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Australian aviation wildlife strike statistics

2006 to 2015

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Addendum

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Safety summary

Why we have done this report

Occurrences involving aircraft striking wildlife, particularly birds, are the most common aviation occurrence reported to the Australian Transport Safety Bureau (ATSB). Strikes with birds continue to be a potential safety risk and present a significant economic risk for aerodrome and airline operators. The aim of the ATSB's statistical report series is to provide information back to pilots, aerodrome and airline operators, regulators, and other aviation industry participants to assist them with managing the risks associated with bird and animal strikes. This report updates the last edition published in 2014 with data from 2014 – 2015.

What the ATSB found

Between 2006 and 2015, there were 16,069 birdstrikes reported to the ATSB, most of which involved high capacity air transport aircraft. Both the number and rate of birdstrikes per 10,000 movements in high capacity operations have increased markedly in the past two years 2014 – 2015. In contrast, the number of birdstrikes in low capacity operations and general aviation has remained relatively consistent. In the two years since 2013, the rates for six of the ten major airports have increased relative to ten year averages. The largest increase in the rate of birdstrikes was observed at Cairns, Canberra, Darwin, Gold Coast and Sydney.

Domestic high capacity aircraft were those most often involved in birdstrikes, and the birdstrike rate per aircraft movement for these aircraft was significantly higher than all other categories. The number of engine bird ingestions for high capacity air transport operations had been increasing until 2011, but has since decreased slightly. Still, about one in ten birdstrikes for turbofan aircraft involved a bird ingested into an engine.

The four most commonly struck types of flying animal in the 2014 to 2015 period were: bats/flying foxes, Swallow/Martins, Kites, and Lapwings/Plovers. Swallows and Martins had the most significant increase in the number of reported birdstrikes per year in the last two years, with these species being involved in an average of 96 birdstrikes per year for 2014 and 2015 compared with 65 per year on average across the entire 10-year reporting period. Galahs were more commonly involved in birdstrikes of multiple birds, with more than 38 per cent of Galah strikes involving more than one Galah. However, larger birds were more likely to result in aircraft damage.

This report presents a new species mass analysis which estimates that over the ten years between 2006 and 2015, 766 kg of flying animals were struck per year by aircraft in Australia. Additionally, for every 1 kg increase in animal mass, the likelihood of a birdstrike causing damage increases by 12.5%.

Compared to birdstrikes, ground-based animal strikes are relatively rare. The most common animals involved were hares and rabbits, kangaroos, wallabies, and dogs / foxes. Damaging animal strikes mostly involved kangaroos, wallabies and livestock.

Safety message

Australian aviation wildlife strike statistics provide a reminder to everyone involved in the operation of aircraft and aerodromes to be aware of the hazards posed to aircraft by birds and non-flying animals. Timely and thorough reporting of birdstrikes is paramount. The growth of reporting to the ATSB that has been seen over the last 10 years has helped to better understand the nature of birdstrikes, and what and where the major safety risks lie. This assists the aviation industry to better manage their safety risk. Over the ten years from 2006 to 2015, 42% of all birdstrikes reported to the ATSB contained no species information. The more accurately this information is provided to the ATSB, the more accurate and useful reports like this one will be.

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1. Context

Each year, the Australian Transport Safety Bureau (ATSB) receives accident and incident notifications from pilots, airlines, aerodrome personnel, air traffic control and others involved in the aviation industry. The reporting of these aviation accidents and incidents, collectively termed occurrences, assists the ATSB in monitoring safety through its core function of independent investigation and the analysis of data to identify emerging trends.

The Transport Safety Investigation Regulations 2003 provide a list of matters reportable to the ATSB.[1] One routine reportable matter has been a collision with an animal, including a bird, for:

- all air transport operations (all bird and animal strikes), and
- aircraft operations other than air transport operations when the strike occurs on a licensed aerodrome.

In addition to the above, all accidents[2] are immediately reportable to the ATSB, and all occurrences involving injury or difficulty controlling the aircraft (including from a bird or animal strike) are reportable matters for all operation types.

A significant proportion of all occurrences reported to the ATSB involve aircraft striking wildlife, especially birds. Wildlife strikes represent an ongoing challenge to the aviation industry. Birds and other animals are hazards to aviation that will always be present and so need to be managed, both in terms of reducing the likelihood of a wildlife strike and reducing the consequences of strikes that occur.

For the purposes of this report, birdstrikes refer to strikes from all flying animals, including bats and flying foxes, while animal strikes refer to strikes from all flightless animals, including flightless birds such as emus and cassowaries.

This report provides aviation birdstrike and animal strike occurrence data for the period 1 January 2006 to 31 December 2015. It should be noted that some data may vary when compared with the previous *Australian aviation wildlife strike statistics* report from 2004 to 2013 due to ongoing quality improvements in ATSB data.

The *Australian aviation wildlife strike statistics* report aims to give industry an insight into the number, locations, and types of wildlife strikes in Australia, and describe characteristics of the common birds and animals involved, and the consequences of these strikes. This is the fourth edition of this report. Chapters 3 to 7 detail birdstrike occurrences, while chapter 8 summarises animal strikes. In response to increasing industry interest, a new chapter was added to the last report (chapter 9) which summarises occurrences involving insects. Due to positive industry feedback and ongoing industry interest, this chapter has been retained for the current report.

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1 Available from the ATSB internet site: http://www.atsb.gov.au.

2 Accident refers to aviation occurrences where (a) a person dies or suffers serious injury, (b) the aircraft is destroyed or seriously damaged; or (c) other property is destroyed or seriously damaged.

2. Data sources

2.1 ATSB Occurrence data

Birdstrike and animal strike occurrence data used in this report have been reported to the Australia Transport Safety Bureau (ATSB) under the provisions of the Transport Safety Investigation (TSI) Regulations 2003. Only actual birdstrikes are included in the report as these are reportable occurrences under the TSI Regulations. This includes birdstrikes reported by pilots that have not been independently verified by aerodrome staff or an engineering inspection. Near strikes with birds or other animals are not reportable matters under the TSI Regulations and are not included in this report. Birdstrike occurrence statistics are updated and published biennially by the ATSB, and can be subject to change pending the provision of new information to the ATSB. When using these statistics, it is important to remember that occurrence data is provided to the ATSB by responsible persons as defined in Part 2.5 of the Regulations. The ATSB accepts no liability for any loss or damage suffered by any person or corporation resulting from the use of these statistics.

Wildlife descriptors and grouping

Bird and animal types have been grouped by similar species rather than reporting data on specific species. Type groupings were defined by grouping birds and animals of similar species, size, and/or appearance. These groupings were done because similar birds are often reported to the ATSB as an incorrect species. A complete list of bird and animal types is included in Appendix A on page 68.

For the purpose of this report, the birdstrike data included all flying animals - including bats and flying foxes. Animal strikes were considered to involve all non-flying animals, including flightless birds (emus and cassowaries for example).

Using the bird ingestion (into an engine) requirements outlined in the US Federal Aviation Regulations (FAR) 33.76 as a guide, new bird size categories are used in this report. The new bird size categories are below, and discussed in further detail in section 5.3.

- small bird: up to and including 85 grams (0.085 kg)
- medium bird: greater than 0.085 kg and up to and including 1.15 kg
- large bird: greater than 1.15 kg and up to and including 3.65 kg
- very large bird: greater than 3.65 kg.

Animal sizes remain unchanged for this report, typical sizes were:

- small animals - rabbit/hare, lizards
- medium animals - wallabies, foxes/dogs
- large animals - cattle, kangaroos.

Location data

Birdstrikes are sometimes identified during a pre, or post-flight inspection, where the previous flight crew had no knowledge of striking a bird. In these cases, the location of the birdstrike has been set to unknown, rather than at the aerodrome where the inspection was carried out. In this report, 1,114 records were identified as having an unknown birdstrike location and as such have been excluded from location reporting.

The proximity of the aerodrome to a birdstrike has been coded as either:

- within the aerodrome confines
- 5 to 15 km from the aerodrome

- more than 15 km from the aerodrome.

Operation types

Some of the data presented throughout this report have been arranged into operation types. This applies only to data where the aircraft involved in the birdstrike was known. The operation types used were:

- *high capacity air transport* – includes regular public transport (RPT) and charter operations on aircraft certified as having a maximum capacity exceeding 38 seats or a maximum payload exceeding 4,200 kg
- *low capacity air transport* – includes all RPT and charter operations on aircraft other than high capacity
- *general aviation* – all aerial work, flying training, and private, business, and sport (including gliding and ballooning) aviation, and recreational (non-VH registered) aviation (including ultralights and trikes)
- *military* – all military operations.

2.2 Aircraft movements

Aircraft movements were defined as a take-off, a landing, or a circuit. Therefore, an aircraft completing a single sector will have two movements recorded, one for take-off and one for landing. Aircraft movements are used in this report as the normalising variable for all wildlife strike rate calculations.

Bureau of Infrastructure, Transport and Regional Economics (BITRE) data

Aircraft movement information by operation type, weight category, and engine type was provided to the ATSB by the Bureau of Infrastructure, Transport and Regional Economics.

Movements were calculated by doubling the number of recorded departures, except in the case of international movements, where arrival and departure information was used.

There are slight differences between the total number of movements when split by each of these categories due to departures being used to calculate movements by operation type, and the combination of arrivals and departures being used to calculate movements by weight category and by engine type.

Airservices Australia data

Movement data by aircraft weight category for specific aerodromes was obtained from movement data published by Airservices Australia.[3]

[3] Located at website: http://www.airservicesaustralia.com/publications/reports-and-statistics/ (Airservices Australia data used in this report was current at the time of writing (August 2016)).

3. Birdstrikes across Australia

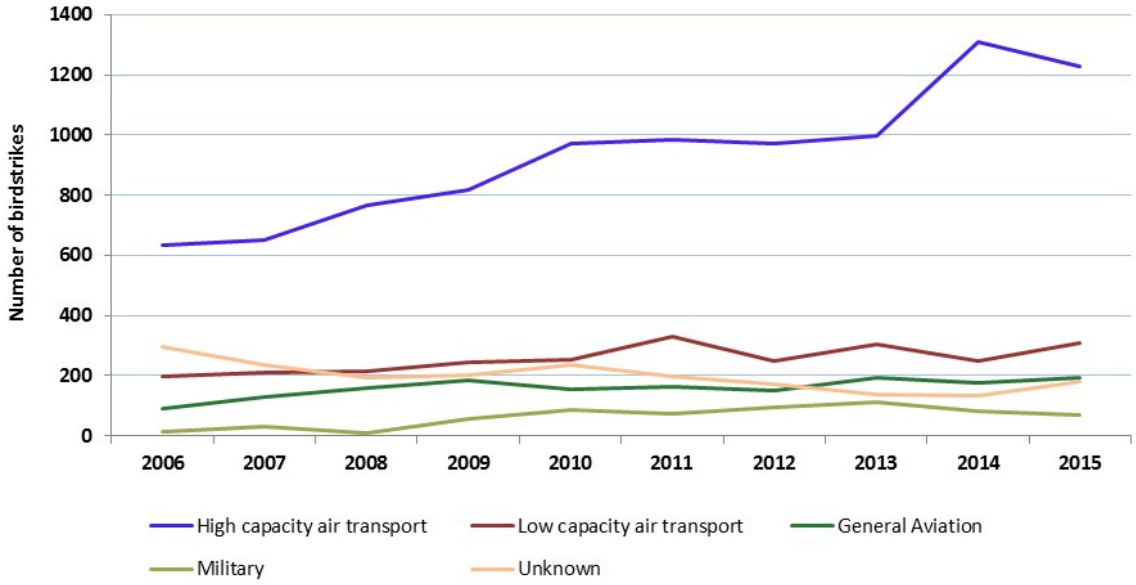
3.1 Birdstrikes by operation type

The number of birdstrikes reported to the ATSB by year and operation type is shown in Table 1 and Figure 1 below. Over the ten years between 2006 and 2015, 16,096 birdstrikes were reported to the ATSB. On average the total number of reported birdstrikes per year has continued to increase over the ten year study period, although there has been a considerable increase in birdstrike reports in the most recent two years (2014 – 2015). Between 2006 and 2015, the number of reported birdstrikes has also increased for each individual operation type, with the exception of the unknown group (generally from aerodrome operator reports of finding bird remains), which could be indicative of an increase in the quality of data reported to the ATSB. Although all operational groups have increased in birdstrike reports, the most significant increase in recent years is observed in high capacity operations.

Table 1: Number of birdstrikes per year by operation type

Operation Type	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
High capacity air transport	632	650	766	819	970	984	972	998	1,308	1,227
Low capacity air transport	198	211	213	246	254	332	248	304	247	307
General Aviation	91	130	158	185	153	162	152	193	178	193
Military	15	30	10	57	86	73	97	111	81	71
Unknown	298	237	192	201	237	197	172	139	132	179
Total	**1,234**	**1,258**	**1,339**	**1,508**	**1,700**	**1,748**	**1,641**	**1,745**	**1,946**	**1,977**

Figure 1: Number of birdstrikes per year by operation type, 2006 to 2015



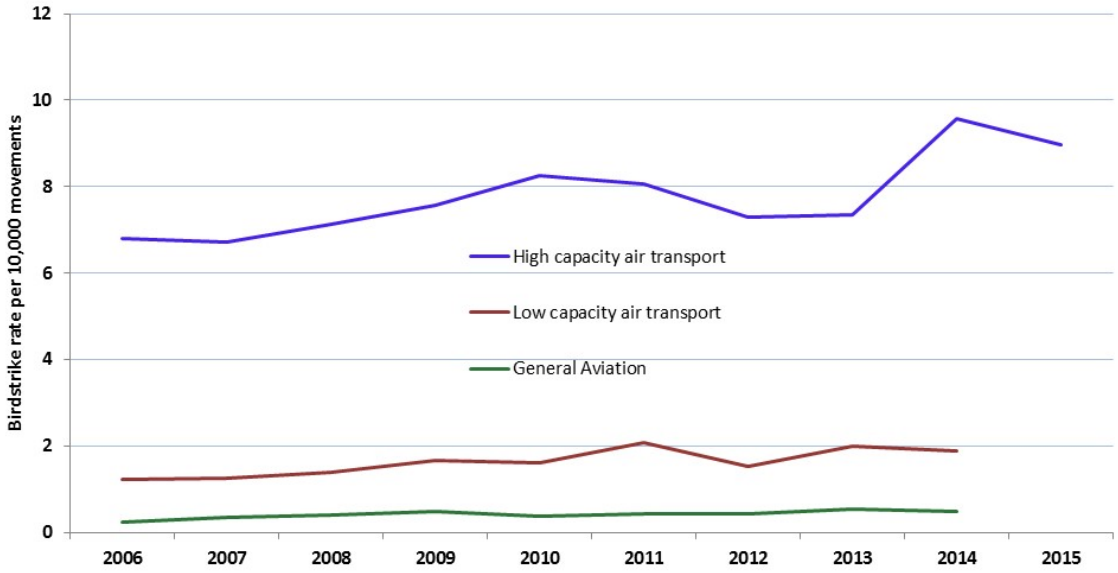
The rate of birdstrikes per 10,000 aircraft movements is shown in Table 2 and Figure 2. High capacity air transport aircraft continue to have a significantly higher birdstrike rate than all other operation types. It is likely that the speed and size of these aircraft, longer take-off and landing rolls, and large turbofan engines are factors contributing to the higher rate. Additionally, the rate

for high capacity operations has increased markedly in the past 2 years, to a ten-year high in 2014 of 9.57 birdstrikes per 10,000 movements before deceasing slightly in 2015 to 8.96 per 10,000 movements. Birdstrike rates for low capacity aircraft jumped to a 10 year maximum in 2011 before decreasing slightly in 2012 and returning to near 2011 levels by 2013. General aviation birdstrike rates have not significantly changed but rather very gradually increased over most of the past ten years to its maximum in 2013 of 0.53 per 10,000 movements, before decreasing slightly in 2014.

Table 2: Birdstrike rate per 10,000 movements per year by operation type[4]

Operation Type	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
High capacity air transport	6.8	6.73	7.13	7.58	8.26	8.05	7.3	7.35	9.57	8.96
Low capacity air transport	1.23	1.26	1.38	1.67	1.6	2.09	1.53	1.99	1.89	--
General Aviation	0.25	0.36	0.4	0.5	0.38	0.44	0.43	0.53	0.48	--

Figure 2: Birdstrike rate for fixed-wing aircraft (per 10,000 movements) per year by operation type, 2006 to 2015



Hawker Beechcraft Kingair B350 multiple Galah strike on take-off - Military

During the take-off roll from East Sale Aerodrome, Vic, the captain observed several Galahs pass over the left wing. The captain initially believed the birds had not impacted the aircraft but elected to abort the take-off. The aircraft was back-tracked along the runway for an inspection at which point the crew observed two carcasses on the left side of the runway. Upon inspection of the aircraft, three impact marks were observed on the left wing's leading edge. Some structural damage had occurred at one of the impact points. An initial inspection carried out by maintenance confirmed minor impact damage to the left wing outer leading edge as a result of the bird strike. On removal of the leading edge de-ice boot, damage was observed on the leading edge skin panel between two ribs (4 December 2014).

[4] Movement data for 2015 for general aviation and charter (which forms part of the low capacity) operations was not available at the time of writing this report.

3.2 Birdstrikes by aircraft weight

Fixed-wing aircraft (aeroplanes and gliders)

The number of birdstrikes reported to the ATSB for aeroplanes by the maximum take-off weight (MTOW) of the aircraft is shown below in Table 3 and Figure 3. Of particular note is the number of birdstrikes encountered by aircraft with a MTOW between 27,000 and 272,000 kilograms. Typical aircraft models in this category flying in Australia range from the Bombardier Dash 8 Q400 to the Boeing 737 and Airbus A320, and include larger wide-body aircraft such as the Airbus A330. Aircraft in this weight category make up the bulk of those conducting high capacity air transport operations. This is reflected by the similarity between the 27,001 – 272,200 kg line in the Figure 3 and the trend for high capacity air transport birdstrikes shown previously in Figure 1.

