Bird Risk Assessment Model for Airports and Aerodromes

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Background

This risk assessment model has been prepared by Associate Professor David C. Paton, School of Earth and Biological Sciences, The University of Adelaide under contract to Adelaide Airport Ltd.

It aims to assist individual airports and aerodromes to assess the relative risk of aviation strike posed by bird species and provides a framework to underpin bird and wildlife management plans, as required in Appendix 1 to *Civil Aviation Safety Regulations 1998* subparagraph 139.095(a)(ii).

Section 10.14 of the Manual of Standards (MOS) 139 requires an airport where a bird hazard has been identified to have a bird and wildlife management plan. This plan, including any risk assessment, should be prepared by a suitably qualified person such as an ornithologist or biologist. Whilst this model has been prepared by an ornithologist, risk assessments developed for specific airports or aerodromes can nonetheless benefit from specialist input.

Template Revision History

Revision number	Revision date	Title	Prepared by
1	July 2008	A Generic Risk Assessment Tool for Ranking Bird Hazards at Individual Airports	The University of Adelaide
2	May 2009	Bird Risk Assessment Model for Airports and Aerodromes	Adelaide Airport Ltd
3	March 2010	Bird Risk Assessment Model for Airports and Aerodromes	Adelaide Airport Ltd

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Disclaimer

This Bird Risk Assessment Model for Airports and Aerodromes proposes a methodology for assessing the relative risk posed to aviation of bird species at an individual aerodrome. The model can be used by aerodrome operators as a framework to underpin a bird or wildlife hazard management plan.

Airport and aerodrome operators are advised to use the methodology detailed in this document, and analyse the results, at their own risk. No responsibility is accepted by the author and publishing parties for those who may use or rely on whole or any part of this model.

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Introduction

The purpose of this document is to outline a simple risk assessment model for assessing bird hazards at individual airports and aerodromes. This tool should allow airport and aerodrome operators to rank species and then focus their bird hazard reduction programs on those species presenting the greatest risk. The risk assessment involves assessing the probability of an event and the consequences when such an event happens. Incidents that have a high probability and or high consequences are regarded as being more hazardous than those with lower probabilities of occurrence and low consequences (Table 1).

The intention with this risk assessment model is to allow operators to identify the more hazardous species at their aerodrome and not to compare bird hazards between aerodromes. As such it is designed to aid and focus bird hazard reduction programs on the most hazardous species for that aerodrome. A more sophisticated approach would be required to compare bird hazards between aerodromes including information on amount of aircraft traffic, and the size, speeds and types of aircraft *et cetera* that use the airport.

The approach taken in the risk assessment is to assume that each aerodrome needs to identify those species that represent the greatest risk, irrespective of the absolute value of that risk. The philosophy behind this approach is two-fold. First, every aerodrome should be maintaining a targeted bird hazard management program irrespective of the number of strikes that might take place since there will always be some, albeit potentially very low risk of a strike. Second, in terms of meeting obligations to provide a safe operating environment, failing to have an effective and targeted management program may be regarded as negligent.

The likely consequences of a bird strike involving particular species of birds are related to the bird’s body mass, their flocking behaviour and flight behaviour, while the probability of a strike are likely to be related to the abundances of different bird species on or near an aerodrome. In many cases some measure of the likely probability of a bird strike involving a particular species can be taken directly from strike statistics. However the probability of a strike on any one aircraft movement is remote and so strike data may not provide the best estimate of the likelihood of a strike. Furthermore using strike data is a reactive approach in that species are only identified as a risk after they have been involved in one or more strikes.

Both quantitative and qualitative measures of abundances and strikes are used to rank probabilities of a species being involved in a strike at a particular airport since airports differ in the quality and quantity of information that they hold. In this way the tool is designed to take into account different levels of knowledge and available statistics for different airports.

The aim of this document is to provide guidelines and procedures for ranking species of birds on the likely severity (*consequence*) of those species being involved in a strike and the likelihood (*probability*) of those species being involved in a strike (Table 1).

Table 1. A simple probability x consequence matrix for assessing the severity of bird hazards at airports.

