegetation within the Fitzroy Delta.

Potential threats include industrial expansion, over-grazing and loss of creek surface water in-flows. The latter may be particularly significant based on observations of the saltmarsh habitat and associated dependent fauna (i.e. Yellow Chat) suggesting a link between productivity of the system and freshwater in-flows. Current and future uses and tenures of the land are discussed because they affect future conservation management.

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## INTRODUCTION

Twelve Mile Creek is a tributary of the Fitzroy River S of Rockhampton containing a natural wetland. It includes a freshwater lagoon and a complex channelled saltmarsh (23° 40.3' S, 150° 45.1' E) (See Figure 1). Small numbers of the endangered Capricorn Yellow Chat were recently located breeding in the saltmarsh area (Houston et. al. 2004a). The wetland is part of the Fitzroy River Delta which is a nationally important wetland (DEH 2005) and key habitat for barramundi (Veitch and Sawynok 2005). It receives a subhumid climate with rain falling seasonally mainly from December until March and very little from June to September.

The area of main interest at Twelve Mile Creek is mapped as regional ecosystem 11.1.2b 'Sapphire forbland on marine clay plains' (EPA 2004) and covers approximately 100ha (See Figure 1). It is a mixture of saltflats and saltmarsh comprised of Marine Couch (*Sporobolus virginicus*), samphire, narrow bands of a salt tolerant sedge *Schoenoplectus litoralis* along some channel edges and a complex braided network of channels. The saltmarsh is bordered with low alluvial terraces dominated by extensive grassland with varying degrees of salt influence depending on topography and aspect. The braided channel network and associated vegetation has structural complexity at Twelve Mile Creek making it unique in the Fitzroy Delta (Bill Sawynok, pers. com.). More uniform and less structurally/hydrologically complex vegetation is more typical of saltmarsh at the terrestrial/estuarine interface in this region. Currently the land is freehold, partly managed for conservation (within the reserve) or leased for grazing or saltfields.

This paper highlights the value of the area for nature conservation and reports the results of a systematic survey conducted over 20 months which sought to record wetland-associated bird species that use the area. It also describes in further detail the structure of the wetland habitats and their associated ecotones especially the saltmarsh vegetation (RE 11.1.2b). Compared to fisheries values (e.g. Thomas and Connolly 2001), those of saltmarsh and saline flats as habitat for wetland birds in subtropical or tropical Australia are little known.

Other bird surveys conducted in the lower Fitzroy River floodplain and delta (in 1994 and 2003) (Houston & McCabe 1996, Jaensch 2004) have not focussed specifically on the Twelve Mile Creek area. Significant shorebird sites including Sandy Point in Corio Bay (Houston & Mitchell 1997) and the Fitzroy River floodplain and Delta (Houston & McCabe 1996, O'Neill & Houston, unpublished data) occur in the region. The 1994 census reported over 8,000 waterbirds from 11 sites within the Fitzroy Delta wetlands system. A fuller assessment of waterbird and shorebird values in the Fitzroy Delta (of a kind described in Bamford et. al. 2006) awaits a longer term study across its entirety.

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## METHODS

The saltmarsh habitat at Twelve Mile Creek (approximately 100ha) is very complex both structurally and hydrologically with a transition from freshwater riparian habitat adjacent to an upstream pool to a deep tidally influenced brackish to saline pool fringed by saltmarsh to an extensive saltmarsh area with a braided network of channels and depressions bordered by mixtures of salt tolerant grass, samphire and sedge.

Hydrologically, the creek grades from a freshwater riparian channel to a steep-sided 500m long brackish-saline pool (> 2 m depth) with a narrow band of saltmarsh vegetation and then to the extensive saltmarsh area where the channel loses definition as it discharges onto the marine plain. Here the creek forms a complex array of braided distributary channels and depressions that form pools during the wet season when the creek flows sufficiently strongly to reach this area. The brackish-saline pool is separated from the freshwater pool by a low (<1m) cement weir and is normally isolated from tidal influence except during the three to four highest tides of the year and when the creek flows following significant wet season rains in the catchment. Thus this upper marine plain area is inherently ecotonal in nature providing a complex array of niches and potential for wetland-associated birds to temporally exploit both fresh and saline systems depending on food availability. Also, the extensive grasslands lying within the alluvial land zone that abut these upper marine plain areas form a continuum with the saltmarsh grasslands and together provide important habitat for grassland-associated birds. Thus a holistic approach was taken with a view to surveying the saltmarsh habitat but also the ecotonal transition areas associated with the freshwater to brackish-saline channel and the adjoining grasslands.

Salinity was measured monthly with a field refractometer (BS Ellipse) within the deep brackish-saline pool and periodically within extensive pools in the saltmarsh area. As a guide to the influence of inundation events, the percentage fullness of the brackish-saline pool, including the area with muddy substrates was estimated (also known as the % active area, Houston & McCabe 1996).

Fifteen standard bird surveys were undertaken monthly from September 2004 to April 2006 with four months not sampled in 2005 (i.e. June, July, September and November). A standard survey comprised a targeted search of the freshwater creek pool, the brackish-saline creek pool and the saltmarsh with its associated shallow pools/saltpans. The same route was followed each time so that all the main habitats were encompassed, usually with two observers. Data has been archived with Birds Australia and the Queensland EPA WildNet database.