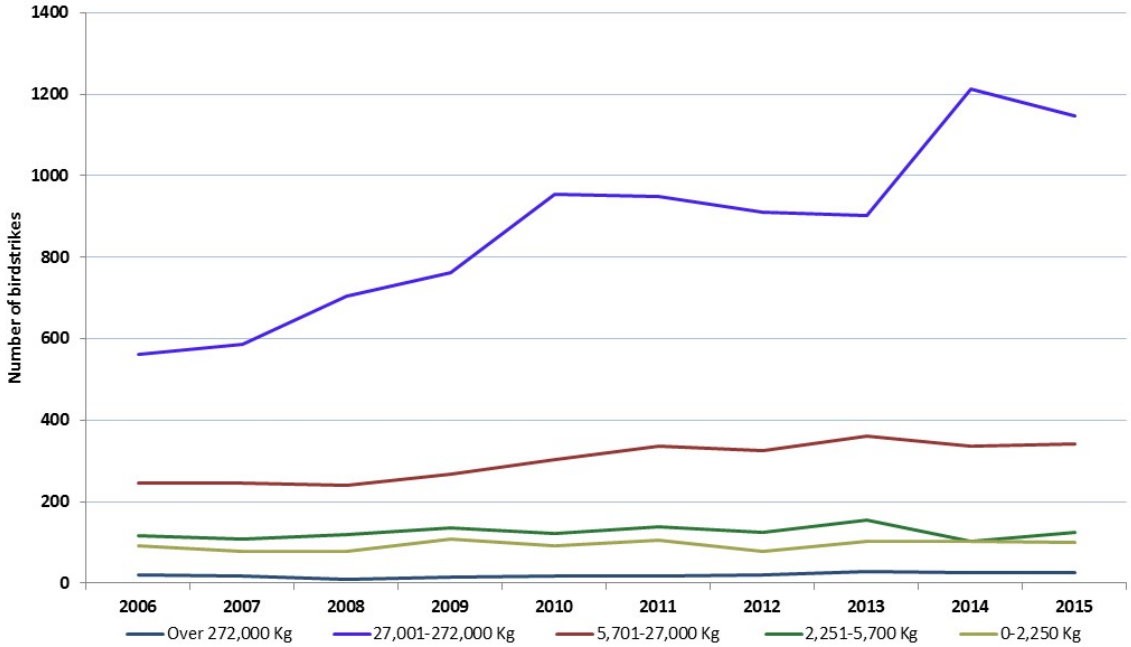
Aircraft with MTOWs between 5,701 and 27,000 kg were the second most commonly involved aircraft in reported birdstrikes, and were mostly used in low capacity air transport operations (but included some high capacity air transport). Models ranged from Fairchild Metro III aircraft through to larger aircraft such as the de Havilland Canada Dash 8 -100 /-300 series aircraft, the ATR-72 and British Aerospace Jetstream 41 aircraft, which are commonly used by regional scheduled and charter airlines in Australia.

The number of birdstrikes involving very large (generally international) aircraft (those with an MTOW above 272,000 kg) were the lowest of all the weight categories, averaging 20 per year over the 10 years. Aircraft in this weight category are generally four-engine aircraft, and include Boeing 747, the Airbus A340, and the Airbus A380 as well as the larger of the Boeing 777 series.

Table 3: Number of birdstrikes for aeroplanes per year by weight category, 2006 to 2015

Weight category	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Over 272,000 Kg	19	17	10	15	18	17	19	29	25	26
27,001 - 272,000 Kg	561	586	704	761	954	948	911	902	1,213	1,146
5,701 - 27,000 Kg	245	245	241	267	304	337	326	362	336	341
2,251 - 5700 Kg	116	108	120	136	123	139	124	154	103	124
0 - 2,250 Kg	93	78	78	109	93	106	77	102	103	101
Total	**1,034**	**1,034**	**1,153**	**1,288**	**1,492**	**1,547**	**1,457**	**1,549**	**1,780**	**1,738**

Figure 3: Number of birdstrikes for aeroplanes per year by weight category, 2006 to 2015



Helicopters

The number of helicopter birdstrikes by MTOW category is shown in Table 4 and Figure 4. The number of birdstrikes is significantly lower for most helicopter weight categories when compared with most aeroplane groups which is a direct consequence of the difference in the number of movements between fixed-wing aircraft and helicopters. The lower number of birdstrikes generally seen for helicopters may also be due to helicopters flying at lower speeds and being easier for birds and pilots to see and avoid.

Helicopters with a MTOW between 5,701 and 27,000 kg have been involved in the most number of reported birdstrikes in the most recent two years, however, the numbers have decreased slightly since 2013. Helicopters in this weight range would typically include Aérospatiale AS332 Super Puma, Eurocopter EC225, Westland Aviation Wessex, Sikorsky S-61 and Agusta AW139.

There has also been a slight decrease in the number of reported birdstrikes for helicopters in both the 2,251 – 5,700 kg, and less than 2,250 kg categories, since 2013. Helicopters in the 2,251 – 5,700 kg category could include the Sikorsky S-76, Bell 412 / 212 / 205 / 407, Eurocopter AS365 and EC135. Helicopters like the Bell 206 Robinson R22 / R44, Bel 47, Aérospatiale AS350 and Hughes 269 / 369 would be found in the less than 2,250 kg category.

Although the number of helicopter birdstrikes is low, the consequences of helicopter birdstrikes are generally more severe (depending on the component struck). Therefore, the risk to the safety of flight is expected to be much higher than the number of occurrences presented would suggest (see Table 17 on page 45).

Eurocopter EC120 Ibis strike to windshield

While the helicopter was climbing through 600 feet over the southern pylons of the Sydney harbour bridge, an Ibis struck the windshield. The Perspex windshield shattered and the bird struck the pilot, then fell into the foot well. The pilot sustained multiple lacerations on their nose, hand and leg from the Perspex. No control issues were reported and the helicopter returned to the heliport (15 September 2014).

Table 4: Number of birdstrikes for helicopters per year by weight category, 2006 to 2015

Maximum weight category	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
27,001 – 272,000 kg	0	0	0	0	0	0	0	0	0	0
5,701 – 27,000 kg	2	2	0	9	8	10	11	18	10	9
2,251 – 5,700 kg	2	16	13	13	10	7	6	14	8	9
Less than 2,250 kg	6	5	7	12	12	8	5	17	12	14
Total	**10**	**23**	**20**	**34**	**30**	**25**	**22**	**49**	**30**	**32**

Figure 4: Number of birdstrikes for helicopters per year by weight category, 2006 to 2015

3.3 Birdstrikes by aircraft engine type

Fixed-wing aircraft (aeroplanes and gliders)

As the different engine types fitted to aeroplanes is highly correlated to the particular types of operations they conduct and the maximum weight of those aircraft, the relative number and rate of birdstrikes by engine type is similar in distribution to the birdstrikes by weight category and operation type. For example, turbofan engine aircraft make up the vast majority of civil aircraft above 27,000 kg conducting high capacity air transport operations. As such, the birdstrike rate for high capacity air transport aircraft is similar to that for aircraft with a maximum weight between 27,000 kg and 272,000 kg, which is similar to the rate for turbofan engine aircraft. Other corresponding categories are:

- aeroplanes with turboprop engines, a maximum weight between 5,700 kg and 27,000 kg, and conducting low capacity air transport operations
- piston-engine aeroplanes aircraft, a maximum weight below 5,700 kg, and operating in general aviation.

A summary table showing the number of birdstrikes by engine type is presented below for aeroplanes (Table 5). The data are also shown in Figure 5

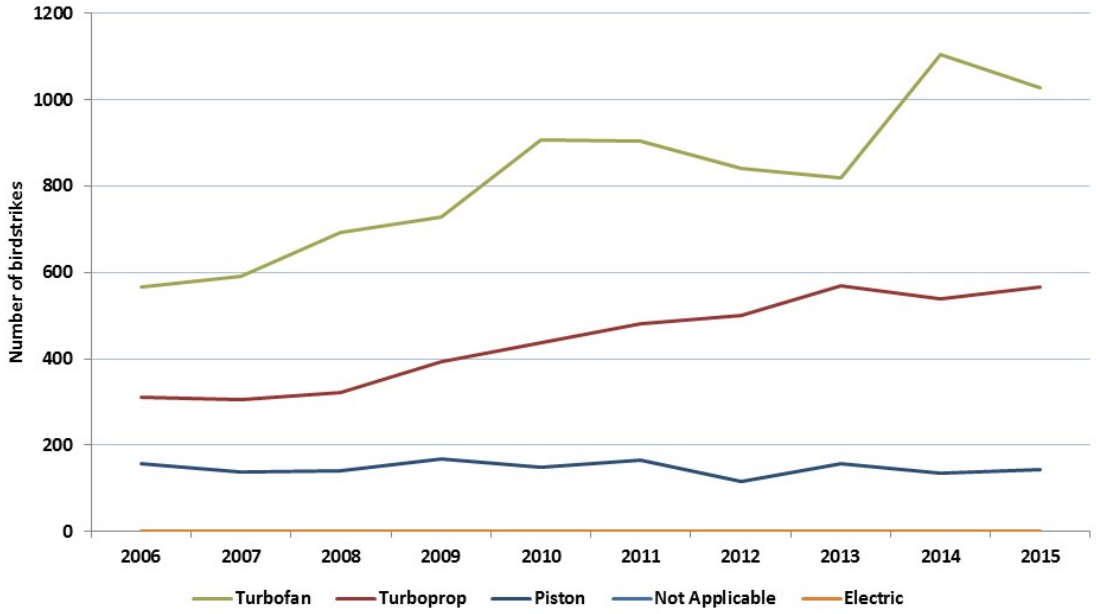
Embraer ERJ 170 engine bird ingestion and air return

On take-off from Darwin Aerodrome, WA, a Whistling Kite was ingested into the right turbofan engine. The aircraft was returned to Darwin. An engineering inspection revealed three damaged fan blades (6 October 2014).

Table 5: Number of fixed-wing aircraft birdstrikes per year by engine type, 2006 to 2015

Engine Type	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Turbofan	565	590	692	727	906	904	841	820	1,106	1,029
Turboprop	312	305	321	392	437	480	499	569	538	565
Piston	157	139	140	168	148	164	115	157	135	143
Not Applicable	0	0	0	0	0	0	0	1	0	0
Electric	0	0	0	0	0	0	0	1	0	1
Total	**1,034**	**1,034**	**1,153**	**1,287**	**1,491**	**1,548**	**1,455**	**1,548**	**1,779**	**1,738**

Figure 5: Number of birdstrikes per year by aircraft ATSB engine type (where known) for fixed wing aircraft, 2006 - 2015



Helicopters

The number of helicopter birdstrikes by engine type is shown in Table 6. Helicopters with turboshaft engines have consistently had larger number of birdstrikes compared with helicopters fitted with piston engines over the past ten years. This may be due to these more powerful (and generally larger) helicopters flying at higher speeds to piston engine helicopters.

McDonnell Douglas MD369D strike with Wedge-tailed Eagle

While conducting airborne insulator washing near Port Pirie SA, the crew encountered a couple of Wedge-tailed Eagles which started to attack the helicopter. The Eagles departed and the crew continued work. After refuelling, passing through around 300 feet at about 50 knots, the pilot noticed an Eagle diving at the helicopter from straight ahead. The pilot took evasive action to try and miss the bird but the Eagle had rolled with its talons out and contacted the main rotor blade. The helicopter was landed for a quick inspection which revealed a couple of cuts in the blade tape on the main rotor blade (29 January 2015).

Table 6: Number of birdstrikes per year by aircraft engine type (where known) for fixed wing aircraft, 2006 - 2015

Engine Type	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Turboshaft	8	19	17	29	27	20	18	43	26	27
Piston	2	4	3	5	3	5	4	6	4	7
Total	**10**	**23**	**20**	**34**	**30**	**25**	**22**	**49**	**30**	**34**

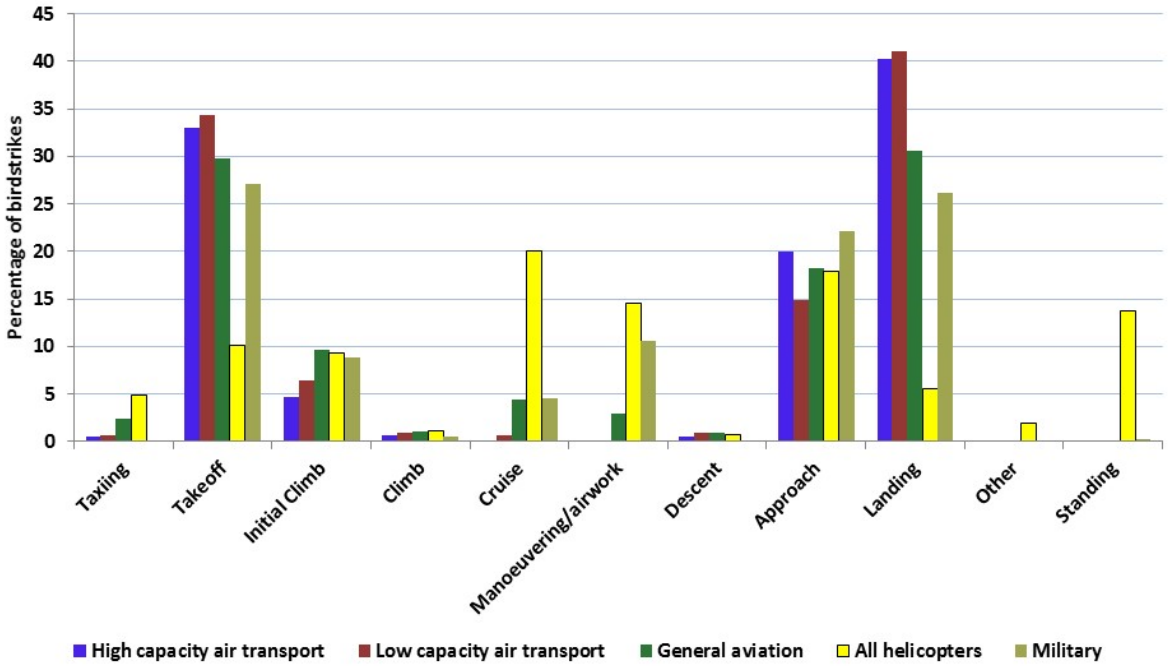
3.4 Birdstrikes by phase of flight

Figure 6 below shows the proportion of birdstrikes in each phase of flight by operation type for both aeroplanes and helicopters. Birdstrikes reported during landing were most common for all fixed-wing aircraft (39%), followed by take-off (33%), approach (19%) and initial climb (6%). This was similar for high capacity, low capacity, and general aviation aeroplanes.

Helicopters had a different distribution for phase of flight when compared with aeroplanes, with cruise, standing and approach and manoeuvring / airwork all being common times in an average flight when a birdstrike occurs. The elevated proportion of birdstrikes occurring during these four phases of flight may be a result of the lower altitudes at which helicopters generally operate. The high proportion of helicopter birdstrikes on the ground (standing) is likely to be due to birds colliding with the moving rotor blades of a stationary helicopter. The lower proportion of birdstrikes during landing and take-off may be due to the louder and varying noise caused by helicopter rotor speed and pitch changes during these flight phases.

About 16 per cent of birdstrikes have an unknown phase of flight as the notification was based on where a carcass has been found on the runway and the aircraft that struck the bird could not be identified, or where evidence of a birdstrike is detected after the flight and was not reported by the pilots after the flight (usually because the pilots were unaware of the birdstrike occurring).

Figure 6: Proportion of birdstrikes by phase of flight (where known) and operation type, aggregated for the 2006 – 2015 period



Boeing 767, flying fox ingestion during take-off

During the take-off from Sydney, the B767 ingested a grey-headed flying fox into its left engine. Thrust to the engine was reduced due to excessive vibrations and the pilot declared a PAN before returning to the airport. An inspection revealed two bent fan blades, four delaminated outlet guide vanes and a delaminated thrust reverser translating sleeve (19 June 2014).

3.5 Birdstrikes by time of day

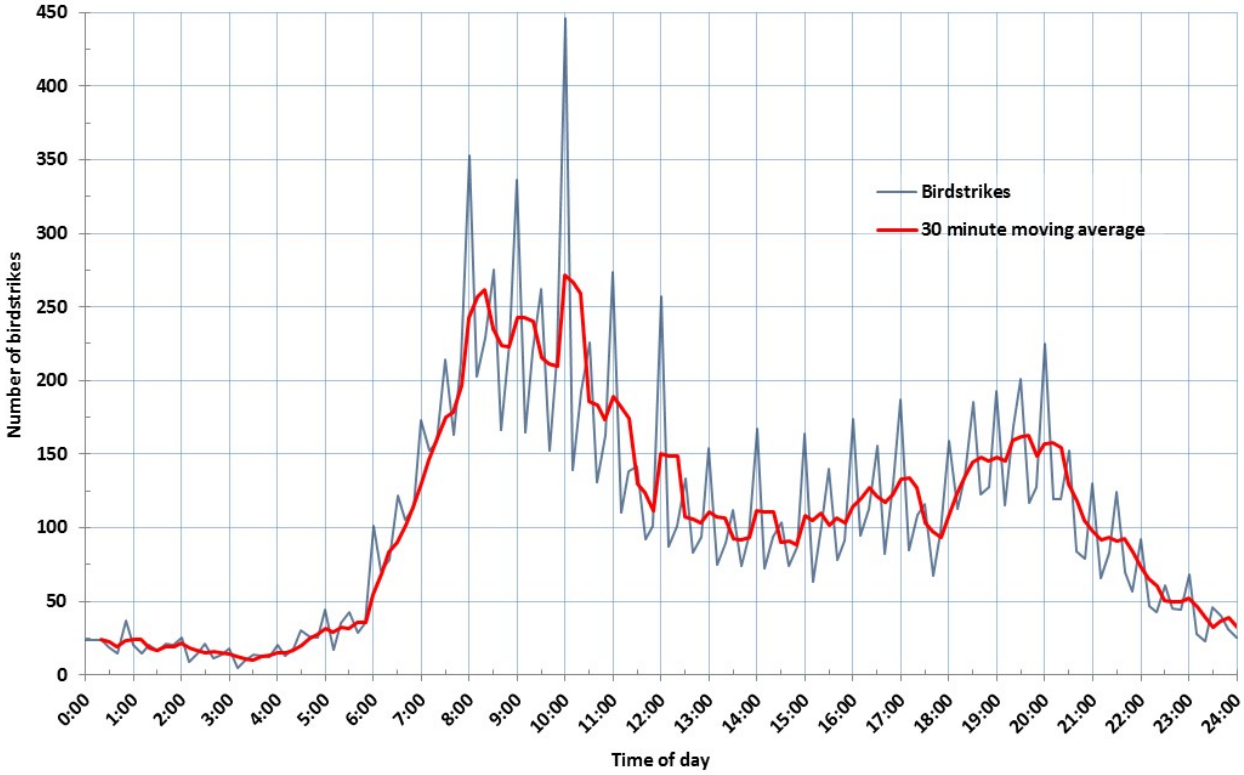
Figure 7 shows the number of birdstrikes by time of day as reported between 2006 and 2015 across Australia. The horizontal axis is set out in 24 hour time format (data shown for each 10 minute interval), with 1 hour repeating at the beginning and end of the day for the purpose of generating a 3 point (30 minute) moving average line (shown in red). This helps to remove some variation from the data.