Consequence	**Probability**			
	Very High	**High**	**Medium**	**Low**
Extreme	extreme	extreme	very high	high
Very high	very high	high	high	medium
High	high	high	medium	medium
Medium	medium	medium	low	low
Low	low	low	negligible	negligible
Very low	negligible	negligible	negligible	negligible

Consequence of a Bird Strike

The consequences of a strike historically have been assessed in two ways (Paton 2007). One method uses information on the size and behaviour of birds to assess the likely consequences with larger species. Large species, species with a propensity to flock and species with slow and meandering flight generating greater consequences and higher severity scores, all other things being equal. A second method uses the proportion of recorded strikes involving a species that cause significant damage to aircraft or disruption to air services to measure likely consequences (Allan 2000, 2006; Allan *et al.* 2003; Barras & Wright 2002; Zakrajsek & Bissobette 2005). These methods of assessment, however, provide similar rankings for species, but there are some important differences.

From an airline's perspective there are two consequences that eventuate from bird hazards: (1) damage to the aircraft if a bird is struck; and (2) disruption to aircraft movements caused by delays. Both have economic and social costs, direct or indirect. Indirect impacts are those where aircraft movements are disrupted even without a strike, for example when pilots decide to delay take-off until a hazardous species has been dispersed.

The damage caused to an aircraft by a bird in a strike will depend on the body mass of the bird (determines the force of the impact) and flock density (and hence the number of birds that may be struck in the one incident). In developing a simple tool for the consequences of a strike, a simple scoring system is used to place birds into one of:

- six categories of body mass (Table 2),
- three categories of flocking behaviour (Table 3), and
- two categories of flight behaviour (Table 4).

These are then combined (the scores for three criteria are multiplied) to provide a consequence score (Table 5). The flight behaviour of birds (Table 4) is included in the consequences score because species that fly slowly, have meandering flight paths or change direction erratically (part of their anti-predator behaviour) will take longer to clear airspace used by aircraft. The consequence in this case is largely economic, in that such species will lead to longer delays if the birds have to be dispersed before aircraft movements resume. In considering the relative importance of the different criteria, larger body masses are disproportionately weighted in this scoring system.

Table 2. Simple ranking and scoring system for body masses of birds that may be involved in a bird strike.

Body Mass	Examples	Body Mass Score
< 20 g	Welcome Swallow	1
21-50 g	House Sparrow; Skylark	2
51-200g	Common Starling, Magpie-Lark, Nankeen Kestrel	4
201-1000g	Domestic Pigeon, Galah, Silver Gull, Australian Magpie, Masked Lapwing, small ducks	8
1-5 kg	White Ibis, Straw-necked Ibis, large duck	16
>5kg	Australian Pelican, Cape Barren Goose	32

Table 3. A simple ranking system to account for different flocking behaviours for bird species

Flock Size	**Examples**	**Flock Score**
Usually solitary or widely spaced	Nankeen Kestrel, Skylark,	1
Often in loose flocks	Australian Magpie, Little Raven, Magpie-Lark, Welcome Swallow, Silver Gull	2
Often in tight flock	House Sparrow, Galah, Little Corella, lorikeets, ducks, ibis,	4

Table 4. Flight behaviours of selected species of birds

Flight Behaviour	**Examples**	**Flight Score**
Rapid direct	Little Raven, Australian Magpie, ducks, ibis	1
Slow, meandering, erratic, hovering, manoeuvrable	Nankeen Kestrel, Galah, Common Starling, swallows, Magpie-Lark, Silver Gull, Australian Pelican, Masked Lapwing	2

Table 5. Categories of consequences based on consequence scores

Consequence Category	**Consequence Score***
Extreme	64-128
Very high	32
High	16
Medium	8
Low	4
Very low	1-2

*** = body mass score x flock score x flight score**

Probability of a Bird Strike

Two methods have been used to estimate the probability of a species being involved in a strike (Paton 2007). One method uses the abundances of a species at an airport; the more abundant species being more likely to be involved in a strike. For some species there is a clear relationship between abundance and numbers of strikes but for others the relationship is sometimes poor, and is affected by the ecology and behaviour of individual species. For example, a species that occurs in a flock may be less likely to have individual birds intruding into airspace compared to a solitary species having the same numbers of birds spread widely across the airport. So, the widely spaced species may be more likely to be struck but the flocking species if struck has more serious consequences, all other things being equal. Other differences in ecology (e.g. food preferences, use of different parts of an airport) will also influence the probability of a species being struck. In many cases this ecological information is lacking.