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## RESULTS

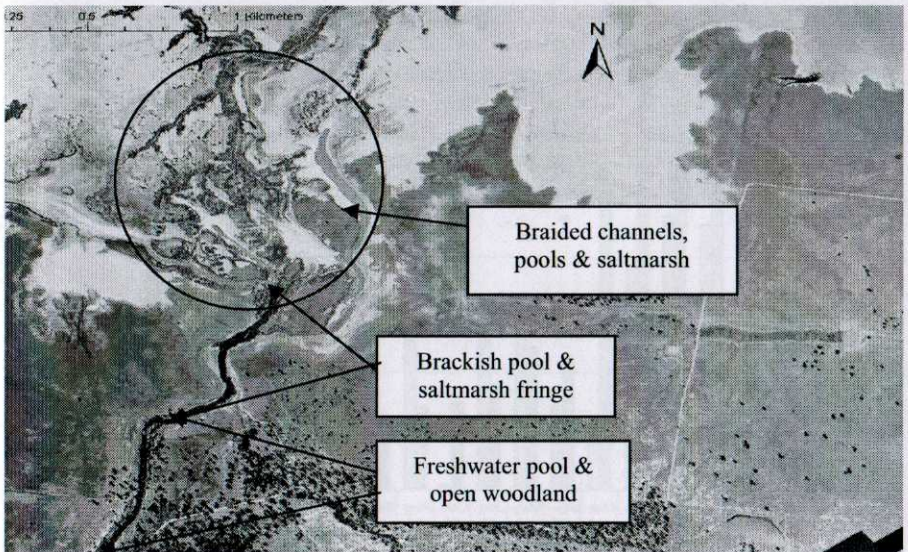
### Vegetation

The freshwater pool was lined with tall stands of Bullrush *Typha* sp., a club-rush *Schoenoplectus* sp., the Common Reed *Phragmites australis* and a sedge (Cyperaceae), and a water-lily *Nymphaea* sp. dominated its surface (coverage varied from 5% to 70%). A riparian woodland corridor along the freshwater pool was comprised of Forest Red Gum (*Eucalyptus tereticornis*) (including some mature trees with hollows), Poplar Box (*Eucalyptus populnea*) and Belah (*Casuarina cristata*).

The steep-sided brackish pool was lined with a (1 – 2 m wide) band of *S. littoralis* with occasional larger patches in shallow backwaters. *P. australis* is present, but only where protected from grazing on a small island in the brackish-saline pool. Muddy substrates become extensive as pools dry. In the north and west of the marine plain saltmarsh gives way to bare saltflats, while the southern and eastern margins support a mixture of terrestrial grasses and isolated shrubs on alluvial terraces comprised of a gradation from land zone 1 (marine plain) to land zone 3 (alluvial terraces).

Saltmarsh vegetation (up to 50 cm tall) was dominated by Marine Couch Grass (*S. virginicus*), and samphire species (*Halosarcia perangulata*, *Halosarcia indica*, *Sueda australis*, *Sesuvium portulacastrum*) with occasional shrubby mangroves (*Avicennia marina*, *Ceriops tagal*) along channels. After wet season inundation, Water Nymph *Najas tenuifolia* and Nardoo *Marsilea mutica* were often present within the braided pools.

**Figure 1:** The relationship between wetland components at Twelve Mile Creek.

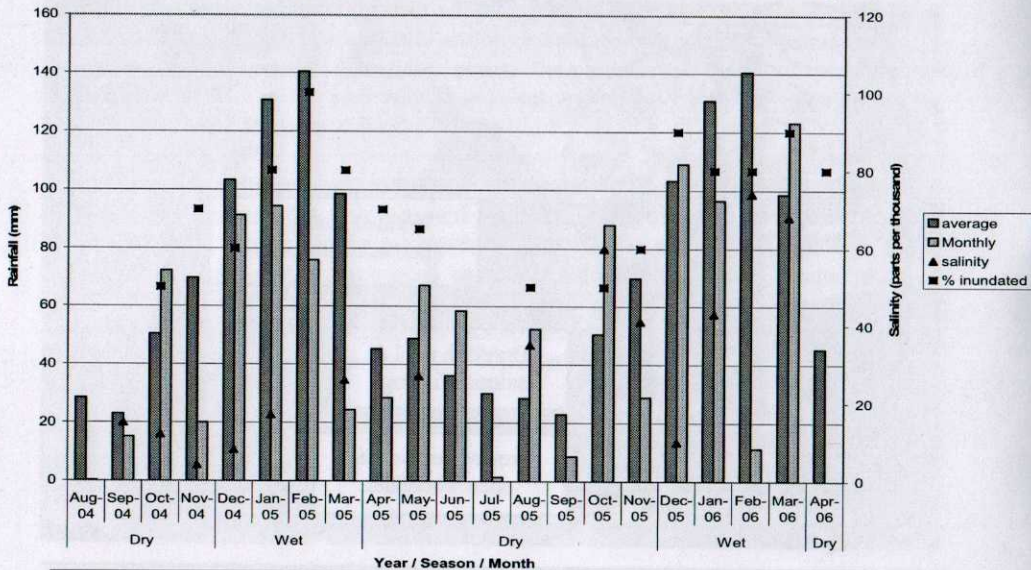


### Seasonal variation

Saltmarsh pools had evaporated completely by September 2004, refilled by February 2005 and then completely dried out again by August 2005. Re-filling of the pools in the saltmarsh area coincided with substantial wet season rains in December 2005 and extreme tidal events (See Figure 2). Salinity in the brackish-saline pool varied from 4 parts per thousand (ppt) in October 2004 to 74 ppt in February 2006 (See Figure 2). Downstream of the brackish-saline pool, salinities were generally greater in the shallow drying pools within the saltmarsh area where a maximum salinity of 80 ppt was recorded in February 2006. Less rain in the 2005-06 wet season reduced creek flows into the brackish – saltmarsh areas and thus salinities in the 2005-06 wet season at Twelve Mile Creek were greater than in 2004-05 (rainfall within the Twelve Mile Creek catchment in 2005-06 was lower than shown here for Rockhampton, Ian Christiansen pers. com.).

Salinity in the brackish-saline pool initially fell in response to runoff following storm rains in October 2004. Despite further rainfall and an increase in water level within the pool, a rise in salinity was observed in the months of December to February and this is likely to reflect input of estuary water (salinity of approximately 36 ppt) from the extreme high tide events that occur at this time of year. The same pattern was observed in the 2005-06 wet season when salinity fell following substantial wet season rain in the catchment and associated runoff in December 2005 but then rose rapidly probably as a consequence of tidal inputs, lower than average wet season rainfall and high evaporation rates.