Birdstrikes are most common across most locations between 0730 and 1030 each morning, reducing to a low birdstrike period in the early afternoon between about 1330 to 1430. An increase in birdstrikes is seen again at dusk and evening twilight periods between 1800 and 2000 at night, steadily reducing after this time to the lowest period in the early hours of the morning (between 0130 and 0400).

In general, the likelihood for a birdstrike is determined by the bird activity and aircraft activity in and around airports. Major airports in particular have week-day peak movement times in the mornings and evenings, which heavily influence the twin peaks seen in Figure 7.

The peak times for birdstrikes are also shown by bird species in Table 41 on page 124. Additionally, Appendix B – *Hourly birdstrikes counts and rates, 2014 - 2015* on page 76 shows both the hourly birdstrike counts as well as the rate of birdstrikes per 10,000 movements for the ten major aerodromes. Also shown are the rates and counts for each of the top three species struck (where species is known) for these ten aerodromes. Due to a number of data anomalies and the high sensitivity of the rate at low count values, data between midnight and 2 am have been excluded.

Figure 7: Number of birdstrikes by time of day, aggregated for the 2006 – 2015 period



4. Birdstrikes in Australian states and territories

Across the last 10 years, the number of birdstrikes continued to rise in all states with an average 32 per cent increase in 2014 - 2015 compared with 2006 - 2013 figures. The number of birdstrikes occurring in Tasmania has risen more slowly in recent years, with an increase of about 25 per cent in 2014 and 2015. Australian territorial islands (denoted in Table 7 as 'Other') have continued to show the most significant increase in the number of birdstrikes, with a 69 per cent increase in the last 2 years.

The 'Unknown' field in Table 7 indicates birdstrikes where it could not be determined where the birdstrike occurred.

The number of birdstrikes in each state over the reporting period is directly related to:

- the number of aerodromes in that state
- the particular bird species and environments available, and the bird population
- the number of air traffic movements into each airport.

These factors are considered and reviewed further in later chapters

Table 7: Number of birdstrikes per year by state, 2006 to 2015

State	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
ACT	48	37	30	24	34	46	21	33	55	62	**390**
NSW	222	256	259	295	291	330	296	351	398	413	**3,111**
NT	112	115	112	161	182	166	145	210	147	210	**1,560**
QLD	396	412	454	470	589	558	516	605	615	657	**5,272**
SA	98	92	94	135	124	161	109	88	110	118	**1,129**
TAS	41	62	56	51	55	36	43	48	60	36	**488**
VIC	126	81	117	134	156	107	118	108	132	135	**1,214**
WA	159	138	124	156	152	210	256	198	249	188	**1,830**
ATW[5]	0	0	0	0	0	0	0	0	1	2	**3**
Other[6]	3	4	9	9	9	7	12	9	18	25	**105**
Unknown	29	61	84	73	108	127	125	95	161	131	**994**
Total	**1,234**	**1,258**	**1,339**	**1,508**	**1,700**	**1,748**	**1,641**	**1,745**	**1,946**	**1,977**	**16,096**

Figure 8 shows the average number of birdstrikes per year from 2006 to 2015 (columns), compared with that for the last 2 years of the reporting period (2014 and 2015) (data points). Relative to the 10-year average, in the past 2 years (2014 – 2015), Tasmania had the smallest increase in birdstrikes per year, with no increase in 2014 –2015, relative to the ten year average.

[5] Australian territorial waters.

[6] Australian territorial islands.

In descending order, Australian Territorial Islands (denoted as 'Other'), Australian Capital Territory, New South Wales, and Queensland and the had the highest percentage increase in the last 2 years when compared with the 10-year average. It is important to note that very few birdstrikes occurred in the Australian Territorial Islands over the last 10 years.

Figure 8: Average birdstrikes per year by state, 2006 to 2015

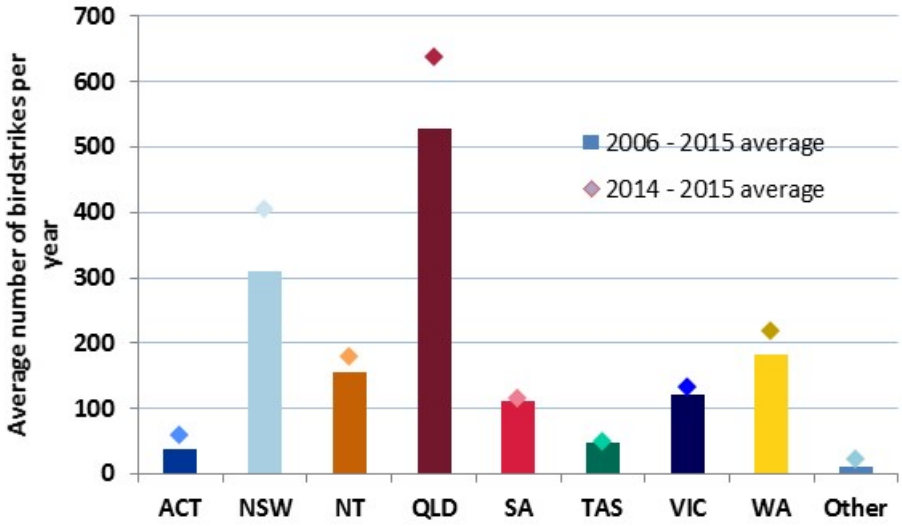
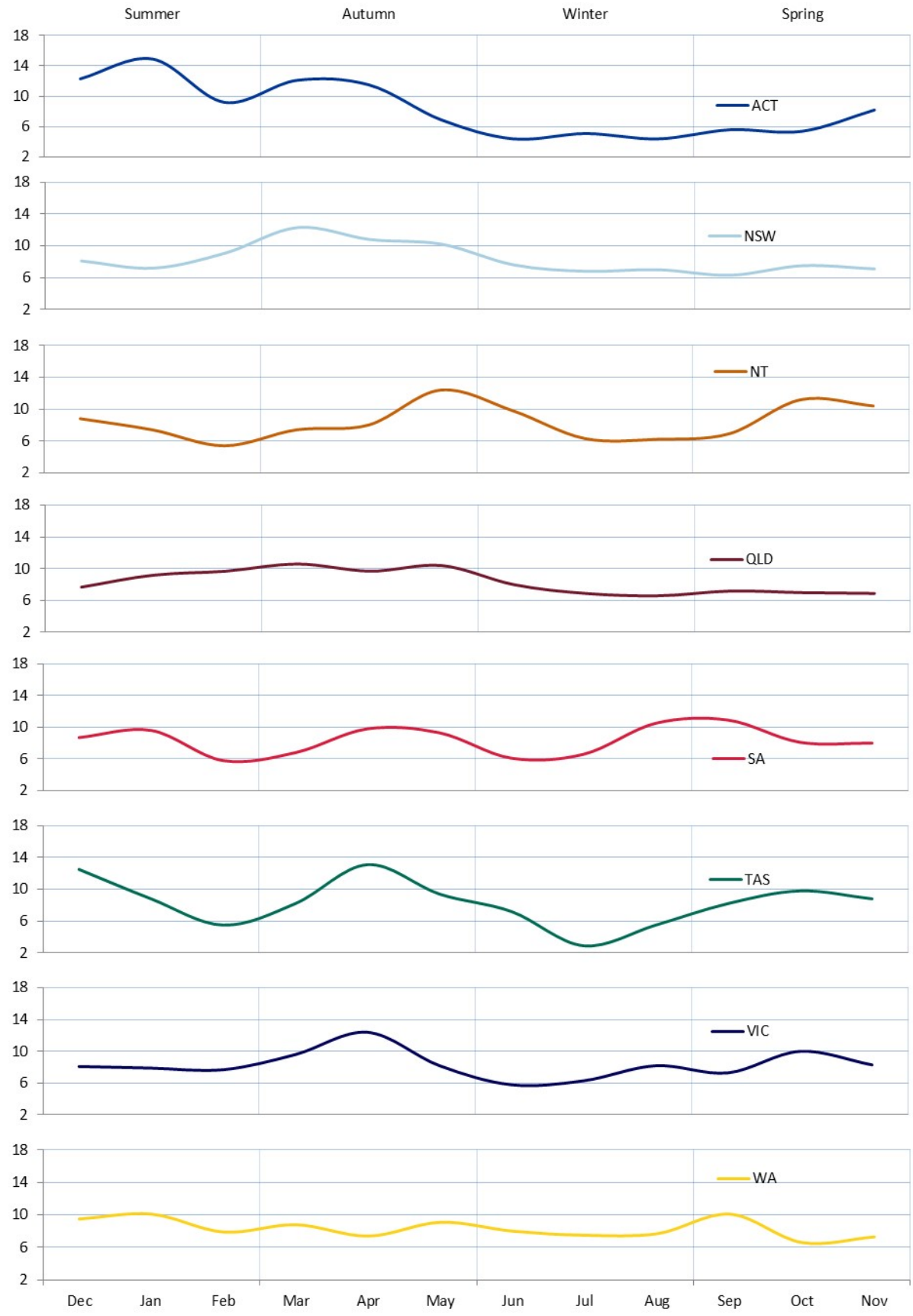


Figure 9 shows birdstrikes by season and by state. Considering all states, July has the lowest number of birdstrikes on average, with 6.4 per cent of the yearly average for the 10-year period. In comparison, over 10 per cent occurred in both October and March. There was some variability observed across all states; however, most have one or two distinct peaks.

To provide further detail into the monthly birdstrikes across the country, aircraft movement data has been obtained for 28 aerodromes for the 10-year period between 2006 and 2015. Using these data the normalised averaged monthly rate of birdstrikes for all major, regional class D and metropolitan class D aerodromes is provided in *Appendix B – Hourly birdstrikes counts and rates, 2014 - 2015* on page 76. Within each of the three aerodrome groups the vertical axis scale remains constant to facilitate a qualitative comparison between similar aerodromes.

Figure 9: Percentage of total yearly reported birdstrikes occurring each month by state, averaged for the 2006 - 2015 period



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5. Birdstrikes at Australian aerodromes

This chapter reviews birdstrikes at and around Australian aerodromes for all types of aircraft, and characterises the risk for operators flying into specific aerodromes (rather than attribute blame to any party).

As shown in Figure 6 on page 11, the majority of birdstrikes occur within the confines of an aerodrome, that is, within 5 km from the aerodrome or on the aerodrome. This is because birds and aircraft more commonly share the same airspace while the aircraft is on the runway for take-off and landing, and during the climb and approach phases of flight. In addition, even when pilots are not aware of a birdstrike on the ground or in the aerodrome confines, remnants of the bird will often be found and reported by aerodrome staff.

An aerodrome-specific list of birdstrikes is provided in Appendix D – *Additional birdstrike data*, showing the number of birdstrikes within the confines of the aerodrome, within 5 to 15 km of the aerodrome, and those that occurred more than 15 km away. In Appendix D, Table 32 provides this information for major aerodromes, Table 33 for towered regional aerodromes, Table 34 for metropolitan class D aerodromes, and Table 35 for other regional aerodromes with a significant number of birdstrikes.

5.1 Birdstrike numbers by aerodrome

Figure 10 shows the number of birdstrikes for the past 2 years (2014 – 2015) at all major aerodromes, towered regional, and metropolitan class D aerodromes, while Figure 11 shows the numbers for other regional aerodromes with a significant number of birdstrikes (10 or more birdstrikes in the 2014 – 2015 period). Only birdstrikes that occurred within the confines of aerodromes have been included. The horizontal scale of the two figures has been held constant to enable a comparison between the two figures.

With an average of nearly 175 birdstrikes each, the major airports (except Hobart) account for the bulk of the number of birdstrikes due to the large number of aircraft movements at these aerodromes. The only other airports with more than 50 birdstrikes over the 2-year period were Townsville, Rockhampton, and Mackay. Aerodromes with between 30 and 50 birdstrikes over the 2-year period were Coffs Harbour, Parafield, Dubbo, Gladstone, Port Hedland and Wagga Wagga.

Figure 10: Number of birdstrikes (inside aerodrome confines) at major aerodromes, towered regional and metropolitan class D aerodromes, 2014 and 2015

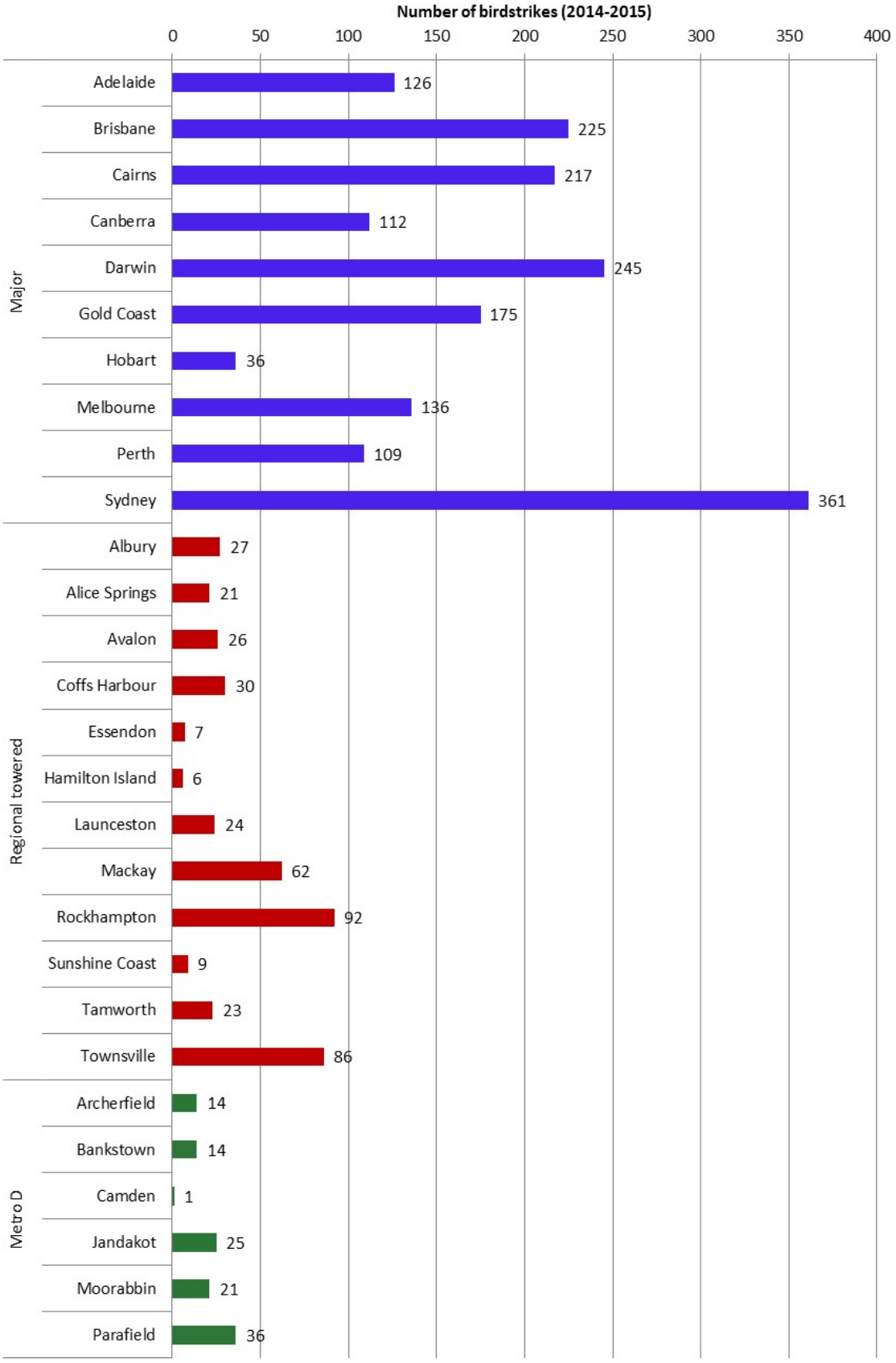
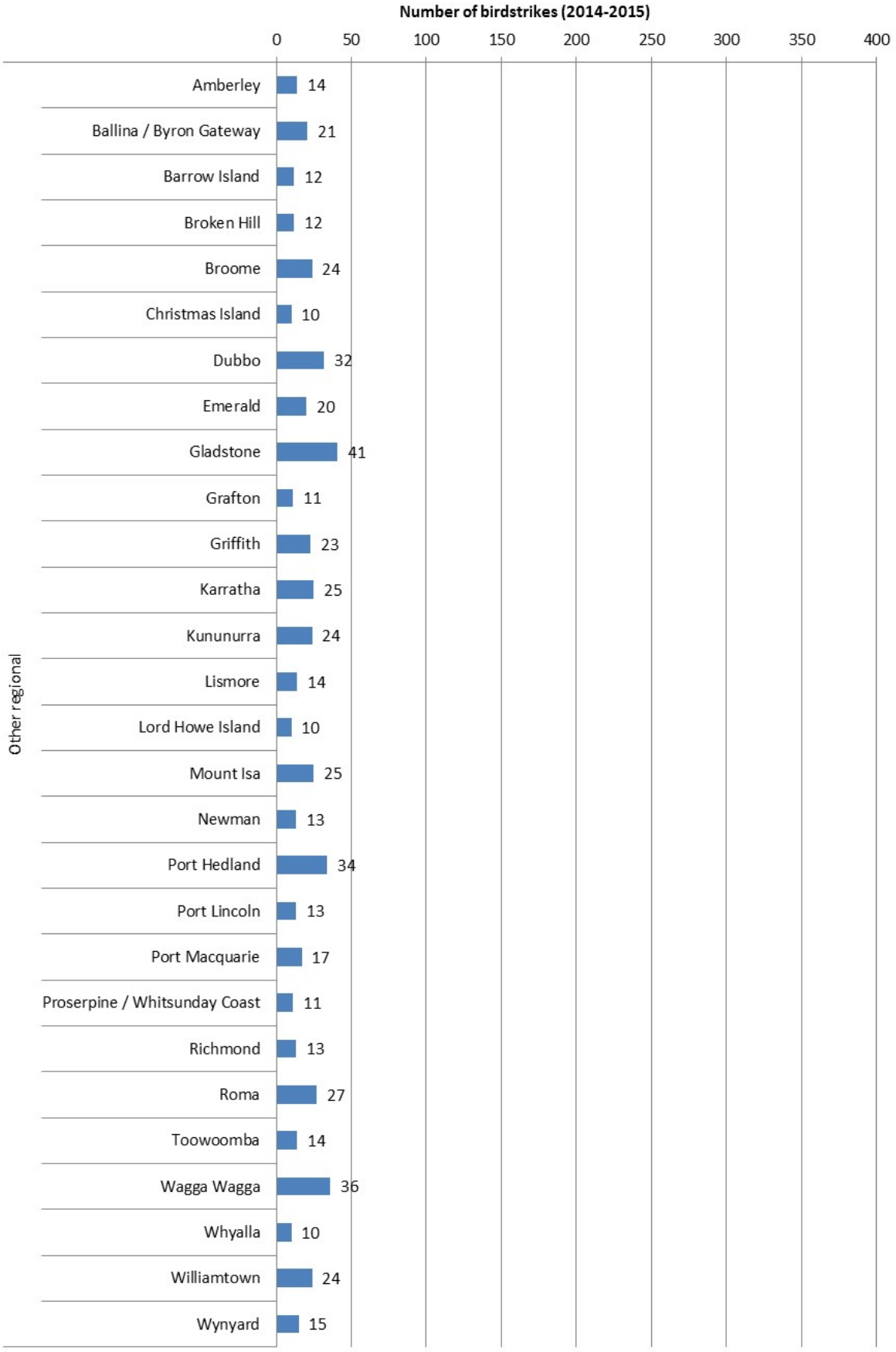