Since many aerodromes do not have good data or estimates of bird abundances an alternative has been used; the numbers of historical strikes (Allan 2000; Allan *et al.* 2003). In some cases these historical strikes are considered at the level of the aerodrome and measure the risk to the aerodrome or airport operator as opposed the flying passenger (Allan 2006). In others the strikes are assessed on a per aircraft movement basis (Barras & Wright 2002).

The probability of a bird strike on any one single flight, however, is remote. For example, at Adelaide and Parafield Airports there is less than one strike per 1,000 aircraft movements; and this rate is typical of many airports (Blokpoel 1976; Allan *et al.* 2003; Barras & Wright 2002). Assessments of the probability of a strike involving different bird species based on historical records of strikes involving that species might, by chance, fail to identify a potentially hazardous bird species until that species has been involved in not just one strike but several strikes, and at least one strike of consequence. The method is also not sensitive to changes in the avifauna at an airport and will fail to detect new hazards in a timely fashion to implement remedial actions. Some care is also required in using bird strike statistics in that a proportion of the reported bird strikes (as much as 10%) may fail to give the species involved or fail to identify the species correctly and so strike data are not perfect. Importantly using strike rate statistics alone is a reactionary approach while incorporating measures of abundance provides a proactive approach since they allow changes in risks to be detected and actions taken to address these before a significant strike event occurs.

When information on the abundances of birds *and* numbers of strikes involving a species is known then considering both of these provides a potentially more robust assessment. For the purposes of this risk assessment, the aim is to have a system that allows airport operators to identify the top 10 or so bird species that have a very high probability of being involved in a strike relative to other species of birds that are present at that airport, and not to derive an absolute percentage.

A generic tool for assessing the relative probability of a strike for an airport also needs to be able to account for the different qualities and types of information that may be available for an airport. Some airports will have large amounts of quantitative data others may have little background data.

For example, many smaller aerodromes may lack systematic counts of birds and so have limited quantitative data for scoring abundance, yet they may have some qualitative or observational data that allows them to rank species in terms of their relative abundances. A range of quantitative or qualitative criteria are listed in Table 6 and the intention is that any one or more of these can be used to rank species with respect to the probability of them being involved in a strike at an airport. The aim in this ranking system is to identify the species with the highest probability of being involved in a bird strike at a particular aerodrome and not to provide an absolute scoring system. As this is a relative measure of risks of a strike the listing of species into different categories (very high, high, medium and low) should aim to have 5-10 bird species falling into each of the two highest categories.

In using the criteria outlined in Table 6, a conservative or precautionary approach should be used and if species are ranked highly under one criteria and not another then the higher ranking criteria should be used to rank the species.

The following sections provide some discussion around the criteria listed in Table 6.

Data Used to Assess Probability

Where quantitative data exist the *relative abundance*, frequency of occurrence and or area of occurrence could be used to assist in ranking species. Relative abundance is straight forward in that it is simply the percentage of the total birds counted on the airport that is accounted for by that species, and those species accounting for >1% of all birds are given a “very high” rank. Two other criteria are also given.

The *frequency of occurrence* is simply a measure of the per cent of surveys or days that the species was detected on the airport, while the *area of occurrence* considers how widely dispersed a species is over an airport. Species which are more frequently present on an airport and/or widely dispersed over an airport are likely to be struck more frequently than those that are present only on some occasions or use only part of the airport *per se*. The likelihood that airports would have data in these two categories and not some measure of abundance is probably unlikely at present, but the purpose in identifying these as potential criteria to use in the future may aid airports to review their monitoring programs to allow opportunities to use these criteria as well. For example some of the difficulties of counting birds systematically over an airport may be overcome in the future by simply recording the presence of a species on different parts of the airport on a regular basis and using the frequency that the species is present.

A qualitative assessment of abundance and distribution could also be conducted. In Table 6, qualitative terms (many, most, some, few, occasional, etc) are used rather than quantitative values to categorize species. Up to four categories based around abundance, frequency of presence, widespread distribution and/or presence near runways. The latter could also be based on quantitative data if available, and assumes that species that aggregate near runways and flight paths are more likely to be involved in strikes.