**Figure 2: Rockhampton rainfall (columns) (Bureau of Meteorology) and changes in salinity and percentage inundation (symbols) of the brackish pool.**



**Bird Fauna**

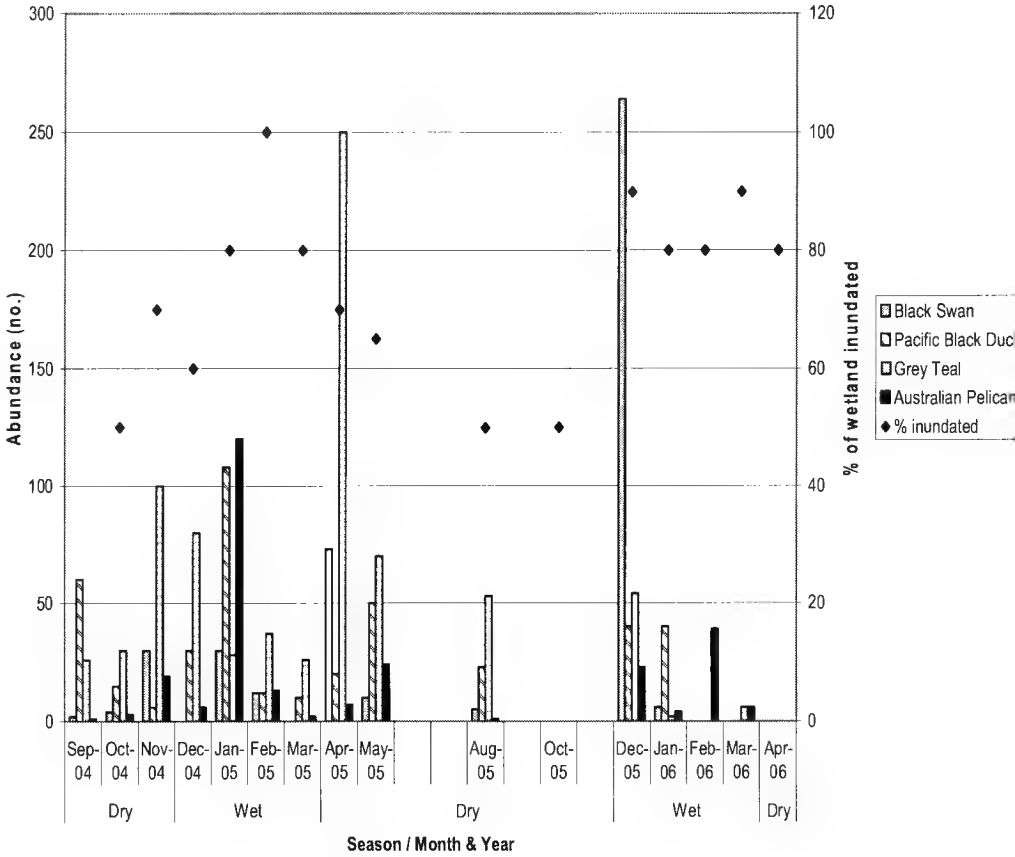
Birds were abundant between December and April. This period corresponded with maximum available water and also drying muddy margins within the extensive saltmarsh area providing feeding habitat for ducks and shorebirds respectively. Fish availability also peaked during this time (Marcus Sheaves pers. com.) providing food for fish-feeding birds such as cormorants and pelicans.

Sixty-four wetland-associated bird species were observed, 15 of which used only the freshwater pool upstream of the saltmarsh area (Table 1). The 49 saltmarsh associated species included grassland specialists and others such as Magpie-larks that are not normally regarded as wetland birds but are active around wetland edges with moist substrates. Fourteen shorebird species and two tern species were observed using the saltmarsh habitat.

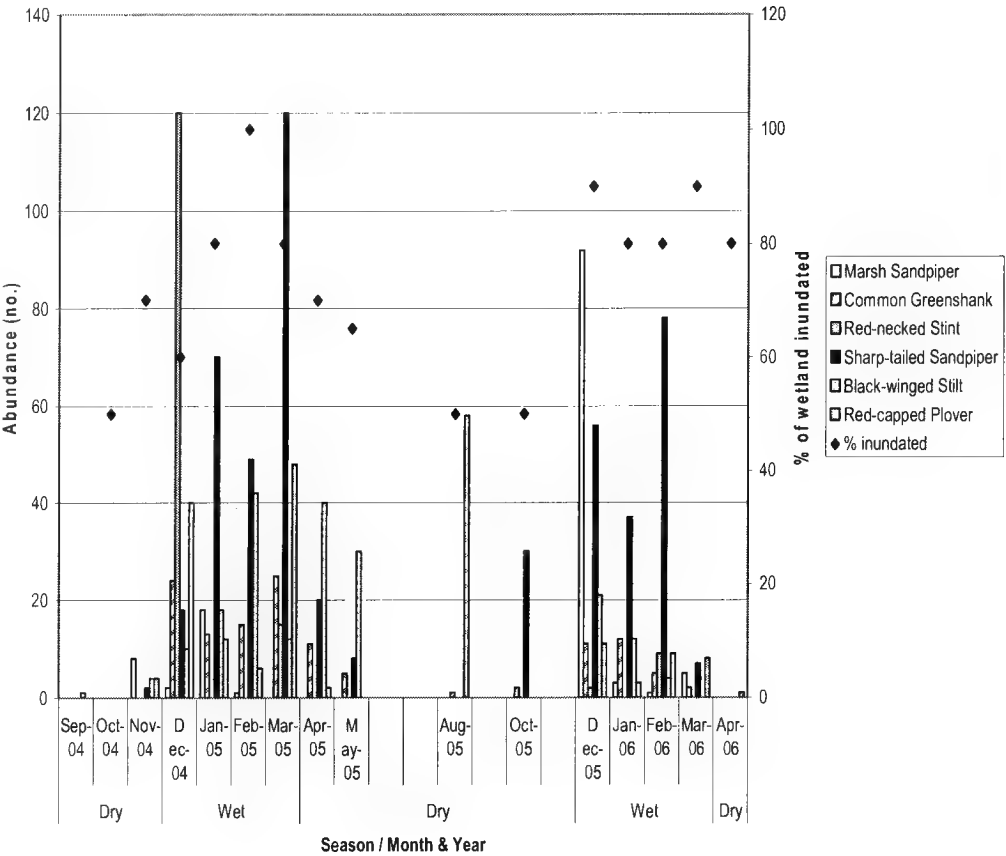
Dominant guilds by abundance were ducks and allies (49% of total birds observed), shorebirds and plovers (35%), and pelicans and allies (10%) and all exhibited a seasonal pattern of abundance at Twelve Mile Creek. Dominant species (those with monthly abundance > 50) included Black Swan, Pacific Black Duck, Grey Teal, Australian Pelican (Figure 3) plus several shorebirds – Marsh Sandpiper, Common Greenshank, Red-necked Stint, Sharp-tailed Sandpiper, Black-winged Stilt and Red-capped Plover (Figure 4).