Figure 11: Number of birdstrikes (inside aerodrome confines) at other regional aerodromes, 2014 and 2015



5.2 Birdstrike rates by aerodrome

The count data from Figure 10 are normalised by movements and shown as the rate of birdstrikes per 10,000 movements for each aerodrome category in Figure 12. Major and towered regional aerodromes continue to have significantly higher rates of reported birdstrikes than metropolitan class D aerodromes. The increase in birdstrike rates for high capacity operations shown in Figure 2 are also reflected in Figure 12. It can be seen in Figure 12 that since 2012 the rate of birdstrikes at major airports has been steadily increasing to a ten year high in 2015. In contrast, the birdstrike rates reported from towered regional aerodromes have been mostly decreasing since 2010 and have been lower than those reported from major airports since 2013. After increasing slightly in the 2010 – 2011 period, the rates for metropolitan class D birdstrikes have decreased slightly, although overall they have been quite consistent over the entire 10 year period. More detail on the birdstrike rates for individual aerodromes are shown in the following figures and tables. Only birdstrikes that occurred within the confines of aerodromes have been included.

Figure 12: Total rate of birdstrikes (inside aerodrome confines) for all aircraft per 10,000 movements, 2006 to 2015

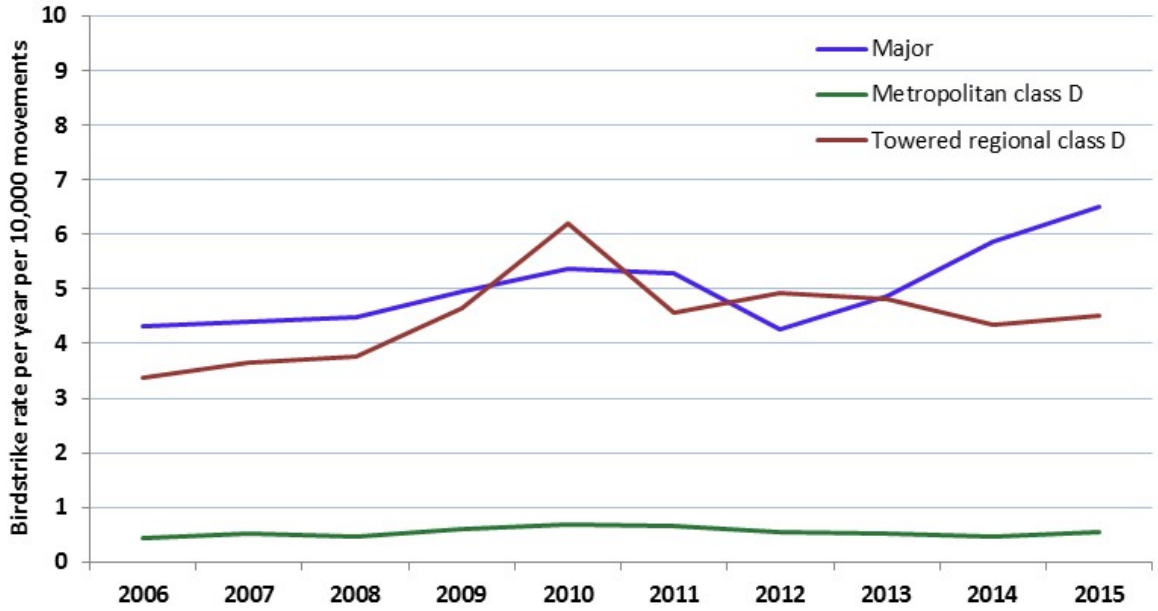
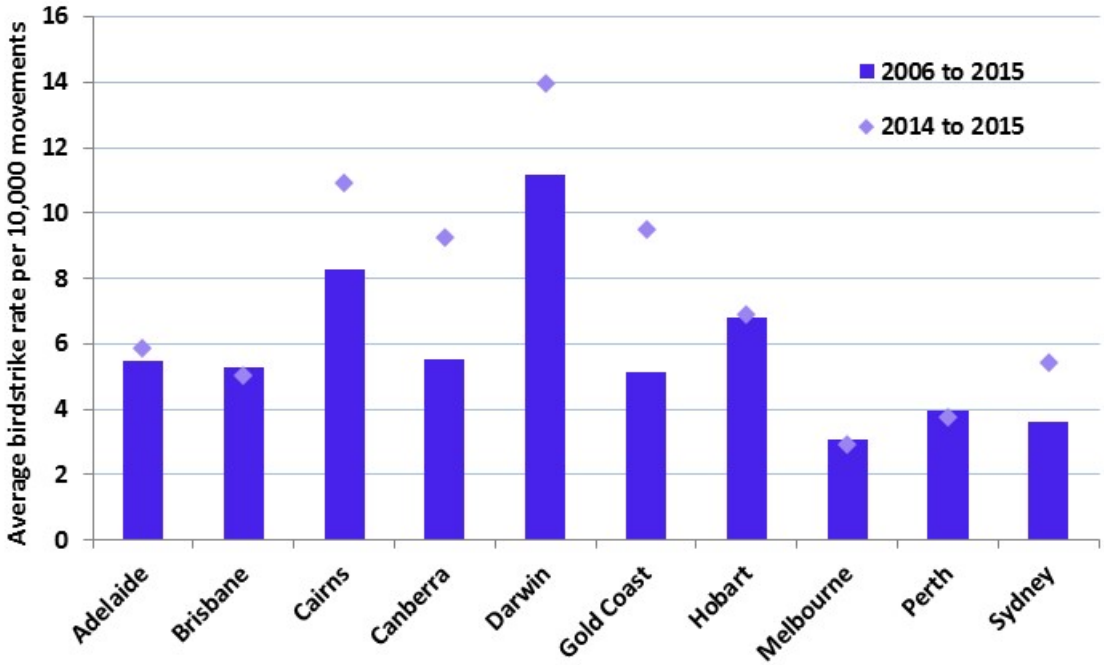


Table 8 shows the birdstrike rates for each of the ten major aerodromes between 2006 and 2015 while Figure 13 shows the ten year average (solid bars) compared with the 2014 – 2015 average (data points) for each major airport. The rates shown in Table 8 show considerable variation from year to year, particularly at Darwin and Hobart. In the 2 years since 2013, the rates for seven (Adelaide, Cairns, Canberra, Darwin, Gold Coast, Hobart and Sydney) of the ten major airports has increased. The largest increase in birdstrike rates was observed at Gold Coast, where the rate has nearly doubled in the 2 years since 2013. Darwin again has the highest average birdstrike rate of all the major airports. These changes are reflected in the average rates shown in Figure 13 where the recent (2012-2013) increase in rates relative to the ten year average are observed at Adelaide, Cairns, Canberra, Darwin, Gold Coast, Hobart and Sydney. Little change is observed at Melbourne, Brisbane and Perth.

Table 8: Rate of birdstrikes each year at major aerodromes (inside aerodrome confines) per 10,000 movements, 2006 to 2015

Aerodrome	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Average
Adelaide	5.42	4.62	4.29	7.21	5.04	7.12	5.41	3.85	5.31	6.47	**5.47**
Brisbane	4.02	4.22	6.14	5.7	5.82	6.29	5.02	5.29	5.03	5.04	**5.26**
Cairns	4.14	8.25	8.24	8.1	9.38	7.49	6.19	8.83	10.47	11.41	**8.25**
Canberra	5.45	4.59	3.34	2.56	5.01	7.09	3.47	5.25	8.39	10.13	**5.53**
Darwin	8.09	8.2	8.72	12.88	11.19	7.76	9.24	17.53	9.44	18.47	**11.15**
Gold Coast	3.86	4.55	2.25	2.4	4.69	5.16	4.76	4.83	8.29	10.7	**5.15**
Hobart	9.21	11.02	7.39	7.23	6.38	4.28	4.33	4.51	9	4.75	**6.81**
Melbourne	3.91	1.95	3.81	3.24	4.64	2.77	2.04	2.31	2.85	3.02	**3.05**
Perth	4.2	3.39	3.93	3.38	4.35	4.92	4.84	3.25	4.53	2.96	**3.98**
Sydney	2.59	3	2.79	3.83	3.66	4.29	2.51	2.79	5.64	5.19	**3.63**

Figure 13: Average rate of birdstrikes for major aerodromes (inside aerodrome confines) per 10,000 movements, 2006 to 2015



The yearly birdstrike rates for towered (class D) regional aerodromes between 2006 and 2015 are shown in Table 9. Figure 14 shows the same rates as averages for both the 2006 – 2015 10-year average birdstrike rate (solid bars), and 2-year (2012 – 2013) average (data points). Rates in the past two years have increased relative to the ten year average at five aerodromes. The increase was most notable at Mackay and Rockhampton, while smaller increases were observed at Avalon, Coffs Harbour, and Launceston. All seven other aerodromes had decreased rates in recent years (2014 – 2015) compared with the 10-year average.

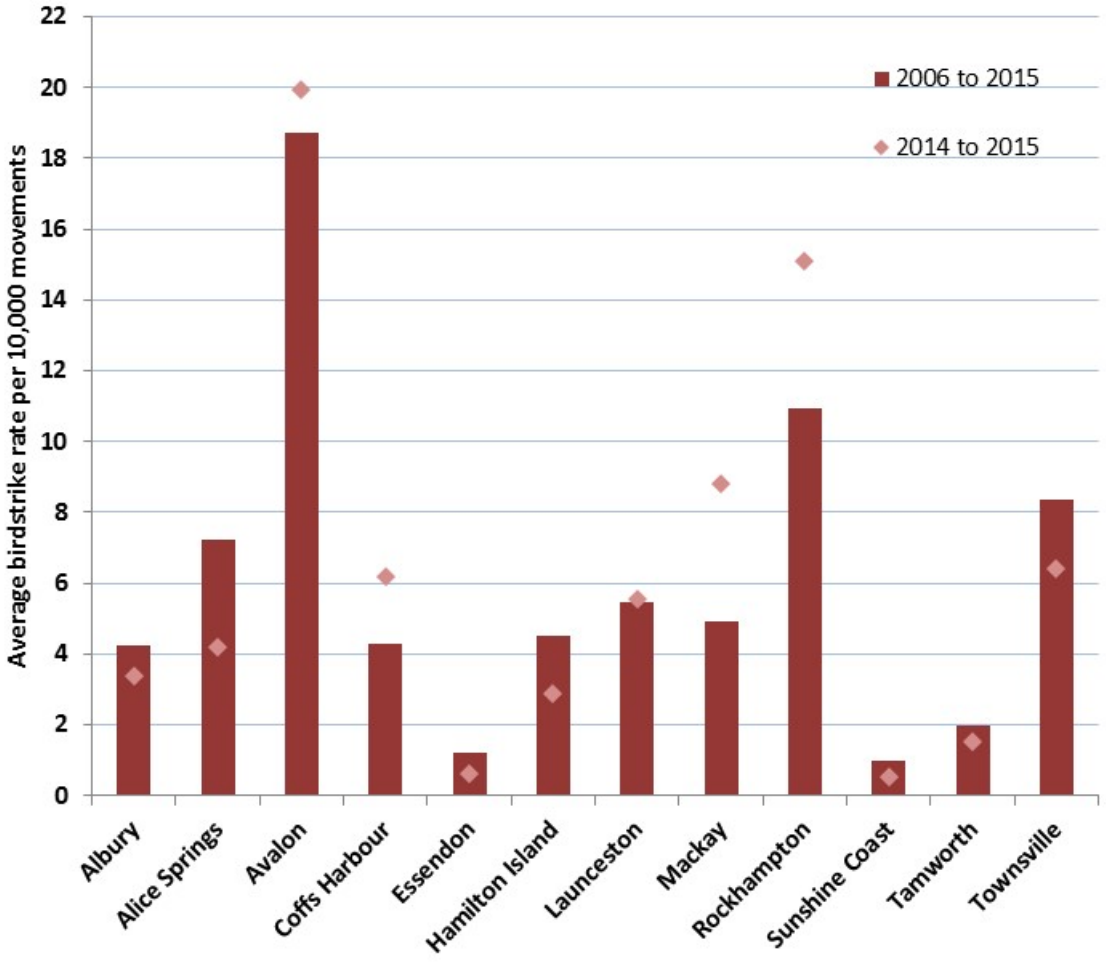
The birdstrike rate per 10,000 movements at Avalon Airport was again the highest average of all towered regional airports with an average birdstrike rate of 18.7 birdstrikes per 10,000 movements

(since 2007 when movement data was first available). After dropping significantly in 2013, the rates at Avalon rose again in both 2014 and 2015 to a two year average of 19.9 birdstrikes per 10,000 movements, slightly higher than the ten year average. Other significant increases were observed at Rockhampton, Mackay and Coffs Harbour, all of which had average rates in the past two years considerably higher than their ten year averages.

Table 9: Rate of birdstrikes each year at towered regional aerodromes (inside aerodrome confines) per 10,000 movements, 2006 to 2015

Aerodrome	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Average
Albury	3.07	4.83	2.88	5.95	4.37	4.06	5.02	5.65	2.61	4.13	**4.26**
Alice Springs	6.05	5.91	1.91	5.32	22.92	13.88	4.19	3.72	4.28	4.15	**7.23**
Avalon	---	7.66	8.71	25.79	24.96	16.75	36.13	8.85	20.18	19.67	**18.74**
Coffs Harbour	3.94	5.05	2.99	3.48	4.02	3.31	4.11	3.68	7.99	4.37	**4.29**
Essendon	2.03	1.12	1.52	2.03	0.94	0.94	0.95	1.14	1.1	0.18	**1.19**
Hamilton Island	6.29	6.66	4.95	4.62	4.87	5.01	1.72	5.34	0.96	4.8	**4.52**
Launceston	1.97	3.93	9.11	5.22	5.5	3.44	8.34	5.77	7.22	3.86	**5.44**
Mackay	3.15	1.96	2.41	4.43	5.03	4.4	5.55	4.81	9.81	7.8	**4.94**
Rockhampton	8.14	5.1	9.5	9.84	12.76	9.59	10.06	14.35	11.32	18.84	**10.95**
Sunshine Coast	1.18	1.97	0.78	1.14	1.58	0.69	0.52	0.85	0.86	0.16	**0.97**
Tamworth	1.69	2.06	2.67	1.51	1.61	1.5	2.89	2.75	1.74	1.34	**1.98**
Townsville	4.73	7.39	8.43	9.97	12.16	8.62	10.35	9.21	6.18	6.67	**8.37**

Figure 14: Average rate of birdstrikes for towered regional aerodromes (inside aerodrome confines) per 10,000 movements, 2006 to 2015



The reported birdstrike rate at metropolitan class D aerodromes remained low (Table 10), with most of these aerodromes having a 10-year average birdstrike rate lower than that of all major and towered regional aerodromes.