No definition of the terms “many, most, often, some, few, occasional” are provided in part to allow aerodromes and airport operatores some flexibility in how these are defined. These terms are intended to be used in a relative sense rather than absolute sense. Where qualitative scoring is all that is possible ranking of bird species across the categories should result in 5-10 species in each of the highest two categories (i.e. very high, high, see Table 6). If on first attempt this qualitative approach does not provide such a result then the qualitative terms need to be adjusted to provide such an outcome.

A similar set of quantitative and qualitative criteria are proposed to allow species to be categorized based on knowledge of their involvement in strikes (Table 6). For the case of bird strikes, the highest category for a relative contribution to bird strikes is set at a higher percentage, in part reflecting the smaller total numbers of strikes (cf numbers of birds counted) and because with rare events some species may have elevated strike rates due to chance alone.

Table 6. Different methods of ranking species on the probability of those species being involved in a bird strike at a particular airport

Criteria	Very High	High	Medium	Low
Abundance				
Quantitative				
(a) relative abundance (% of total birds counted)	> 1	> 0.1	> 0.01	< 0.01
(b) frequency of occurrence (% surveys species scored)	> 75	50-75	25-50	< 25
(c) area of occurrence (% airport land used)	> 75	50-75	25-50	< 25
Qualitative				
(a) abundance	many	some	few	occasional
(b) frequency of occurrence	most	some	few	occasional
(c) area of occupation	most	some	few	occasional
(d) seen close to runways	often	some	occasionally	rarely
Bird Strikes				
Quantitative				
(a) relative frequency (% all strikes at airport)	> 5	1-5	0.1-1	< 0.1
Qualitative				
(a) apparent frequency	often	some	occasional	rare/none

Other Factors Influencing Probability

The above assessment of the relative likelihoods of species being involved in a bird strike is largely based on abundances or frequencies of events. Some species are rarely detected on airports but nevertheless are involved in strikes and these and other species are disproportionately involved in strikes relative to their abundance. Such species are often nocturnally active or have slow, erratic and or meandering flights. Where this information is known such species should be allocated to the next higher category of likelihood (Table 7). Similarly where information is available to suggest a species is increasing in abundance or the rate at which that species is involved in strikes (cf other species) is increasing, the species should be allocated to the next higher category. Similarly if abundances are known to be declining and or the involvement of that species in strikes is also declining then such species could be allocated to the next lower category. This allows some adjustment of the ranking system based on ecological information for individual species which is currently rarely taken into consideration.

In the above assessments, individual species may be ranked by a number of different criteria and if species are allocated to different categories based on the different criteria then the highest ranking criteria should take precedence. This is precautionary approach in that more species should fall into higher categories.

The end result of this process should lead to a suite of 10-20 species of birds being given high or very high scores for likelihood or probability of being involved in a strike. If fewer than 10 species have been identified in these two categories by this process then the assessment of likelihood of strikes should be repeated but with lower thresholds separating the different categories. These can then be combined with the consequences rank in the risk assessment table to determine the species that the airport should focus their management programs on (see Table 1).

Table 7. Additional factors to consider when ranking species on the likelihood of that species being involved in a strike. Where this is likely to increase risks the species should be allocated to the next higher category, and where this is likely to reduce risks to next lower category.

Other Bird Behaviours	Species Displays Attribute	Change in Category
Slow, erratic flight behaviour	yes	+ 1
Nocturnal flight activity	yes	+ 1
Trend of increasing abundance	yes	+ 1
Trend of decreasing abundance	yes	- 1
Trend of increasing strikes	yes	+ 1
Trend of decreasing strikes	yes	- 1

Timeframes

Throughout this assessment process no consideration has been given to the time lines over which an assessment of risk is conducted. However the above assessment process can be based on specific periods of the year (seasons) or over longer periods as the case may require.

Summary

The bird risk assessment model outlined in the above sections is aimed at providing airport and aerodromes operators with a simple method of documenting a risk assessment process for bird hazards at their facility. It uses information on the likely consequences and probabilities of strikes involving different species of birds at an airport or aerodrome and is aimed at helping operators identify the major bird hazards and to focus management on those species.