Sharp-tailed Sandpiper, Common Greenshank, Marsh Sandpiper and Black-winged Stilt mainly fed, or sheltered, along edges of braided channels and pools within the saltmarsh. Red-capped Plover and Red-necked Stint were mainly associated with mudflats and shallow extensive pools. With the exception of Red-capped Plover, shorebirds were mainly present during October to April when surface water was present within the saltmarsh. Both Sharp-tailed Sandpipers and Common Greenshanks maintained relatively consistent numbers during the wet season but their numbers declined rapidly afterwards. Water in depressions and braided channels plus associated muddy margins was still present into April but relatively few shorebirds were present. A similar pattern was observed in the 2005-2006 wet season with no shorebirds present by April 2006 although the saltmarsh pools retained some water.

**Figure 3: Changes in the abundance of common wetland-associated birds at Twelve Mile Creek.**



**Figure 4: Changes in the abundance of common shorebirds at Twelve Mile Creek.**



**Bird Fauna**

Four wetland-associated bird species surveyed at Twelve Mile Creek are listed as rare or threatened species under the Nature Conservation (NC) Act 1992 in Queensland. Three are Rare; Radjah Shelduck (observed once), Cotton Pygmy-goose, Black-necked Stork and the fourth, Capricorn Yellow Chat is Vulnerable (also Critically Endangered under the EPBC Act 1999 (Figure 5). Thirty-one species are listed as Migratory under the EPBC Act 1999 including all the ducks, raptors and most of the shorebirds (Table 1).

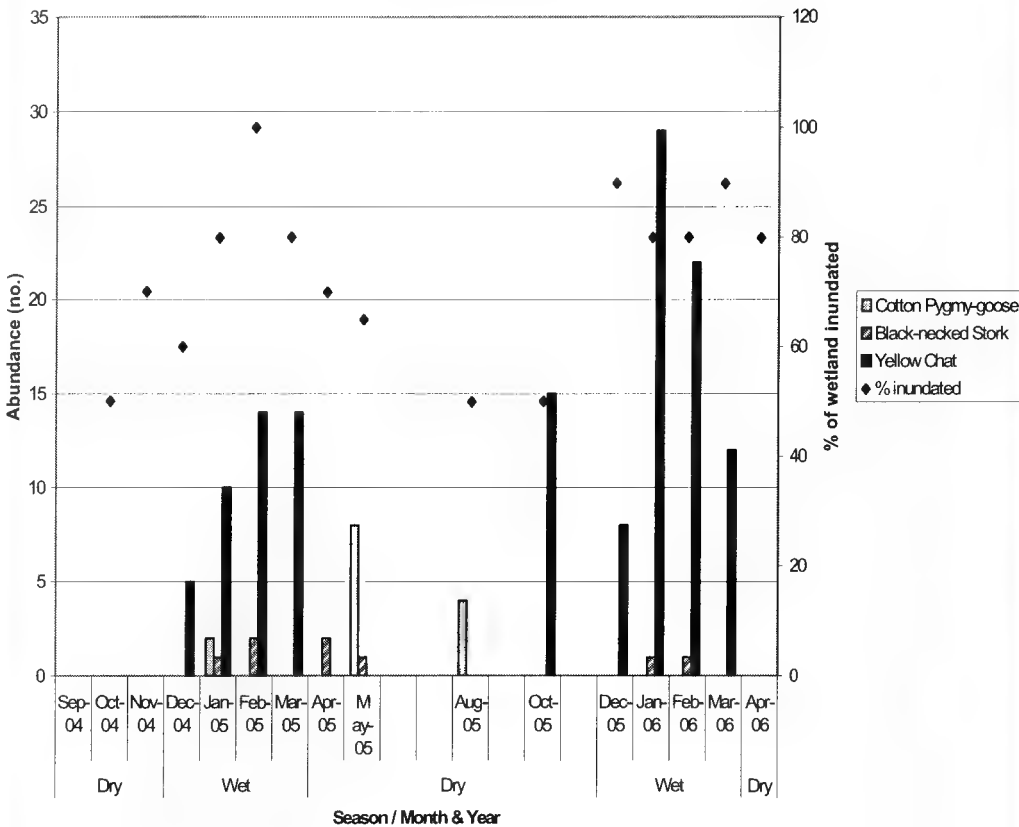
Yellow Chat bred in the saltmarsh area during the wet season of all 3 years of the survey (2004-06). Based on the presence of dependent young it is considered that a further two species, the Black-necked Stork in the saltmarsh area and the Cotton Pygmy-geese within the freshwater section, are likely to breed in or near the study area. A pair of immature Black-necked Stork was present from January to May 2005 and adults were observed in January and February 2006 indicating regular use of this area. Black-necked Stork ranged widely across the study area but were always associated with channels within the saltmarsh.