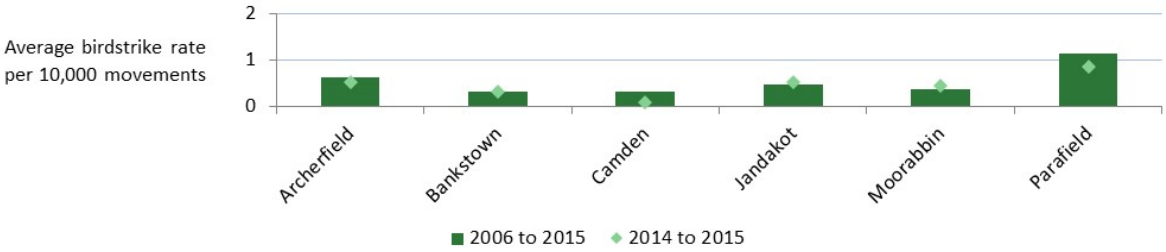
Table 10: Rate of birdstrikes each year at metropolitan class D aerodromes (inside aerodrome confines) per 10,000 movements, 2006 to 2015

Aerodrome	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Average
Archerfield	0.31	0.51	0.51	1.36	0.76	0.59	0.23	0.89	0.65	0.37	**0.62**
Bankstown	0.16	0.23	0.36	0.37	0.25	0.21	0.3	0.6	0.18	0.45	**0.31**
Camden	0.44	0.8	0.36	0	0.12	0	0	0.11	0.1	0	**0.19**
Jandakot	0.69	0.55	0.11	0.22	0.63	0.53	0.66	0.33	0.47	0.58	**0.48**
Moorabbin	0.21	0.29	0.31	0.45	0.48	0.31	0.46	0.44	0.34	0.54	**0.38**
Parafield	0.72	1.16	1.35	1.31	1.66	1.79	0.91	0.66	1.02	0.68	**1.13**

Although Parafield Airport had the highest birdstrike rate of all metropolitan class D aerodromes, with an average birdstrike rate of 1.13 strikes per 10,000 movements between 2006 and 2015, the 2-year average between 2014 and 2015 has decreased to 0.75 strikes per 10,000 movements (Figure 15). The rate of birdstrikes at Bankstown, Jandakot and Moorabbin Airports have all

increased slightly in recent years, although they are relatively low when compared with other regional and metropolitan Australian locations.

Figure 15: Average rate of birdstrikes for metropolitan class D aerodromes (inside aerodrome confines) per 10,000 movements, 2006 to 2015

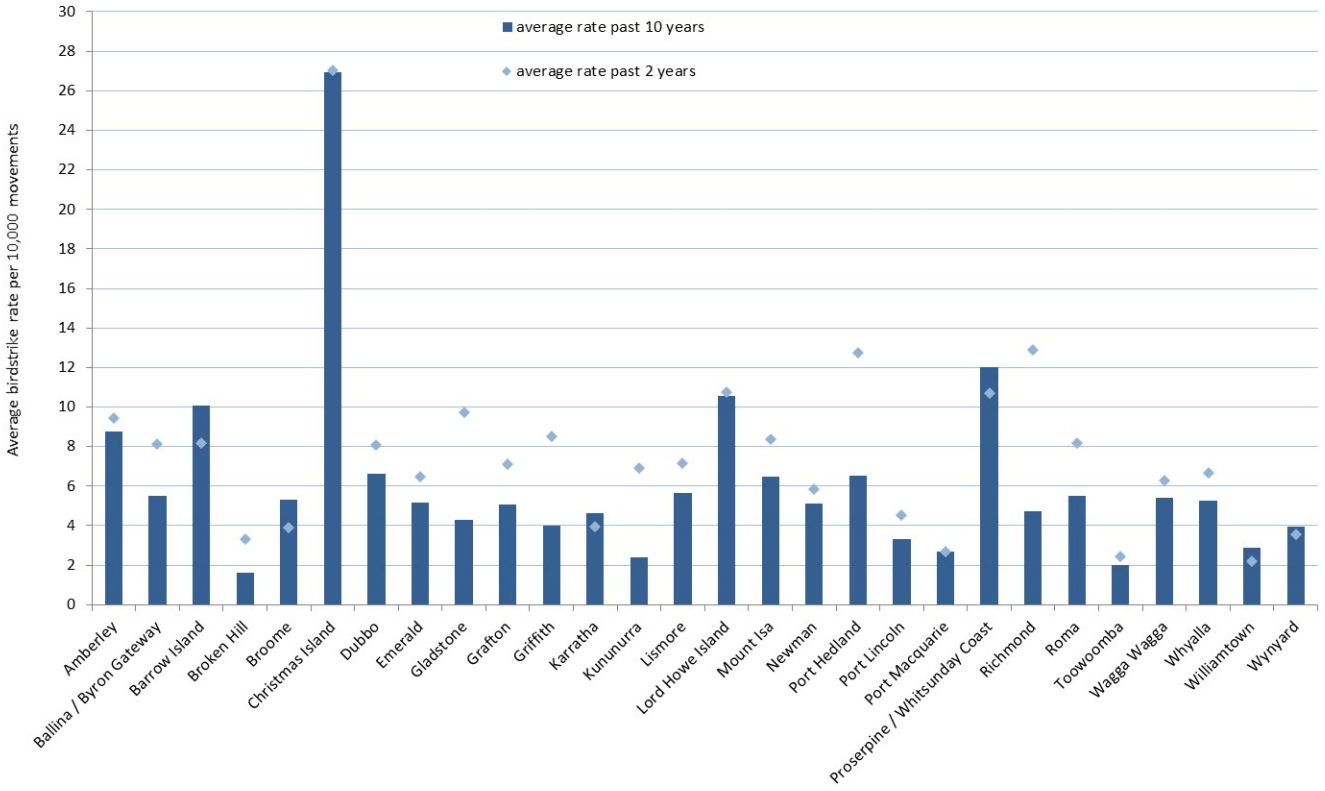


The yearly rates of birdstrikes for the other significant aerodromes are shown in Table 11, while the average rates are shown in Figure 16. Christmas Island had by far the highest rate of birdstrikes on average over the ten years, however, this is likely an artefact of the comparatively low movements at this location. Proserpine / Whitsunday Coast, Lord Howe Island and Amberley all had higher rates as well. The numbers of birdstrikes at these locations were by no means the highest in this group, with 11, 10 and 14 birdstrikes respectively for the ten year period. However, relatively low number of aircraft movements at these locations has also driven up the rates for these aerodromes.

Table 11: Rate of birdstrikes each year at the other significant aerodromes (inside aerodrome confines) per 10,000 movements, 2006 to 2015

Aerodrome	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Average
Amberley	0.00	1.06	0.00	5.80	48.7	10.64	14.0	15.52	9.46	9.46	**11.47**
Ballina/Byron Gateway	1.84	7.14	5.67	3.92	5.63	6.54	5.30	4.17	3.16	21.74	**6.51**
Barrow Island	11.1	0.00	0.00	9.09	7.69	21.21	22.2	4.44	14.29	3.57	**9.36**
Broken Hill	2.11	0.00	0.00	0.00	1.17	3.39	1.67	0.54	1.67	5.00	**1.55**
Broome	2.99	7.09	5.65	2.96	10.8	4.87	5.23	8.79	4.94	2.72	**5.61**
Christmas Island	66.6	33.3	166.67	50.0	22.7	12.50	35.2	11.11	12.50	120.00	**53.08**
Dubbo	2.65	6.46	12.12	3.77	6.39	5.32	7.06	9.19	8.57	7.60	**6.91**
Emerald	3.41	9.00	5.86	1.57	7.15	3.30	3.57	5.85	7.85	5.10	**5.27**
Gladstone	2.20	0.91	0.00	1.98	8.82	2.76	4.09	4.72	7.07	12.87	**4.54**
Grafton	0.00	3.23	6.41	4.05	5.56	5.48	4.23	5.80	2.86	10.59	**4.82**
Griffith	1.45	2.67	0.90	2.48	2.05	6.97	3.72	4.41	8.68	8.33	**4.17**
Karratha	5.28	2.71	1.91	11.2	3.15	6.85	5.24	3.79	4.63	3.26	**4.81**
Kununurra	0.44	0.79	2.76	2.01	2.81	1.51	5.10	1.96	6.44	7.39	**3.12**
Lismore	3.19	10.6	2.30	5.19	3.11	6.60	5.55	8.76	5.95	8.44	**5.97**
Lord Howe	7.14	15.9	13.04	8.89	15.5	0.00	10.6	13.04	6.52	14.89	**10.56**
Mount Isa	3.18	4.27	6.31	9.76	7.65	12.57	6.56	2.79	8.33	8.38	**6.98**
Newman	1.42	1.52	1.95	6.93	1.22	8.90	6.73	9.44	6.57	4.94	**4.96**
Port Hedland	5.00	1.09	1.00	6.22	3.51	6.69	11.3	8.13	16.90	7.99	**6.79**
Port Lincoln	2.79	0.74	6.59	4.51	0.67	1.39	1.31	7.12	5.75	3.37	**3.43**
Port Macquarie	1.27	0.00	1.42	1.37	5.73	3.75	3.63	5.37	3.07	2.28	**2.79**
Proserpine / Whitsunday	8.78	8.71	14.67	13.2	25.7	9.80	11.5	14.27	17.01	5.38	**12.90**
Richmond	0.00	1.04	0.00	0.00	6.52	10.71	6.38	11.11	8.51	16.67	**6.09**
Roma	0.00	3.21	10.77	3.36	8.73	5.26	1.30	5.86	8.14	8.25	**5.49**
Toowoomba	0.00	0.54	1.55	2.75	1.96	1.43	1.63	3.58	1.99	3.08	**1.85**
Wagga Wagga	3.32	6.23	7.18	8.18	5.42	7.30	2.12	4.70	6.71	5.86	**5.70**
Whyalla	3.53	2.40	0.00	7.97	4.49	10.48	5.15	5.41	5.41	7.88	**5.27**
Williamtown	2.58	3.21	2.81	4.17	2.50	2.36	3.35	3.15	3.28	1.25	**2.86**
Wynyard	1.74	2.71	3.07	2.55	6.96	2.56	3.98	21.54	3.98	3.20	**5.23**

Figure 16: Average rate of birdstrikes for the other significant aerodromes (inside aerodrome confines) per 10,000 movements, 2006 to 2015



5.3 Birdstrikes at aerodromes by bird size

The figures below show the number of birdstrikes by the size of bird struck at major, regional towered, metropolitan class D, and other significant aerodromes during 2014 and 2015. As there are more birdstrikes reported at major airports than regional airports, the figures are not to the same scale. This has been done so that the bird size proportions are more visible.

For this report the bird size classifications have been redefined based on an average species mass. In order to determine an appropriate sizing classification system based on bird mass, the engine bird ingestion standards have been used as a guide. The US Federal Aviation Regulations (FAR) 33.76 outlines the engine certification standards for the ingestion of birds. The number and size of birds that an engine is required to be able to ingest without adverse effects is governed by the inlet throat cross-sectional area. In Australia, the most common turbofan engine aircraft in use are the Boeing 737 and Airbus A320 families, using the CFR 56 and IAE V2500 family of engines. These engines have throat areas of about (depending on the model) 1.88 m^2 and 1.98 m^2 respectively. These areas have been used with FAR 33.76 to categorise the bird sizes as follows:

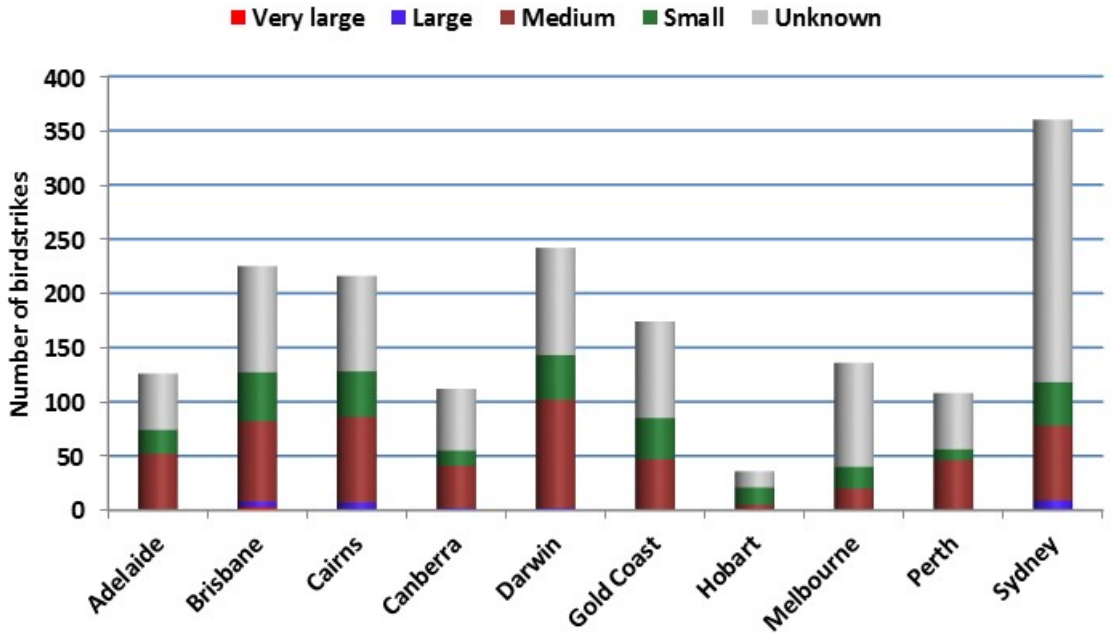
- small bird: up to and including 85 grams (0.085 kg)
- medium bird: greater than 0.085 kg up to and including 1.15 kg
- large bird: greater than 1.15 kg up to and including 3.65 kg
- very large bird: greater than 3.65 kg.

A fourth bird size category (very large) has been added for this report. The maximum bird size stipulated in FAR 33.76 for a single large bird ingestion is 3.65 kg for turbofan engines with a throat area of greater than 3.9 m^2. Therefore, bird masses of greater than 3.65 kg (very large birds) are beyond the certification standards of any current turbofan engine. It can therefore be

reasonably assumed that the ingestion of any bird greater than 3.65 kg will likely result in adverse effect on the engine and possibly an engine failure. As such, these birds represent a significantly increased threat and have been given their own category of 'very large'. Examples of such birds includes the Australian Bustard, Brolga, Crane, Goose, Wedge-tailed Eagle, Pelican, Swan, Albatross, Petrel and Jabiru.

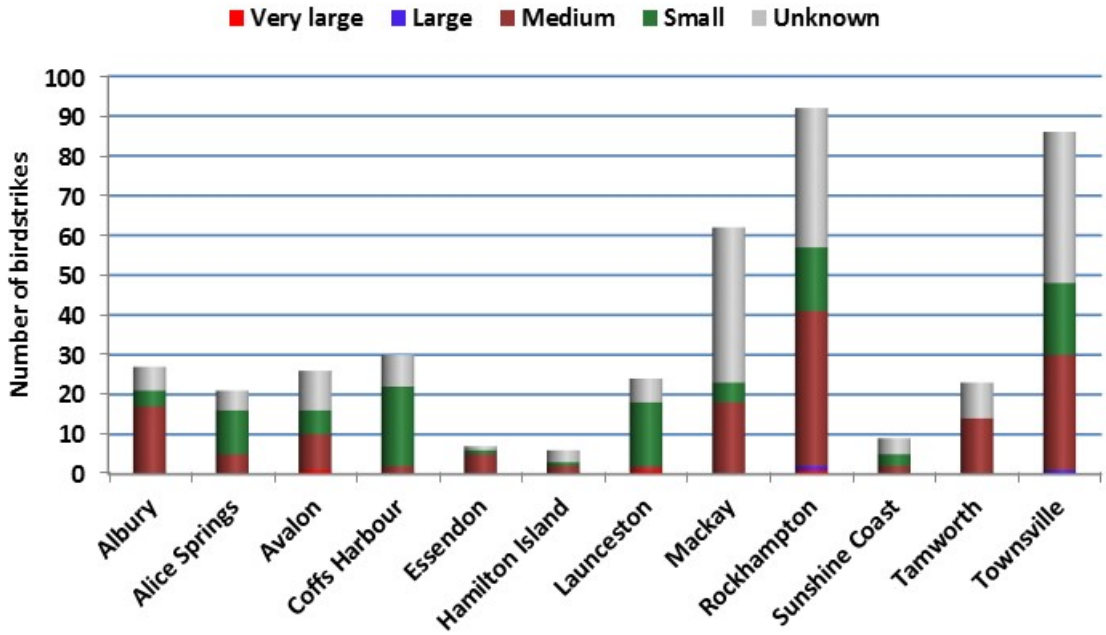
Figure 17 shows that large birds are mostly struck by aircraft operating in the vicinity of Sydney (8), Cairns (6), and Brisbane (5) Airports, although medium and small birds were most commonly struck at all airports. In the two years between 2014 and 2015, six very large birds were struck at the major airports. Three were at Brisbane (a Pelican and two Eagles), and one each at Cairns (Eagle), Darwin (Jabiru) and Sydney (Pelican).

Figure 17: Birdstrikes at major airports (aerodrome confines only) by bird size for the 2014 – 2015 period



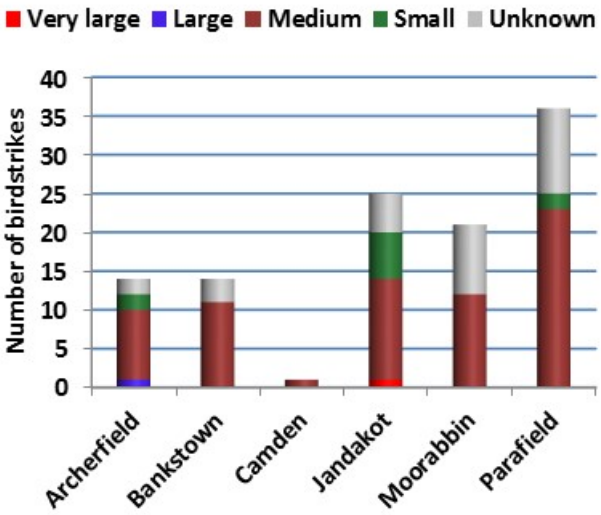
Of the towered regional airports (Figure 18), only Rockhampton and Townsville reported strikes involving large birds in 2014 and 2015. There were three reports of strikes involving very large birds. One was at Avalon (Eagle), one at Launceston (Swan), and one at Rockhampton (Pelican).