Once the risk assessment table (Table 1) is populated with bird species, decisions about the species on which the operator should focus future management will still be required. Species that fit in the extreme or very high categories (ie. top left-hand corner of the table) should be given priority.

The intention with this risk assessment is to define the species of greatest risk and *not* to determine the relative risks to aviation *between* different airports. The intent with this approach is that each and every airport and aerodrome will be able to rank species of birds and have a suite of species that are considered the most hazardous, irrespective of whether it experiences many or only a few if any strikes.

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Appendix 1
Bird Species Scores

Appendix 1: Bird Species Scores

Common Name	Scientific Name	Mass (g)	Mass Score	Flock Score	Flight Score	Hazard Score	Hazard Rank	Notes
Australian Bustard (M)	Ardeotis australis	6,900	32	1	1	32	vh	
Australasian Grebe	Tachybaptus novaehollandiae	220	8	1	1	8	l	rarely flies
Australasian Pipit	Anthyus novaeseelandiae	32	2	1	1	2	vl	
Australian Hobby (F)	Falco longipennis	290	8	1	1	8	m	
Australian Magpie	Gymnohina tibicen	330	8	2	1	16	h	
Australian Pelican	Pelecanus conspicillatus	5,500	32	2	1	64	ex	
Australian Pratincole	Stiltia isabella	65	4	2	1	8	m	
Australian White Ibis (M)	Threskiornis molucca	2,000	16	4	1	64	ex	
Australian Wood Duck	Chenonetta jubata	810	8	4	1	32	vh	
Baillon's Crake	Porzana pusilla	29	2	1	1	2	vl	
Banded Lapwing	Vanellus tricolor	185	4	2	1	8	m	
Barking Owl (F)	Ninox connivens	583	8	1	2	16	h	
Barn Owl	Tyto alba	355	8	1	1	8	m	
Black Falcon (F)	Falco subniger	850	8	1	1	8	m	
Black Kite (F)	Milvus migrans	625	8	1	2	16	h	
Black Swan (M)	Cygnus atratus	6,270	32	4	1	128	ex	
Black-faced Cuckoo-shrike	Coracina novaehollandiae	115	4	1	1	4	l	
Black-fronted (Dotterel) Plover	Elseyornis melanops	32	2	1	1	2	vl	
Black-shouldered Kite (F)	Elanus axillaris	290	8	1	2	16	h	
Black-tailed Native-hen (M)	Gallinula ventralis	410	8	4	1	32	h	rarely flies
Black-winged Stilt (M)	Himantopus himantopus	170	4	2	2	16	h	
Bourke's Parrot	Neopsephotus bourkii	42	2	2	1	4	l	
Brolga (M)	Grus rubicundus	6,700	32	1	2	64	ex	
Brown Falcon (F)	Falco berigora	625	8	1	1	8	m	
Brown Goshawk (F)	Accipiter fasciatus	570	8	1	1	8	m	
Brown Songlark (M)	Cincloramphus cruralis	74	4	1	1	4	l	
Budgerigar	Melopsittacus undulatus	26	2	4	1	8	m	
Cape Barren Goose	Cereopsis novaehollandiae	5,000	32	2	1	64	ex	
Caspian Tern	Sterna caspia	575	8	1	2	16	h	
Chestnut Teal (M)	Anas castanea	680	8	4	1	32	vh	
Clamorous Reed-Warbler	Acrocephalus australis	19	1	1	1	1	vl	
Cockatiel	Nymphicus hollandicus	94	4	2	1	8	m	
Collared Sparrowhawk (F)	Accipiter cirrhocephalus	220	8	1	2	16	h	
Common Blackbird	Turdus merula	92	4	1	1	4	l	
Common Starling	Sturnus vulgaris	80	4	4	1	16	h	
Crested Pigeon	Ocyphaps lophotes	205	8	1	1	8	m	
Crested Tern (M)	Sterna bergii	305	8	1	1	8	m	
Crimson Rosella	Platycercus elegans	135	4	2	1	8	m	
Curlew Sandpiper	Calidris ferruginea	57	4	4	2	32	h	
Darter	Anhinga melanogaster	1775	16	1	1	16	h	
Domestic Fowl (M)	Gallus gallus	1420	16	2	1	32	h	rarely flies
Domestic Pigeon (see Rock Dove)								
Dusky Moorhen (M)	Gallinula tenebrosa	570	8	1	1	8	l	rarely flies
Emu (F)	Dromaius novaehollandiae	37,500	32	2	1	64	ex	does not fly
Elegant Parrot	Neophema elegans	44	2	1	1	2	vl	
Eurasian Coot	Fulica atra	530	8	2	1	16	m	rarely flies
European Goldfinch	Carduelis carduelis	14	1	2	1	2	vl	
European Greenfinch	Carduelis chloris	27	2	2	1	4	l	
Fairy Martin	Hirundo ariel	11	1	2	2	4	l	
Flame Robin	Petroica phoenicea	13	1	1	1	1	vl	
Galah	Eolophus roseicapillus	330	8	4	2	64	ex	
Great Cormorant (M)	Phalacrocorax carbo	2400	16	2	1	32	vh	
Great Egret (M)	Ardea alba	970	8	1	1	8	m	
Grey Fantail	Rhipidura fuliginosa	8	1	1	2	2	vl	
Grey Teal (M)	Anas gracilis	500	8	4	1	32	vh	
Hardhead (M)	Aythya australis	900	8	4	1	32	vh	
Hoary-headed Grebe (M)	Poliocephalus poliocephalus	258	8	1	1	8	l	rarely flies
Horsfield's Bronze-cuckoo	Chrysococcyx basalis	23	2	1	1	2	vl	
House Sparrow	Passer domesticus	29	2	4	1	8	m	
Latham's Snipe	Gallinago hardwickii	190	4	2	1	8	m	
Laughing Kookaburra (F)	Dacelo novaeguineae	350	8	1	1	8	m	
Little Black Cormorant (M)	Phalacrocorax sulcirostris	1,100	16	4	1	64	ex	
Little Button-quail (F)	Turnix velox	54	4	1	1	4	l	
Little Corella (M)	Cacatua samguinea	560	8	4	1	32	vh	