In late April 2004, an adult pair of Cotton Pygmy-geese and four half-grown young was observed in the freshwater pool swimming amongst a sparse cover of water-lilies (*Nymphaea* sp.). A maximum of 15 Cotton Pygmy-geese (in July 2004) have been observed at this site and much higher numbers (approximately 100) commonly occupy a freshwater storage just above tidal limits on Eight Mile Creek about seven kilometres to the north (unpublished data). A flock of 20 Glossy Black Cockatoo fed in Belah (*Casuarina cristata*) bordering the freshwater riparian area in December 2005. This species is also listed as Vulnerable under the NC Act 1992.

Other species which bred (i.e. with established nests within the saltmarsh area) were Black Swan, White-bellied Sea Eagle, Black-winged Stilt and Red-capped Plover, and Nankeen Night Heron which bred in the freshwater area. Breeding, or likely breeding, was observed for Golden-headed Cisticola, Richard's Pipit and Brown Songlark in the grasslands within and adjoining the saltmarsh, and Yellow-rumped Thornbill (nests from several years) and Bar-breasted Honeyeater in the riparian vegetation along the freshwater pool. The latter is a slight southern extension of their breeding range, formerly listed as Rockhampton (Higgins et. al. 2001).

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**Figure 5: Frequency of occurrence of rare of threatened birds at Twelve Mile Creek.**





**Table 1: Abundance, habitats and breeding status of species Surveyed (2004-2006).**

Bird Species	Abundance (max.)	Conservation Status, Habitat & Breeding Status
Plumed Whistling-Duck, <i>D. eytoni</i>	6	Mig, F, Immatures present (March 05)
Wandering Whistling-Duck, <i>D. arcuata</i>	8	Mig, Mar, F, B
Black Swan, <i>C. atratus</i>	264	Mig, F, B, Nesting B (Feb 05), Dependent young F (March 05)
Radjah Shelduck, <i>T. radjah</i>	2	R, Mig, Mar, B
Australian Wood Duck, <i>C. jubata</i>	3	Mig, F
Cotton Pygmy-goose, <i>N. coromandelianus</i>	15	R, Mig, F, Dependent young F (April 04)
Pacific Black Duck, <i>A. superciliosa</i>	108	Mig, F, B, Dependent young B
Grey Teal, <i>A. gracilis</i>	250	Mig, F, B, Dependent young B
Chestnut Teal, <i>A. castanea</i>	1	Mig, F
Hardhead, <i>A. australis</i>	16	Mig, F, B
Australasian Grebe, <i>T. novaehollandiae</i>	4	F, Dependent young F (March 05)
Darter, <i>A. melanogaster</i>	10	F, B
Little Pied Cormorant, <i>P. melanoleucos</i>	2	F, B
Pied Cormorant, <i>P. varius</i>	1	F
Little Black Cormorant, <i>P. sulcirostris</i>	20	F
Great Cormorant, <i>P. carbo</i>	1	B
Australian Pelican, <i>P. conspicillatus</i>	120	Mar, F, B
White-faced Heron, <i>E. novaehollandiae</i>	4	F, B
Little Egret, <i>E. garzetta</i>	3	Mar, F, B
Great Egret, <i>A. alba</i>	7	Mar, F, B
Intermediate Egret, <i>A. intermedia</i>	2	Mar, F
Striated Heron, <i>B. striatus</i>	1	B
Nankeen Night Heron, <i>N. caledonicus</i>	1	Mar, F, Dependent young F (Oct 05)
Black Bittern, <i>I. flavicollis</i>	2	F, B
Australian White Ibis, <i>T. molucca</i>	2	Mar, B
Straw-necked Ibis, <i>T. spinicollis</i>	1	Mar, F
Royal Spoonbill, <i>P. regia</i>	1	B
Yellow-billed Spoonbill, <i>P. flavipes</i>	1	B
Black-necked Stork, <i>E. asiaticus</i>	3	R, B, Dependent young B (Jan 05), Immatures B (April, May 05)
Brolga, <i>G. rubicunda</i>	4	Mig, F, B
Purple Swamphen, <i>P. porphyrio</i>	6	Mar, F
Dusky Moorhen, <i>G. tenebrosa</i>	14	F
Eurasian Coot, <i>F. atra</i>	2	F

Bird Species	Abundance (max.)	Conservation Status, Habitat & Breeding Status
Latham's Snipe, <i>G.hardwickii</i>	1	Mig, Mar, B
Marsh Sandpiper, <i>T.stagnatilis</i>	92	Mig, Mar, F, B
Common Greenshank, <i>T.nebularia</i>	25	Mig, Mar, F, B
Great Knot, <i>C.tenuirostris</i>	60	Mig, Mar, B
Red-necked Stint, <i>C.ruficollis</i>	500	Mig, Mar, B
Long-toed Stint, <i>C.subminuta</i>	1	Mig, Mar, B
Sharp-tailed Sandpiper, <i>C.acuminata</i>	500	Mig, Mar, F, B
Black-winged Stilt, <i>H.himantopus</i>	100	Mig, Mar, F, B, Nest found (Jan 06, Immatures B (Feb 05, Apr 05)
Red-capped Plover, <i>C.ruficapillus</i>	58	Mig, Mar, B, Nesting B (Feb 04, April 06)
Lesser Sand Plover, <i>C.mongolus</i>	6	Mig, Mar, B
Black-fronted Dotterel, <i>E.melanops</i>	3	Mig, F, B
Red-kneed Dotterel, <i>E.cinctus</i>	6	Mig, B
Banded Lapwing, <i>V.tricolor</i>	6	Mig, B
Masked Lapwing, <i>V.miles</i>	4	Mig, F, B
Caspian Tern, <i>S.caspia</i>	11	Mar, B
Whiskered Tern, <i>C.hybrida</i>	3	Mar, B
Whistling Kite, <i>H.sphemurus</i>	2	Mig, Mar, F, B
Brahminy Kite, <i>H.indus</i>	2	Mig, Mar, B
White-bellied Sea-Eagle, <i>H.leucogaster</i>	3	Mig, Mar, F, B, Nesting B (Aug 05), Immatures B (Nov 04, April 05)
Swamp Harrier, <i>C.approximans</i>	1	Mig, Mar, B
Azure Kingfisher, <i>A.azurea</i>	1	F
Yellow Chat, <i>E.crocea</i>	40	V, CE, B, Nesting B (Feb-Mar 04), Dependent young B (Feb-Mar 04, Feb-Mar 05), Displays B (Feb 04, 05), Immatures B (Mar 04, 05, Feb 06)
Magpie-lark, <i>G.cyanoleuca</i>	4	Mar, B
Clamorous Reed-Warbler, <i>A.stentoreus</i>	2	Mar, F
Little Grassbird, <i>M.gramineus</i>	1	B