Figure 18: Birdstrikes at towered regional class D airports (aerodrome confines only) by bird size for the 2014 – 2015 period



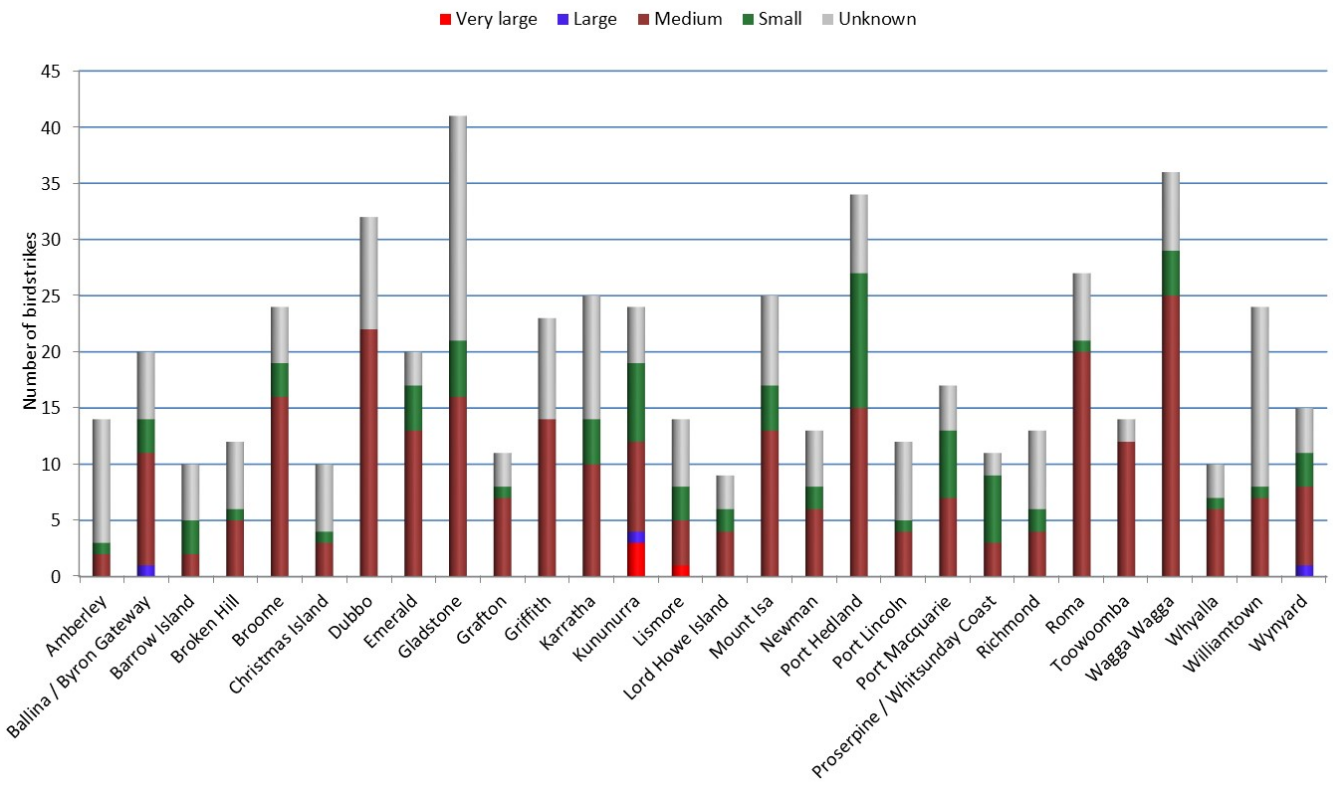
At metropolitan class D airports, Parafield Airport had the largest number (Figure 19) and rate (Figure 15) of birdstrikes with the majority of birdstrikes arising from medium sized birds, in particular Galahs and Magpie-Larks. There was only one large birdstrike reported at Archerfield (Ibis) and one very large birdstrike reported from Jandakot (Goose).

Figure 19: Birdstrikes at metropolitan class D airports (aerodrome confines only) by bird size for the 2014 – 2015 period



Three aerodromes reported strikes involving large birds at other regional aerodromes (Figure 20). These were Ballina / Byron Gateway (Ibis), Kununurra (Bush Turkey) and Wynyard (Sea Eagle). Additionally, three strikes with very large birds were reported from Kununurra (all three involved Bustards), and one at Lismore (Eagle). The majority of other strikes at the other regional aerodromes involved medium sized birds.

Figure 20: Birdstrikes at other regional aerodromes (aerodrome confines only) by bird size for the 2014 – 2015 period



6. Significant Australian birdstrikes

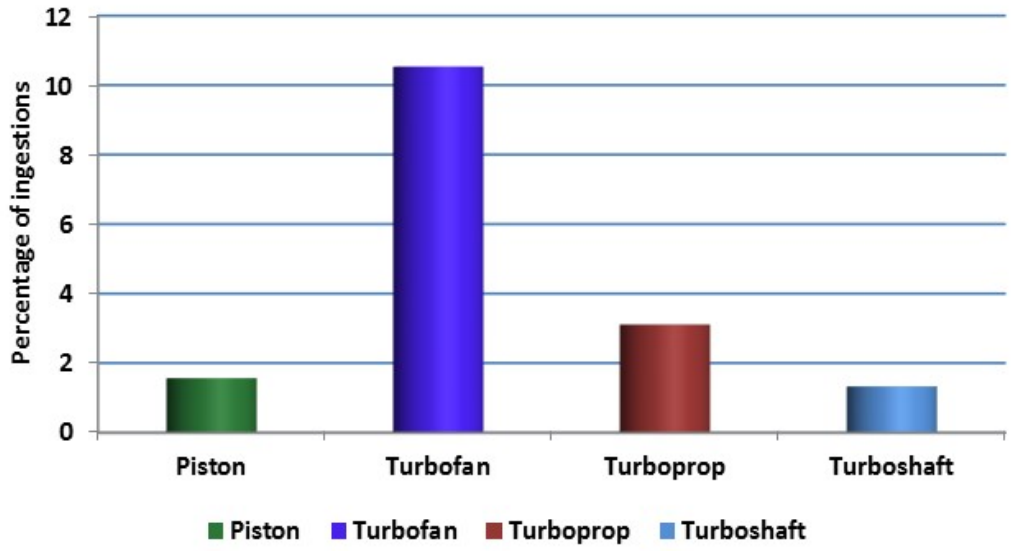
This chapter reviews birdstrikes that have been identified as posing a significant threat to the continued safety of flight of an aircraft. Birdstrikes involving ingestion of a bird, or birds, into a turbine engine, and occurrences involving aircraft damage and personal injuries as a result of birdstrikes are considered.

6.1 Bird ingestion into engines

Most birdstrikes in which a bird was ingested into an engine involved aircraft powered by turbofan engines. This is related to the relatively larger engine air intake and suction of these engines compared with other engine types, and because of the longer landing and take-off runs of most turbine aircraft (resulting in a higher exposure to altitudes where birds fly more frequently).

Figure 21 shows the percentage of birdstrikes where a bird ingestion occurred, compared with the type of engine involved. Turbofan engine aircraft had the highest proportion of bird ingestions per birdstrike, with one in every ten birdstrikes involving at least one bird being ingested into an engine.

Figure 21: Percentage of birdstrikes resulting in a bird ingestion by engine type (where known) over the 2006 - 2015 period



Most birdstrikes involving a bird ingestion involved aircraft being used for high capacity air transport (79 per cent). Aircraft operating these services (such as Boeing and Airbus aircraft) are primarily fitted with turbofan engines. Table 12 shows that the number of bird ingestions for high capacity air transport operations had been increasing until 2011 but has since decreased slightly for single engine bird ingestions. However, after five years without any two-engine bird ingestions, in 2015 there was one. Fortunately, all seven two-engine bird ingestions across the 10-year period involved either small or medium sized birds. The number of ingestions involving low capacity air transport aircraft has remained relatively steady after peaking in 2008.

Table 12: Number of bird ingestions by operation type, 2006 - 2015

Operation Type	Engine Ingestion	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
High capacity air transport	1 engine	63	74	76	71	82	82	81	55	67	62	**713**
	2 engines	3	0	1	2	0	0	0	0	0	1	**7**
Low capacity air transport	1 engine	8	14	20	6	6	10	6	11	5	11	**97**
	2 engines	0	0	1	0	0	1	0	0	0	0	**2**
General Aviation	1 engine	0	3	5	1	2	2	1	3	2	5	**24**
Military	1 engine	0	3	0	7	8	11	13	9	3	4	**58**
	2 engines	0	0	1	0	2	0	0	0	1	0	**4**
Unknown	1 engine	1	1	0	0	0	1	0	0	0	1	**4**
Total	**1 engine**	**72**	**95**	**101**	**85**	**98**	**106**	**101**	**78**	**77**	**83**	**896**
	2 engines	**3**	**0**	**3**	**2**	**2**	**1**	**0**	**0**	**1**	**1**	**13**

Cattle Egret ingestion during take-off

During the take-off from Brisbane airport, the Boeing 737 ingested a Cattle Egret into the left engine. The crew detected abnormal vibrations and returned the aircraft to Brisbane. Engineers replaced two sets of fan blades (20 December 2015).

Fan blade damage (lower left of image) caused by ingesting a Cattle Egret. Source: Reporter

Significant occurrences involving bird ingestions

There were 160 single engine bird ingestions in 2014 – 2015, slightly less than the preceding 2 years; most of these did not result in damage to the engine. There are case studies of some of the more significant single engine bird ingestions throughout the report.

Table 12 shows that multiple engine bird ingestions account for less than two per cent of all bird ingestion occurrences. Multiple engine bird ingestions present a greater hazard to aviation safety, as the potential for loss of thrust to more than one engine exists, which may result in an aircraft being unable to maintain height.

There have been two multiple engine bird ingestion reported in the 2014 – 2015 period, one in military operations and one in high capacity operations. Summaries of these occurrences are presented on the following page.

PC-3 Orion, engine bird ingestion on landing

During the landing roll at Learmonth WA, a large amount of feathers were observed behind engine #4. Approximately 10 seconds later, a momentary plume of blue smoke was observed from the same engine. Upon shutdown a visual inspection of the aircraft was conducted with a large amount of feathers and blood evident on engine #4 cowl. Bird remains were also evident on the #3 cowl, #3 intake and starboard flaps.

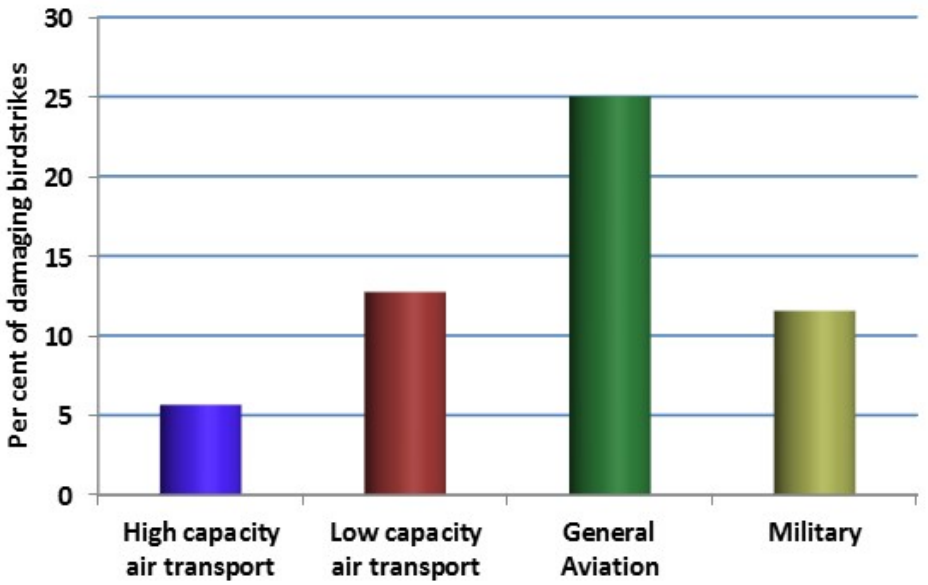
Boeing 737, engine bird ingestion during take-off

While lining up for take-off at Darwin, no birds were observed. However, during the take-off, after 80 kts, several Kites where noticed resting on the runway. At rotation they took flight and two Kites were struck, one in each engine. A smell of burning 'toasted cheese sandwiches' was reported but the engine parameters were normal. The crew elected to return to Darwin for an engineering inspection and conducted a 'normal' overweight landing.

6.2 Damage caused to aircraft by birdstrikes

Birdstrikes resulting in aircraft damage (including bird ingestions) present a significant hazard to aviation. In cases where a birdstrike results in aircraft airframe or engine damage, a considerable repair cost can also be involved. General aviation operations continue to have the highest proportion of damaging birdstrikes, with one quarter of all reported general aviation birdstrikes between 2006 and 2015 resulting in damage (Figure 22).

Figure 22: Proportion of birdstrikes resulting in damage in each operation type over the 2006 – 2015 period



Aircraft parts damaged from birdstrikes

Aeroplane wings and helicopter rotor blades are the most commonly damaged aircraft components across all operational types, particularly in general aviation, which had the highest number of birdstrikes in which these parts were damaged (Table 13). Wings may be the most common damaging birdstrike location on fixed-wing aircraft as they present a large frontal surface area on an aircraft and aerodynamic effects may draw birds into a collision course, and in helicopters, because of the high rotational speed of the rotors. Engines were the most frequently

damaged component in high capacity air transport aircraft (related to the large proportion of these birdstrikes which result in a bird being ingested into the engine).

Table 13: Number of birdstrikes by part damaged and operation type over the 2006 - 2015 period

Part damaged	High capacity air transport	Low capacity air transport	General Aviation	Military	Unknown	Total
Wing/Rotor	106	112	190	20	6	**434**
Engine	145	44	10	19	1	**219**
Nose	49	23	15	7	1	**95**
Propeller	28	35	24	2	6	**95**
Other	23	30	30	10	1	**94**
Landing Gear	25	11	12	2	2	**52**
Windscreen	10	9	30	2	0	**51**
Lights	24	12	7	1	3	**47**
Tail	15	9	18	2	0	**44**
Fuselage	17	8	9	4	0	**38**

Birdstrikes resulting in serious damage

There were 11 birdstrike occurrences from 2006 to 2015 that resulted in serious damage[7] to aircraft. Ten of these occurrences were in general aviation flying, while one was in low capacity air transport operations. Four of the 11 occurrences involved helicopters, six involved fixed wing aircraft while one occurrence involved a remotely piloted aircraft (RPA). The three birdstrike occurrences resulting in substantial aircraft damage that have occurred in the last two years (2014 – 2015) are summarised on the following pages.

[7] Serious damage is defined in the Transport Safety Investigation Regulations 2003 as damage to an aircraft that: (i) significantly affects the structural integrity, performance or operational characteristics of the aircraft; and (ii) requires major repair or replacement of the affected component or components of the aircraft; or (b) destruction of the aircraft.

Birdstrike with Whistling Kite

Shortly after dropping off three rangers near Emu Springs NT, the pilot of the Robinson R44 was cruising at 200 feet en route to re-fuel. The pilot heard a loud bang as a Whistling Kite struck the tail rotor and the aircraft started yawing and then spinning (approximately 3-4 turns). The pilot throttled back the engine, dropped collective and commenced a forced landing. The pilot reported seeing what they thought was the tail rotor gearbox fly past the aircraft shortly before landing in some trees hard and coming to rest. The pilot walked away without serious injury.

Damage caused by hard landing after a Whistling Kite struck the tail rotor of an R44. Source: Reporter

Piper PA-31 strike with Pelican

During the cruise near Archerfield Qld, the pilot of the Piper PA-31 spotted a Pelican flying in the opposite direction, toward the aircraft, at windscreen height. The pilot took evasive action and the Pelican passed above the aircraft but struck the empennage. After returning to Archerfield, a subsequent inspection showed substantial damage to the port horizontal stabiliser leading edge.

RPA Birdstrike with Eagle

Flying a routine mapping mission near Boonah Qld, an Eagle clipped the left wing of the SenseFly eBee remotely piloted aircraft (RPA). The wing subsequently separated from the fuselage and the RPA began a controlled spiral to the ground. The aircraft was recovered on a nearby road, substantially damaged.

There were a further two occurrences that resulted in aircraft being destroyed, both in general aviation. The first of these, in 2008, involved an unknown bird striking the tail of a Robinson R22 helicopter near Princess Charlotte Bay QLD. After the birdstrike the pilot lost control of the helicopter and it crashed into a river; the pilot escaped without injury. The second occurrence, between an RPAS and an Eagle is described below.

RPA Birdstrike with Eagle

In January 2013, a Gatewing X100 remotely piloted aircraft was being used for aerial survey work south of Perth, WA. During the cruise, the aircraft struck an Eagle resulting in it losing stability and colliding with terrain. The aircraft was destroyed.

An example of the Gatewing RPA system on its launch rail. Source Wiki Commons

6.3 Personal injuries resulting from birdstrikes

Injuries from birdstrikes mostly occur in general aviation and occasionally in low capacity air transport operations. Typically, the injury results from a bird penetrating the aircraft windscreen. However, some injuries have occurred due to some form of loss of control following the birdstrike. Sometimes, this is through emergency actions such as a forced landing that may have been required after a birdstrike to another part of the aircraft, such as the tail rotor (in helicopters) or the leading edge of the wing (in aeroplanes), where critical damage prevented safe and effective control of the aircraft.