Common Name	Scientific Name	Mass (g)	Mass Score	Flock Score	Flight Score	Hazard Score	Hazard Rank	Notes
Little Eagle (F)	Hieraaetus morphnoides	1030	16	1	2	32	vh	
Little Egret	Ardea garzetta	330	8	1	2	16	h	
Little Grassbird	Megalurus gramineus	13	1	1	1	1	vl	
Little Pied Cormorant (M)	Phalacrocorax melanoleucos	800	8	2	1	16	h	
Little Raven	Corvus mellori	530	8	2	1	16	h	
Little Tern	Sterna albifrons	54	4	1	1	4	l	
Little Wattlebird (M)	Anthochaera chrysoptera	75	4	1	1	4	l	
Long-billed Corella (M)	Cacatua tenuirostris	590	8	4	2	64	ex	
Magpie Goose (M)	Anseranas semipalmata	2,800	16	4	1	64	ex	
Magpie-lark (M)	Grallina cyanoleuca	92	4	2	2	16	h	
Mallard (M)	Anas platyrhynchus	1,735	16	4	1	64	ex	
Masked Lapwing	Vanellus miles	360	8	2	2	32	vh	
Musk Lorikeet	Glossopsitta concinna	76	4	2	1	8	m	
Nankeen Kestrel (F)	Falco cenchroides	185	4	1	2	8	m	
Nankeen Night Heron	Nycticorax calendonicus	800	8	1	2	16	h	
New Holland Honeyeater (M)	Phylidonyris novaehollandiae	22	2	1	1	2	vl	
Noisy Miner (M)	Manorina melanocephala	65	4	1	1	4	l	
Osprey (F)	Pandion haliaetus	1,500	16	1	2	32	vh	
Pacific Black Duck (M)	Anas superciliosua	1,120	16	4	1	64	ex	
Pacific Black Duck/Mallard Hybrid	Anas sp.	~1400	16	4	1	64	ex	
Pacific Golden Plover	Pluvialis fulva	150	4	4	1	16	h	
Pacific Heron (see White-necked Heron)								
Pallid Cuckoo	Cuculus pallidus	88	4	1	1	4	l	
Peregrine Falcon (F)	Falco peregrinus	890	8	1	1	8	m	
Pied Cormorant (M)	Phalacrocorax varius	1950	16	2	1	32	vh	
Pink-eared Duck (M)	Malacorhynchus membranaceus	410	8	4	1	32	vh	
Purple Swamphen (M)	Porphyrio porphyrio	1090	16	1	1	16	l	rarely flies
Purple-crowned Lorikeet	Glossopsitta porphyrocephala	45	2	2	1	4	l	
Rainbow Lorikeet	Trichoglossus haematodus	125	4	2	1	8	m	
Red Wattlebird (M)	Anthochaera carunculata	114	4	2	1	8	m	
Red-capped Plover	Charadrius rufficapillus	38	2	2	1	4	l	
Red-kneed Dotterel	Erythrogonys cinctus	53	4	1	1	4	l	
Red-necked Stint	Calidris ruficollis	27	2	4	2	16	l	
Richard's Pipit (see Australasian Pipit)		26	2	1	1	2	vl	