Status: R = rare, V = vulnerable under the Nature Conservation Act 1992, CE = critically endangered, Mig = migratory species and Mar = marine listed species under the EPBC Act 1999, Habitat: F = freshwater, B = brackish-saline, G = grassland.

GRASSLAND / SALTMARSH ECOTONE		
Bird Species	Abundance (max.)	Conservation Status, Habitat & Breeding Status
Red-backed Fairy-wren, <i>M.melanocephalus</i>	40	G, B
Singing Bushlark, <i>M.javanica</i>	common	G, B, Displays G (summer-autumn)
Richard's Pipit, <i>A.novaeseelandiae</i>	common	Mar, G, B, Displays G/B (summer-autumn)
Brown Songlark, <i>C.cruentalis</i>	common	G, B, Displays G/B (summer-autumn)
Zitting Cisticola, <i>C.juncidis</i>	uncommon	G, B, Displays G/B (summer-autumn)
Golden-headed Cisticola, <i>C.exilis</i>	common	G, B, Nestling G (March-April 05), Displays

Status: R = rare, V = vulnerable under the Nature Conservation Act 1992, CE = critically endangered, Mig = migratory species and Mar = marine listed species under the EPBC Act 1999, Habitat: F = freshwater, B = brackish-saline, G = grassland.

## DISCUSSION

The survey demonstrated that together the saltmarsh and its associated ecotonal habitats at Twelve Mile Creek are of high nature conservation value and are a biodiversity 'hotspot' for birds. Three of the five rare or threatened species present breed in or adjacent to the saltmarsh and 31 migratory species, including 14 species of shorebirds, use it seasonally or in transit on migration. Breeding sites for some of the rare or threatened species present are very limited in central Queensland. Twelve Mile Creek is one of only three localities where Capricorn Yellow Chat breed broods in the region, only in the Fitzroy River barrage pool backwaters and several creeks (Houston et. al. 2004a, b, Jaensch et. al. 2004). Cotton Pygmy-geese have raised broods in the region, only in the Fitzroy River barrage pool backwaters and several creeks (Houston & McCabe 1996). Wetland habitats in the region have been altered in the last decade by the invasion of exotic ponded pasture grasses. The Twelve Mile Creek saltmarsh habitat is easily defined and if protected in its current state could provide a reliable breeding location for these species in the future.

The area is used seasonally by migrating shorebirds as a temporary refuge in which to rest and feed. In March 2004 the maximum estimated number (500) of Sharp-tailed Sandpipers present during their northwards migration exceeded the staging criterion (400 or 0.25% of the estimated flyway population) set for the flyway population of a long distance migrant (Bamford et. al. 2006). Longer term and more detailed studies of shorebirds throughout the Fitzroy Delta are required to fully assess the importance of Twelve Mile Creek. Similar coastal saltmarshes in northern New South Wales are also considered as important habitat for migrating Sharp-tailed Sandpipers (Smith 1991).

Compared to mangroves, greater amounts of coastal saltmarshes in the region are lost under industrial development (Duke et. al. 2003), perhaps because the ecological services they provide are perceived as less important. Nevertheless the regionally significant, unique saltmarsh vegetation and complex landforms at Twelve Mile Creek deserve greater protection.

The area provides breeding habitats for a wide range of terrestrial and wetland-associated birds. Although absent in the dry season, Yellow Chats breed regularly at Twelve Mile Creek (Houston et. al. 2004a) during the wet season. As at Curtis Island (Houston et. al. 2004b), the absence of fresh surface water did not appear to limit breeding but it may be necessary to maintain saltmarsh vegetation for breeding in the longer term.

The study area also contains mature eucalypts with hollows suitable for Cotton Pygmy-geese to breed adjacent to the freshwater pool containing water-lilies (*Nymphaea*) that would provide cover for ducklings. Black-necked Stork and their young were attracted to the saltmarsh in both the 2004-05 and 2005-06 wet seasons and may continue to use the area regularly. Regular breeding attempts were made by resident Red-capped Plovers and nomadic Black-winged Stilts. The saltmarsh at Twelve Mile Creek is classified as RE 11.1.2b characterised by salt-tolerant grasses, sedges and samphire rather than the bare open saltflat (RE 11.1.2a) dominating most coastal saline sites (RE 11.1.2) in the region. At Twelve Mile Creek this vegetation supports and shelters significant numbers of birds, including migrating shorebirds and it should be mapped and its faunal habitat values evaluated as a matter of priority.

Compared with 2005-06, the 2004-05 wet season saw greater numbers of migratory shorebirds visiting the study area, more rain and higher surface water salinities. Sharp-tailed Sandpipers dominated with > 50 individuals being recorded regularly in both years. They prefer the shallow edges of fresh or brackish wetlands (Higgins & Davies 1996) and were observed feeding at the margins of pools with salinities almost twice that of seawater.