Ten of the reported birdstrike occurrences between 2006 and 2015 resulted in injury, two of which were during 2014 and 2015. Eight of the ten occurred in general aviation, while two occurred during low capacity air transport operations. In all cases, the injuries received as a consequence of the birdstrike were minor.

Of the two occurrences in 2014 – 2015 resulting in injuries, one has previously been summarised on page 7. The other, which was investigated by the ASTB is summarised on the next page.

Glasair Sportsman GS-2 birdstrike, ATSB investigation AO-2016-001

In December 2015, the pilot of a Glasair Sportsman GS-2 was cruising at 5,500 ft near Bathurst, when the aircraft collided with a very large bird, believed to be a Wedge-tailed Eagle. The bird broke though the windscreen on the left side of the aircraft and struck the pilot. The collision left the pilot with serious facial injuries and they were temporarily unable to see. The pilot was wearing a headset and spectacles, which were both dislodged and damaged during the collision. Following the birdstrike, the aircraft entered a rapid descent, but the pilot recovered sufficiently to regain control. Despite the broken windscreen and their injuries, the pilot was able to divert to Bathurst Airport and land successfully. During their ordeal, the pilot had been able to locate the microphone of the headset and transmit a MAYDAY call, but damage to the headset meant that they were unable to hear any incoming transmissions. Although air traffic control (ATC) received the MAYDAY call, they did not know the callsign or specific location of the aircraft involved, or the intentions of the pilot. About 30 minutes after the MAYDAY call, the Safety Officer at Bathurst airport contacted ATC to advise them that an aircraft with a broken windscreen (the result of a birdstrike) had landed at Bathurst.

The result of an impact with a Wedge-tailed Eagle, showing where the animal penetrated the windshield of the Glasair Sportsman GS-2. Source: Reporter

7. Birdstrikes by bird type, number struck, and size

7.1 Types of birds struck

7.1.1 Total birdstrikes by bird type

Table 14 shows the total number of birdstrikes by bird type, distributed by state. The data is presented in order of the most commonly struck bird types nationwide, and includes all bird types that were involved in 70 or more birdstrike occurrences nationally between 2006 and 2015. A full listing of the bird species involved in birdstrikes in each Australian state over this period can be found in Appendix D (Table 38).

Flying foxes and bats continue to be the most commonly struck species in Australia for the 2006 to 2015 period, with the majority of flying fox and bat strikes occurring at locations on the east coast of Australia. It is likely that the majority of these occurrences involve flying foxes, however, bats and flying foxes are reported as a combined group as flying foxes are often reported as bats (see Appendix A for bird groupings used in this report, Table 30).

Since the last edition of this report, Kites have replaced Lapwing/Plovers as the second most frequently struck bird type. In Appendix A, it can be seen that the Kite group is made up of birds that are reported as being either Kites, Black Kites, Kite-Hawks, Whistling Kites, Black-shouldered Kites, and Fork-tailed Kites. Birds in the Lapwing/Plover family were the third most frequently struck; however, it is likely that this is influenced by the broad species range included in this bird type (Banded Plover, Black-fronted Plover, Dotterel, Lapwing, Masked Lapwing, Masked Plover, Oriental Plover, Pacific Golden Plover, Plover, Spur-winged Plover). Galahs, however, are a single group, and although fourth overall, they remain the most frequent single species struck across Australia in the 2006 to 2015 period. They also make up the highest number of overall strikes in South Australia and the Australian Capital Territory and the second highest in New South Wales.

Some larger, less commonly struck birds are not included in Table 14, such as the Brush Turkey (34 birdstrikes), Wedge-tailed Eagle (25 birdstrikes), Magpie Goose (20 birdstrikes), Pelican (22 birdstrikes) and Bustard (30 birdstrikes). These are, however, shown in the section on damaging birdstrikes. While the number of total birdstrikes involving these larger birds is relatively low, the potential for aircraft damage or injury from such birdstrikes represents a significant risk to continued safety of flight (see Section 7.1.2).

Table 14: Birdstrikes by bird type and state, 2006 to 2015

Bird Type	ACT	NSW	NT	QLD	SA	TAS	VIC	WA	Other	Total
Bat/Flying Fox	5	322	71	537	8	0	39	34	0	**1016**
Kite	0	81	277	426	9	0	29	108	0	**930**
Lapwing/Plover	14	174	107	176	58	142	45	149	0	**865**
Galah	110	308	27	132	130	2	44	73	0	**826**
Swallow/Martin	11	120	40	328	38	18	25	68	2	**650**
Nankeen Kestrel	15	105	32	219	54	1	11	126	18	**581**
Magpie	32	135	3	87	113	4	110	29	0	**513**
Magpie-lark	1	50	25	121	129	3	10	30	0	**369**
Hawk	7	76	16	108	21	10	13	65	1	**317**
Pipit	12	79	11	43	0	25	58	43	0	**271**
Silver Gull	1	66	1	13	42	29	58	42	4	**256**
Curlew/Sandpiper	0	3	95	122	1	1	0	11	3	**236**
Duck	22	44	4	82	2	6	13	54	3	**230**
Dove	0	39	15	60	64	1	25	20	3	**227**
Pratincole	0	0	143	24	0	0	0	20	0	**187**
House Sparrow	2	30	5	72	11	14	30	16	0	**180**
Heron/Egret	0	25	6	115	2	0	5	8	10	**171**
Owl	0	25	10	39	7	0	16	44	1	**142**
Ibis	2	32	4	78	4	0	12	5	0	**137**
Parrot	0	9	21	35	11	0	1	26	0	**103**
Crow/Raven	6	12	7	37	10	7	14	8	0	**101**
Finch	0	5	19	18	1	22	4	22	2	**93**
Eagle	0	13	8	32	1	3	6	24	0	**87**
Swift	0	15	0	61	0	0	0	3	1	**80**
Falcon	0	11	17	14	2	1	12	19	0	**76**
Starling	1	15	1	9	12	17	14	3	1	**73**

Table 15 shows the common bird types struck in the last 2 years (2014 and 2015) with more than 30 reported birdstrikes across Australia. Of the 19 bird types in Table 15, the Swifts and Parrots are the only new additions when compared with the previous 2-year period. When compared with the 10-year average there is also very little difference regarding the top ten bird types, where only the tenth place bird is different. The biggest difference comparing Table 14 and Table 15 is that bird strikes involving Swallow/Martins have been the second most frequent in 2014 and 2015, increasing from sixth most frequent in the previous 2-year period.

Table 15: Birdstrikes by bird type and state, 2014 to 2015

Bird Type	ACT	NSW	NT	QLD	SA	TAS	VIC	WA	Other	Total
Bat/Flying Fox	4	62	18	156	2	0	2	11	0	**255**
Swallow/Martin	4	49	5	85	18	7	1	22	1	**192**
Kite	0	19	67	75	0	0	3	22	0	**186**
Lapwing/Plover	4	30	25	36	13	10	7	28	0	**153**
Galah	15	57	8	28	15	1	13	15	0	**152**
Nankeen Kestrel	5	22	4	41	14	0	2	22	3	**113**
Magpie	7	33	0	19	20	0	17	5	0	**101**
Magpie-lark	0	9	5	34	22	0	2	12	0	**84**
Pipit	5	8	3	11	0	14	10	8	0	**59**
Pratincole	0	0	34	7	0	0	0	13	0	**54**
Hawk	1	17	0	17	4	1	2	10	1	**53**
Duck	3	11	0	14	0	0	4	20	1	**53**
Curlew/Sandpiper	0	0	14	30	0	1	0	3	0	**48**
House Sparrow	1	8	1	17	5	3	5	4	0	**44**
Silver Gull	0	11	0	1	8	2	16	3	2	**43**
Dove	0	7	2	14	5	1	5	1	1	**36**
Heron/Egret	0	5	1	23	0	0	1	2	1	**33**
Parrot	0	3	4	13	5	0	0	5	0	**30**
Swift	0	4	0	25	0	0	0	0	1	**30**

Figure 23: The four bird types most commonly involved in birdstrikes between 2014 and 2015. Clockwise from top left; Bat/Flying Fox, Kite, Lapwing/Plover and Swallow/Martins.

Figure 24 shows the yearly average number of birdstrikes by species group for the last 10 years (2006 - 2015) (columns), versus the average over just the last 2 years (2014 and 2015) (data points) for bird types with a 10-year average of over 20 birdstrikes per year. The Bat/Flying Fox and Swallow/Martin groups have had the most significant increase in the number of reported birdstrikes per year in the last 2 years. Bat/Flying Fox strikes averaged 139 per year for 2014 and 2015 compared with 106 per year on average across the entire 10-year reporting period. Birdstrikes with Swallow/Martins averaged 96 per year in the most recent two years compared to 65 per year over the ten years.

Lapwing/Plovers, Galahs, Nankeen Kestrels and Magpies were all involved in birdstrikes slightly less frequently than the 10-year average during 2014 and 2015.

Figure 24: Average number of birdstrikes per year by bird type, 2006 to 2015

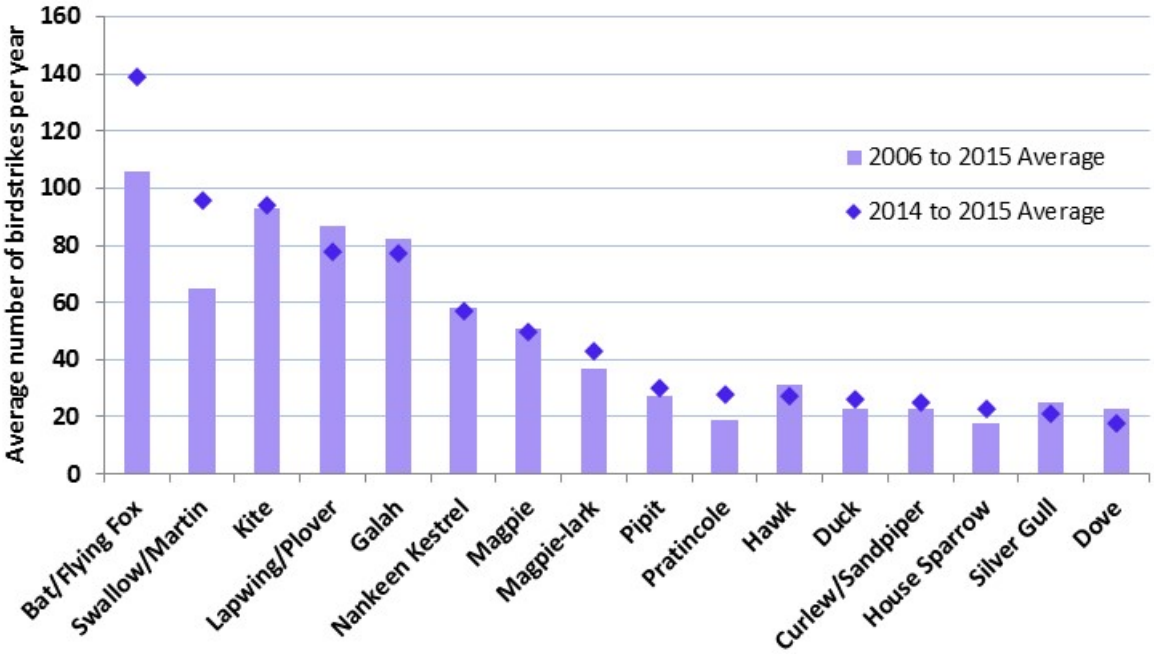
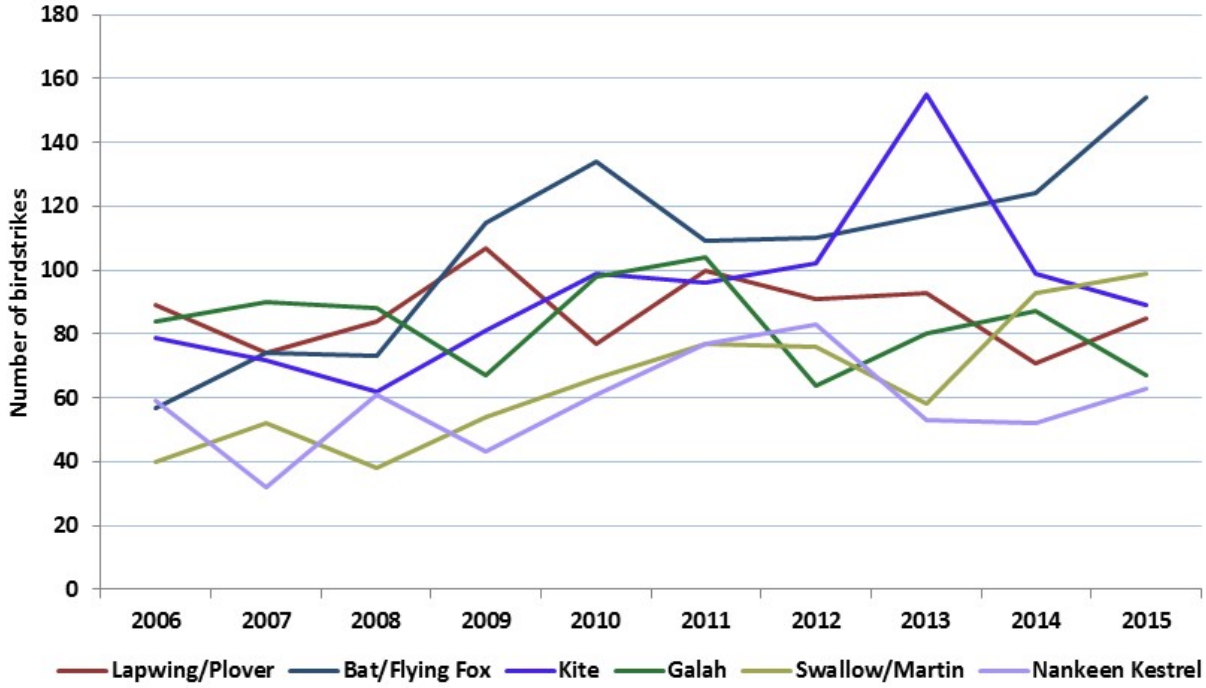


Figure 25 shows the 10-year trend for the six bird types most commonly struck by aircraft from 2006 to 2015. The large increase in the Bat/Flying Fox and Swallow/Martin groups' birdstrikes in the 2014 – 2015 can be seen. Interestingly, after a large spike in Kite strikes in 2013 the number of Kite strikes has significantly decreased. A full list of species by year is included in Appendix D (Table 39).

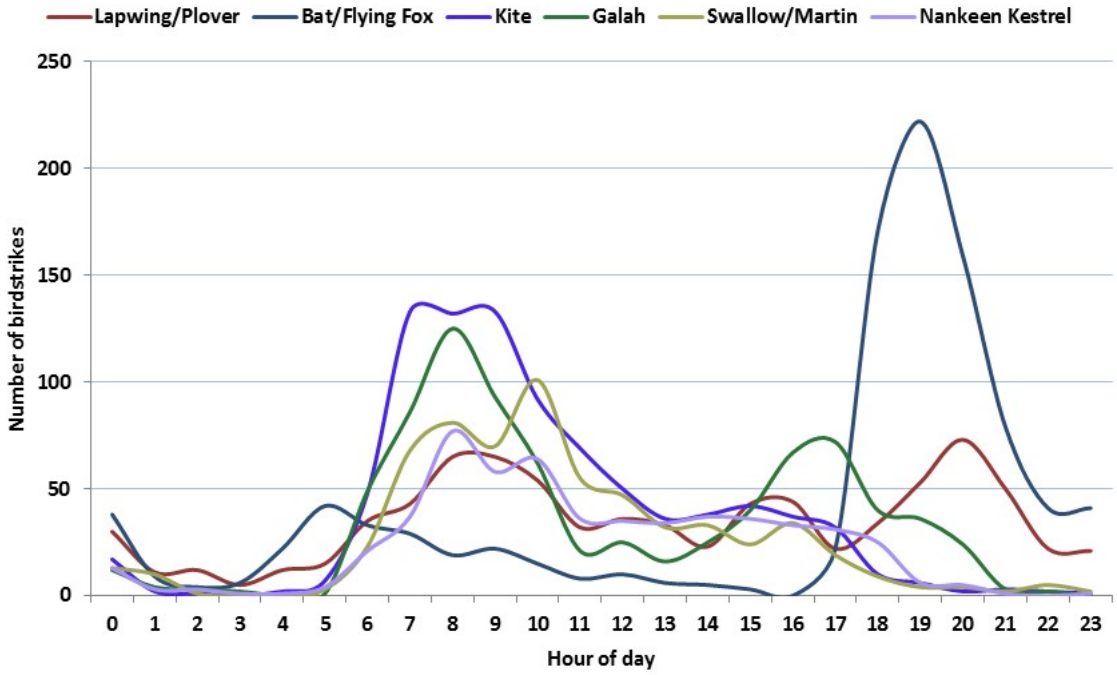
Figure 25: Number of birdstrikes for the Top 6 most frequent bird types struck by year, 2006 to 2015



7.1.2 Time of day and bird type

Figure 26 shows the times of the day when birdstrikes occurred for the six most commonly struck bird types. As previously mentioned, the overall frequency of birdstrikes across the day is influenced by the morning and evening peak aircraft movement times at major airports, but the hourly level of activity for different species clearly also has an influence on birdstrikes. Of note are strikes involving Bats and Flying Foxes, which tend to occur around 1900 (likely just after last light), whereas most other birds are struck during daylight hours. The Galah and Lapwing/Plover have peak birdstrike times in the morning and later significant peaks in late afternoon for the Galah and just after dark for the Lapwing/Plover. This is contrary to other types of birds, which generally exhibit only one period of the day where most strikes occur. A complete list of birdstrike times (by hour of the day) by bird type is included in Appendix D (Table 41).

Figure 26: Birdstrikes by bird type by hour of day over the 2002 – 2011 period



7.1.3 Damaging birdstrikes by bird type

Fixed-wing aircraft (aeroplanes and gliders)

Table 16 on page 44 shows the total number of birdstrikes (by bird type) which resulted in reported damage to fixed-wing aircraft. The level of damage to the aeroplanes (destroyed, substantial, minor and nil) is presented where both the damage and bird type was known, and the bird type was involved in at least one birdstrike in the last 10 years that resulted in damage. A 'damage ratio' is also presented, which shows, for each bird type, the proportion of all strikes that resulted in damage. This gives a relative indication of which bird types tend to be involved in damaging strikes.