Rock Dove	Columba livia	310	8	4	2	64	ex	
Royal Spoonbill (M)	Platalea regia	1,885	16	2	1	32	vh	
Rufous Songlark (M)	Cincloramphus mathewsi	35	2	1	1	2	vl	
Sanderling	Calidris alba	60	4	4	2	32	vh	
Sharp-tailed Sandpiper (M)	Calidris acuminata	75	4	4	2	32	vh	
Short-tailed Shearwater	Puffinus tenuirostris	550	8	2	1	16	l	only likely near breeding colonies
Silver Gull (M)	Larus novaehollandiae	325	8	4	2	64	ex	
Silvereye	Zosterops lateralis	11	1	2	1	2	vl	
Singing Honeyeater (M)	Lichenostomus virescens	28	2	1	1	2	vl	
Skylark	Alauda arvensis	38	2	1	2	4	l	
Southern Boobook (F)	Ninox novaeseelandiae	300	8	1	1	8	m	
Spotless Crake (M)	Porzana tabuensis	45	2	1	1	2	vl	rarely flies
Spotted Harrier (F)	Circus assimilis	670	8	1	2	16	h	
Spotted Turtle-dove	Steptopelia chinensis	160	4	1	1	4	l	
Straw-necked Ibis (M)	Threskiornis spinicollis	1,465	16	4	1	64	ex	
Stubble Quail (F)	Coturnix pectoralis	105	4	1	1	4	l	
Sulphur-crested Cockatoo	Cacatua galerita	790	8	2	2	32	vh	
Superb Fairy-wren	Malurus cyaneus	10	1	2	1	2	vl	
Swamp Harrier (F)	Circus approximans	870	8	1	2	16	h	
Tree Martin	Hirundo nigricans	15	1	2	2	4	l	
Wedge-tailed Eagle (F)	Aquila audax	3,950	16	1	2	32	vh	
Welcome Swallow	Hirundo neoxena	15	1	2	2	4	l	
Whiskered Tern (M)	Chlidonias hybridus	90	4	2	2	16	h	
Whistling Kite (F)	Haliastur sphenurus	910	8	1	2	16	h	
White-bellied Sea-Eagle (F)	Haliaeetus leucogaster	3,200	16	1	2	32	vh	
White-browed Woodswallow	Artamus superciliosus	35	2	2	2	8	m	
White-faced Heron (M)	Ardea novaehollandiae	600	8	1	2	16	h	
White-fronted Chat	Epthianura albifrons	13	1	2	1	2	vl	
White-necked Heron	Ardea pacifica	880	8	1	2	16	h	
White-plumed Honeyeater (M)	Lichenostomus penicillatus	20	1	1	1	1	vl	
White-winged Fairy-wren	Malurus leucopterus	8	1	2	1	2	vl	
Willie Wagtail	Rhipidura leucophrys	20	1	1	1	1	vl	
Yellow-billed Spoonbill	Platalea flavipes	1,820	16	2	1	32	vh	
Yellow-rumped Thornbill	Acanthiza chrysorrhoa	9	1	2	1	2	vl	
Yellow-tailed Black-cockatoo	Calyptorhynchus funereus	700	8	2	2	32	vh	