Intuitively, nutrient gain and biological productivity in the saltmarsh should coincide with wet season surface water in-flows. All bird breeding observed in the study area followed substantial wet season rainfall. The health of saltmarsh may partly be dependent on topography and natural flushing with freshwater, and thus a reduction in freshwater flows may threaten the saltmarsh community. The importance of freshwater in-flows to the productivity and maintenance of the saltmarsh needs further investigation.

The unusual and dynamic juxtaposition of complex self-sustaining fresh and saline wetlands with associated grassland and riverine avifauna at Twelve Mile Creek warrants increased legislative protection from possible future industrial development in the Delta. Possible threats include future port expansion and expansion of salt harvesting. The tidally influenced land in this section of the Fitzroy River Delta is State land under Special Lease and Mining Lease tenures.

The sections within 400 m downstream from Twelve Mile Creek are not currently harvested for salt. Pipeline development associated with mineral processing in the Gladstone industrial area may affect habitat. Any future plans for development of the Delta should maintain, manage and protect the existing natural resources, including fisheries and wetland bird habitats.

Freehold grazing tenure covers most lands above high tide. The brackish-saline pool on Twelve Mile Creek is within a Camping and Water Reserve which is managed and used for grazing, as is land downstream from the Reserve where the creek spreads out into several saline distributary channels. The latter is breeding habitat for Yellow Chat. While samphire can be vulnerable to overgrazing (Loyn et. al. 1986), the current low to moderate stocking densities used at Twelve Mile Creek do not appear to threaten it.

Habitat security and protection at Twelve Mile Creek could be improved by: (i) informal landholder agreements, (ii) addition of the current leasehold grazing tenure to the existing reserve, (iii) securing both leasehold and adjacent freehold lands under appropriate conservation tenure such as a Nature Refuge under the provision of the Nature Conservation Act 1992, or (iv) establishment of a Conservation Park. The latter has the capacity to permit current land uses, including grazing, provided they are complimentary to the natural values. These options need to be explored in consultation with the current land owners/managers and the community.

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**THE BREEDING CYCLE OF A PAIR OF WEDGE-TAILED EAGLES  
*AQUILA AUDAX* IN SOUTH-EAST QUEENSLAND**

MAUREEN ALLOTT, MALCOLM ALLOTT AND  
NIKKI HATCHETT

**ABSTRACT**

The breeding cycle of a pair of Wedge-tailed Eagles *Aquila audax* was observed almost daily from nest-building to fledging of the juvenile near Kingaroy, south-east Queensland, in 2005. Both sexes shared incubation, which lasted 42 days. The nestling period lasted 87 days, and the post-fledging period lasted at least 3.5 months. In its first two weeks after fledging, the juvenile was often on the nest, feeding, or in the nest-tree, but by the end of its third week it ranged away from the nest and soared. From week 4 it was seen intermittently, and was often absent from the nest area, although it was seen occasionally in the nest area with the adult pair until 14 weeks after fledging.

**INTRODUCTION**

At the time of the summary by Marchant & Higgins (1993) there had been few determinations of the incubation and nestling periods of the Wedge-tailed Eagle *Aquila audax*, and surprisingly little study of its parental or post-fledging behaviour. Since then there has been one further published study, by Harder (2000) who determined approximate durations of the egg and nestling phases at three nests, and provided some observations on parental roles. Olsen (2005) stated the incubation period to be fixed at 42–43 days for each egg in a clutch.

In 2005 a pair of Wedge-tailed Eagles nested in view of a house, and this event provided an opportunity to monitor the progress of the breeding cycle and thus identify the laying, hatching and fledging dates. This paper reports on the duration of incubation, nestling and post-fledging phases of the cycle, and some behavioural aspects of these phases.

**STUDY SITE AND METHODS**

The events described here took place on the property 'Hillsdale Hideaway' B&B at Hillsdale (26°33'S, 151°55'E) near Kingaroy in south-eastern Queensland. The eagles' nest was about 350m from the house, and could be watched readily with the aid of binoculars and telescopes. The house is on a hill overlooking a valley, and higher than the trees in the valley, with a steep descent over rough terrain to the valley floor. An observation diary was kept, and the almost-daily record was supplemented by occasional visits by other birdwatchers. When fledging seemed imminent, in the last week of the nestling period, the nest was monitored frequently through the day from around 05:00 h.

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Both parent eagles were still in immature plumage. The female was larger and browner, with a blonde nape, and appeared to have a broader tail; the male was darker, but also had a pale nape. Laying, incubation and hatching were inferred from the adults' behaviour.

## RESULTS

Eagles were known on the property since June 2000. The newly built house was occupied on 22 December 2004, and from 26 December two eagles arrived and spent hours in the area for 2–3 days at a time, returning at weekly intervals to repeat the process. At that stage they did not perch in the future nest-tree, which was located on a ridge and higher than surrounding trees. This was a newly established nest-site, as there were no other nesting sites on the property. A previous nest-site was located on the neighbouring property owned by S. and H. Leask, approximately 1.6 km away; this nest was occupied for several years until it blew down in a storm.

The eagles occupied their breeding territory in April 2005, although they were not seen in the nest-tree at that stage. On 2 June there were two eagles, and through June and July they built a new nest in a large dead eucalypt in a back corner of the property, which is bushland with some very large trees (some dead). There were two other eagle nests in the area also being added to; these nests were 2–3 km apart and 5–6 km from the focal nest, and may have belonged to other pairs.

The focal pair of eagles appeared to mate on 25 June, with much wing-flapping; this behaviour was repeated on a subsequent day, in the same tree. Through the breeding cycle, the male had a favoured perching tree: a dead tree 75–80 metres from the nest-tree.

### **Incubation**

Laying appeared to take place around 9 July. On that date both adults were in the nest, then one remained, sitting. From 10 July incubation changeovers were observed, though the female performed most of the incubation duty. Through the incubation phase one or other adult was always on the nest, except on very warm days when both soared over the nest area for about half an hour around midday. Throughout this phase, fresh greenery was added to the nest. Sitting from 9 July to inferred pipping or hatching on 20 August gave an incubation period of 42 days.

### **Nestling period**

From the female's increased level of activity on the nest on 21 August, pipping or hatching appeared to have taken place. The female fed a downy white chick on 22 August. On 24 August there were two chicks, and by the end of the first week one was larger than the other; at feeding times one was vigorous and demanding, the other sitting low in the nest. Through week 1, the female was off the nest for periods of a few minutes (once 3 minutes) to collect food that the male apparently cached in a tree near the nest-tree. Greenery was added throughout the nestling phase, almost daily in the early stages (mostly by the female), until week 12. The only identifiable food item was a lizard brought by the female late in week 12.

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Early in week 2 a chick was pecking at sticks in the nest, and pecking and moving greenery; on day 12 it was moving around the nest. On day 16 the female was seen preening the chicks. At the end of that week, only one chick was in the nest and the remains of the other were found on the ground (scavenged by a fox).

In week 3 the surviving chick was left alone more, and the female perched with the male parent nearby; when the female was absent, the male was on his perch. At the end of the week she was on the nest for short periods, and was off soaring for an hour. On day 18 the chick appeared to peck at food in the nest before the female fed it.

In week 4 the chick was standing on the nest, and in week 5 it was large and downy. On day 28 the female brooded it in cold, windy weather. In week 6 the chick was flapping its wings, which had developed dark edges, and it had dark markings; through that week its wings became darker. By that stage the male was being seen less often around the nest.

In week 7 the eaglet developed brown wings, though its underwings were still downy. In week 8 it was downy with brown wings, and about half the size of the adults; it stretched its wings and flapped in the wind. In week 9 its tail was developing.

In week 10 the eaglet was dark (i.e. feathered), including the legs; on day 70 it was jumping and flapping across the nest. By the end of week 11 (on day 77) it was flapping a metre above the nest. In week 12 (day 78) it hovered above the nest briefly, and ventured onto a branch 1.5 m from the nest. Through this week it 'branched' further, to 5m above the nest on day 83, and flapped back to the nest. In week 13 it continued 'branching', to the top of the nest-tree on day 88, until it took its first flight from the nest-tree on 16 November. The nestling period thus lasted 87 days from inferred hatching.

### **Fledging**

From dawn until around midday on the fledging day the juvenile spent its time jumping and flapping in the nest, or between branches and the nest. After returning to the nest from a venture to a branch below the nest, at 13:15 h it launched from the nest and flew out over the valley, returning to a branch in the nest-tree. When an adult appeared, the juvenile took off again and flew higher than before, with the parent. Later in the afternoon the juvenile was back on the nest with the male, feeding. Still later, all three eagles were on a branch of the nest-tree.

### **Post-fledging period**

Through week 1 the juvenile was mostly in the nest-tree or on the nest, feeding. On day 6 it was flapping on the nest (as on the pre-fledging days), and on the evening of day 7 it apparently roosted on a branch above the nest.

In week 2 the juvenile was on the nest, sometimes feeding, on most days, but also soared with the adults (day 8) and was flushed from the ground, on a roadside (day 10).

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In week 3 it was also mostly on the nest (sometimes feeding) or a branch of the nest-tree, but was distant from the nest on day 18, absent from the nest area on day 19, and soaring on day 20.

In week 4 the juvenile was not seen at the nest all week, and was with the female on day 28. Thereafter, the juvenile was seen only intermittently. In week 6 it was feeding on the nest with the female (day 39), roosting in the nest-tree with both parents (day 40), and soaring well (day 42). In week 7 it was seldom seen, but was with the parents on day 47. In week 8 all three were near the nest on days 51 and 53.

Observations lapsed from mid-January 2006 (in the observers' absence, weeks 9–10) for almost a fortnight. On 25 February (14 weeks after fledging) all three eagles were near the nest, that occasion being the last sighting of the juvenile after it had been absent for several days. The post-fledging period thus lasted at least 3.5 months. During that period, the eagles were vocal when they returned to the nest area.

On 5 March 2006 an adult eagle performed an undulating display. On 21 April the adults landed on the nest and walked around on it before departing. On 24 April one walked around on the nest while the other perched in the tree above; similar behaviour was repeated on 2 May. Thus, by late April the adults were showing signs of starting the next breeding cycle.

## DISCUSSION

The results of this study are consistent with aspects of the Wedge-tailed Eagle's breeding biology and behaviour (e.g. parental roles, juvenile development) as summarised by Marchant & Higgins (1993) and Olsen (2005). For instance, the incubation, nestling and post-fledging periods are all within values previously obtained. Similarly, the incubation and nestling periods agree well with mean values (44 and 79 days respectively) obtained by Harder (2000).

This study adds a little to knowledge of the Wedge-tailed Eagle's post-fledging period. However, the juvenile's behaviour suggests the need for caution, or frequent monitoring, before concluding that a young eagle (or other raptor) has not yet fledged. Juveniles may fledge unobserved, and return to the nest over the ensuing days, behaving as if they had not fledged. Aspects of the juvenile eagle's behaviour in the nestling and post-fledging periods seem typical of the Wedge-tailed Eagle, so far as is known (cf. Marchant & Higgins 1993, Olsen 2005), and of other large *Aquila* species (cf. Gargett 1990, Watson 1997, Ferrer 2001).

There is scope for further observation of the breeding and post-fledging behaviour of this accessible and readily observable pair of Wedge-tailed Eagles, by members of Birds Queensland. Potential subjects for future study include parental time-budgets and prey delivery in the various stages of the cycle (nest-building, incubation, nestling period), collection and analysis of food remains and pellets under the nest and surrounding roost-trees, and the daily progress of juvenile eagles in the post-fledging period.

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