Eagles, Pelicans, Australian Brush-turkeys, Magpie Geese and Bustards were all reported as causing substantial damage on aeroplanes in at least one reported birdstrike since 2006, with Bats / Flying Foxes, Galahs and Kites most frequently causing minor damage over the same period.

Table 16: Damaging birdstrikes to aeroplanes by bird type, 2006 to 2015

Bird Type	Destroyed	Substantial damage	Minor damage	Nil damage	Damage ratio
Eagle	0	1	24	49	0.36
Pelican	0	1	16	3	0.85
Australian Brush-turkey	0	1	10	17	0.39
Bustard	0	1	8	19	0.32
Magpie Goose	0	1	5	11	0.35
Bat/Flying Fox	0	0	93	631	0.13
Kite	0	0	82	635	0.11
Galah	0	0	76	552	0.12
Duck	0	0	42	134	0.24
Lapwing/Plover	0	0	35	610	0.05
Hawk	0	0	32	215	0.13
Magpie	0	0	26	334	0.07
Ibis	0	0	24	83	0.22
Silver Gull	0	0	22	148	0.13
Curlew/Sandpiper	0	0	14	148	0.09
Dove	0	0	14	136	0.09
Cockatoo	0	0	14	41	0.25
Nankeen Kestrel	0	0	13	382	0.03
Magpie-lark	0	0	13	241	0.05
Crow/Raven	0	0	12	58	0.17
Heron/Egret	0	0	10	125	0.07
Owl	0	0	9	71	0.11
House Sparrow	0	0	7	148	0.05
Parrot	0	0	7	73	0.09
Falcon	0	0	7	49	0.13
Wedge-tailed Eagle	0	0	6	12	0.33
Swallow/Martin	0	0	5	515	0.01
Pipit	0	0	2	192	0.01
Pratincole	0	0	2	106	0.02
Tern	0	0	2	42	0.05
Pacific Gull	0	0	2	16	0.11
Cormorant	0	0	2	14	0.13
Thrush	0	0	2	3	0.4
Swan	0	0	2	3	0.4
Swift	0	0	1	68	0.01
Other	0	0	1	22	0.04
Frigate	0	0	1	7	0.13
Oystercatcher	0	0	1	2	0.33

Helicopter damage

Table 17 shows the number of helicopter birdstrikes by bird type where at least one report of damage was received for a particular bird type. Helicopters have a relatively smaller number of birdstrikes reported to the ATSB; however, these tend to result in aircraft damage more frequently than for aeroplanes. Wedge-tailed Eagles, Galahs, Kites and Pelicans were all reported as causing substantial damage to helicopters in at least one reported birdstrike since 2006. There was one helicopter reported as destroyed as a result of a birdstrike in the study period. However, this occurrence is not represented in Table 17 as the bird species involved was not reported to the ATSB.

Table 17: Damaging birdstrikes to helicopters by bird type, 2006 to 2015

Bird Type	Destroyed	Substantial damage	Minor damage	Nil damage	Damage ratio
Wedge-tailed Eagle	0	1	2	1	0.75
Galah	0	1	0	4	0.2
Kite	0	1	0	2	0.33
Pelican	0	1	0	0	1
Bat/Flying Fox	0	0	9	37	0.2
Silver Gull	0	0	5	22	0.19
Hawk	0	0	3	2	0.6
Ibis	0	0	2	0	1
Dove	0	0	1	7	0.13
Magpie	0	0	1	1	0.5
Australian Brush-turkey	0	0	1	0	1

Remotely piloted aircraft (RPA) damage

In recent years there has been a growing use of RPA throughout Australia. Like all aircraft, RPA are also vulnerable to birdstrikes, perhaps more so due to their smaller size. Table 18 shows the number of RPA birdstrikes by bird type where at least one report of damage was received for a particular bird type. There have only been two birdstrikes with RPA reported to the ATSB, both of which involved Eagles aggressively attacking, and in one case destroying, the aircraft. Both these occurrences have previously been discussed in section 6.2, page 35.

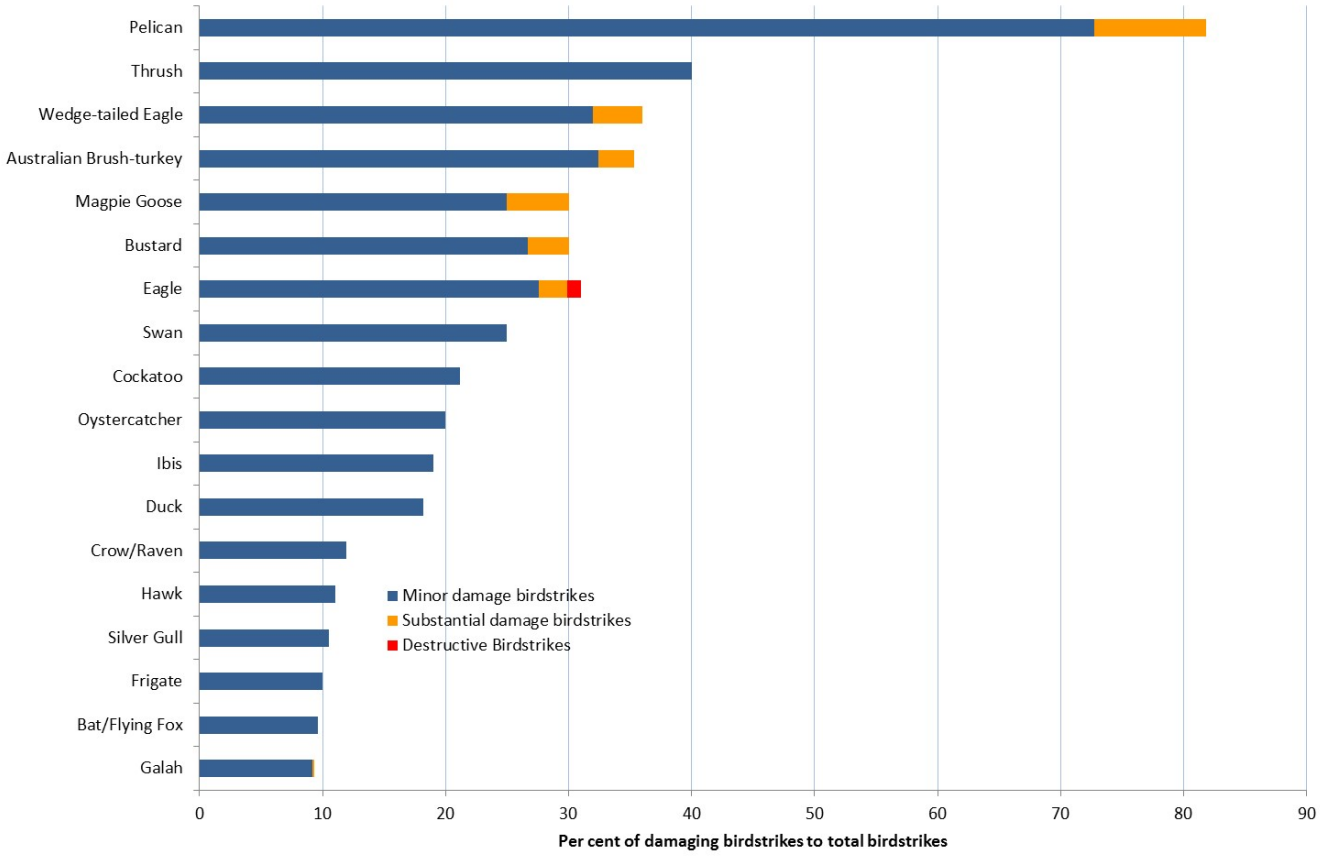
Table 18: Damaging birdstrikes to remotely piloted aircraft by bird type, 2006 to 2015

Bird Type	Destroyed	Substantial damage	Minor damage	Nil damage	Damage ratio
Eagle	1	1	0	0	1

All aircraft types

Figure 27 shows the bird types that have the highest proportion of damaging birdstrikes, compared with the total number of birdstrikes reported involving that bird type. Nearly 80 per cent of Pelican strikes resulted in aircraft damage (74% minor damage and 5% substantial damage). Magpie Geese, Australian Brush-turkeys, Wedge-tailed Eagles and other Eagles all have a high rate of damaging birdstrikes (at least one in every three reported birdstrikes resulted in some level of damage). More than one in every five reported birdstrikes involving Bustards and Ibis also resulted in damage.

Figure 27: Percentage of reported birdstrikes where damage occurred by bird type (where known) over the 2005 – 2016 period



7.1.4 Damaging birdstrikes by bird type and operation type

Strikes causing serious damage

There were 11 reported birdstrikes that caused either substantial or destructive aircraft damage between 2006 and 2015 where the bird type was known. One of these birdstrikes involved a Pelican that hit a Robinson R44 helicopter conducting low capacity air transport operations resulting in substantial damage to the aircraft. All other substantial damage birdstrikes involved aircraft conducting general aviation operations.

Birds with the most reported damaging birdstrikes for each operation type

The following figures show the bird types with the highest number of damaging birdstrikes reported for each operation type. There were common species across all of the operation types; however, each operation type shows a distinct distribution of the bird species that most frequently caused damage. This probably reflects varying bird threats at specific locations used by different types of operations – for example, major capital city airports are generally not used by general aviation aircraft. A complete list of bird types involved in damaging birdstrikes (by aerodrome and operation type) is included in Appendix D (Table 37).

Figure 28: High capacity air transport damaging birdstrikes by bird type, 2006 – 2015

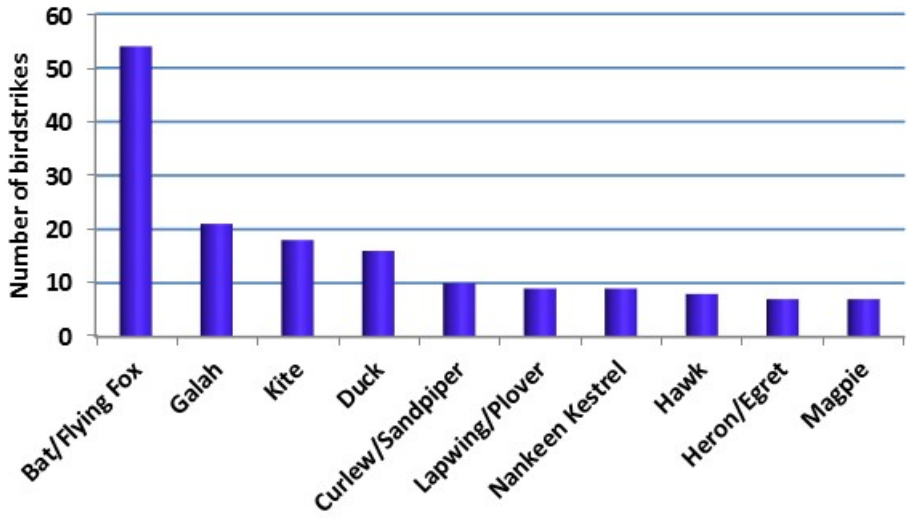


Figure 29: Low capacity air transport damaging birdstrikes by bird type, 2006 – 2015

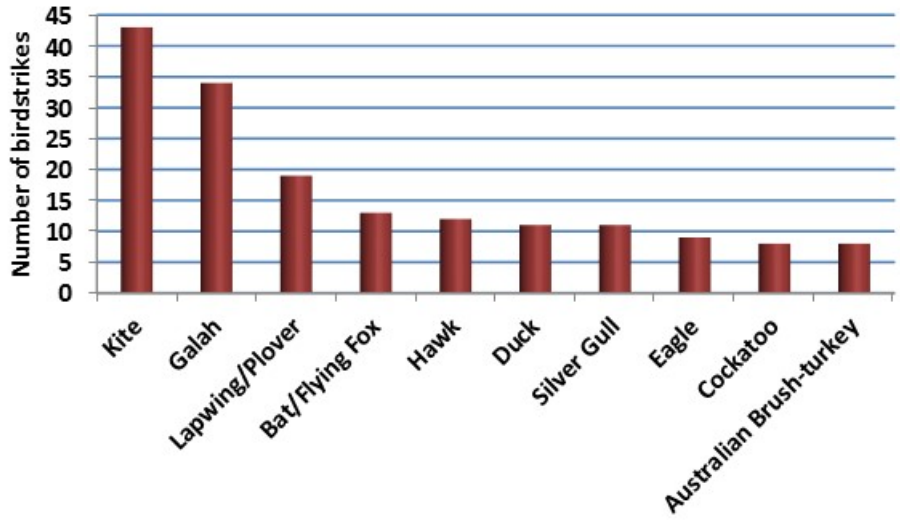
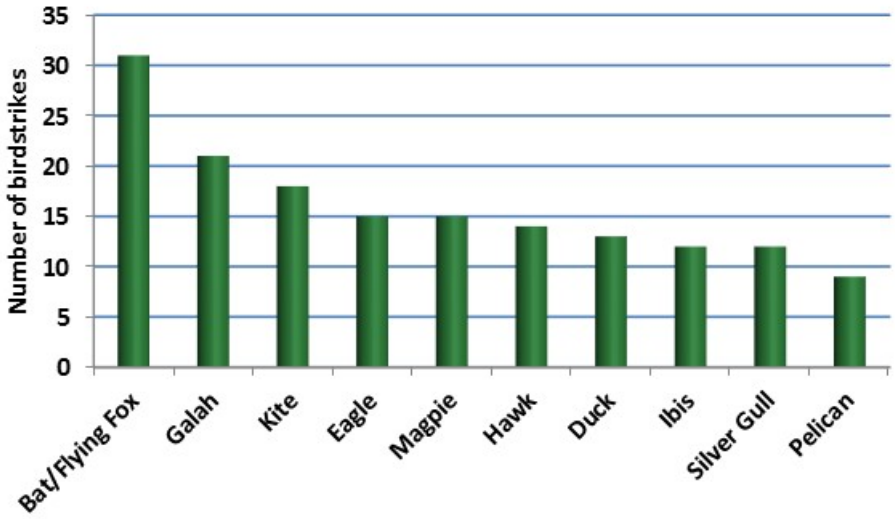


Figure 30: General aviation damaging birdstrikes by bird type, 2006 – 2015



In addition, there were 13 reported cases where birdstrikes resulted in damage to military aircraft where the species were known (shown in Table 19). Damaging military birdstrikes had no distinct distribution by bird type, although similar types of birds were struck when compared with other operation types.

Table 19: Damaging birdstrikes to military aircraft by bird type and damage severity, 2006 – 2015

Bird type	Birdstrikes
Bat/Flying Fox	3
Pelican	2
Duck	2
Eagle	1
Galah	1
Kite	1
Nankeen Kestrel	1
Crow/Raven	1
Dove	1

7.2 Strikes involving multiple birds

A birdstrike occurrence in which multiple birds are struck generally presents a greater hazard to continued safe flight. For larger aircraft, one of the most hazardous scenarios is when multiple engine bird ingestions occur, especially involving large birds.

Table 20 shows those bird types with at least one birdstrike occurrence in the 2006 - 2015 period which involved multiple birds being struck. Multiple Galah birdstrikes were the most common over the study period, with more than one bird hit in over 38 per cent of Galah birdstrikes, related to the fact that Galahs are known to have flocking tendencies. Doves, Silver Gulls, Parrots and Ducks all involved collisions with multiple birds in at least one in four occurrences (when considered collectively).

Bombardier DHC-8, multiple strikes with Corellas

Just after takeoff from Dubbo Aerodrome NSW, prior to selecting the landing gear up, a large flock of birds (Corellas) collided with the aircraft. There was immediate evidence of the impact on the windscreens but all systems appeared to be functioning normally. After landing, inspection of the aircraft revealed multiple impacts to both propellers, the #2 engine intake, the leading edge of each wing either side of the engine nacelles, the right main landing gear strut, under each wing root on the side of the fuselage and near the top of the vertical stabiliser, as well as underneath the right horizontal stabiliser. The pilot's-side windscreen and the co-pilot's main windscreen also showed evidence of impact. The only visible damage to the aircraft was that the co-pilot's windscreen wiper blade was rotated so that the wiper blade was no longer touching the windscreen (12 February 2015).

Cessna 206, multiple strikes with unknown birds

While conducting survey work the Cessna 206 struck a flock of birds at about 1,800 ft. The birds impacted several parts of the aircraft including the windshield, which was broken by the impact. The pilot returned the aircraft to Mackay Qld and made a successful landing (20 July 2014).

The result of multiple birdstrikes to a Cessna 206.
Source: http://cqplanespotting.blogspot.com.au/2014/07/graphic-photos-of-aftermath-of-bird.html

Table 20: Birdstrikes involving multiple strikes by bird type, 2006 – 2015

Bird type	Greater than 10	Between 2 and 10	Single bird
Galah	17	294	502
Dove	5	50	172
Silver Gull	4	66	186
Parrot	4	28	72
Duck	2	68	161
Finch	2	20	71
Bat/Flying Fox	1	80	957
Swallow/Martin	1	70	567
Curlew/Sandpiper	1	26	210
Pratincole	1	20	165
Cockatoo	1	19	45
Swift	1	13	65
Tern	1	5	58
Lapwing/Plover	0	129	739
Kite	0	70	856
Magpie	0	22	480
Magpie-lark	0	22	347
Nankeen Kestrel	0	17	564
Ibis	0	16	114
Pipit	0	11	262
Hawk	0	10	307
House Sparrow	0	9	166
Heron/Egret	0	9	162
Pacific Gull	0	8	15
Starling	0	7	66
Crow/Raven	0	5	92
Magpie Goose	0	5	15
Owl	0	2	140
Thrush	0	2	3
Eagle	0	1	84
Skylark	0	1	54
Australian Brush-turkey	0	1	33
Other	0	1	29
Wedge-tailed Eagle	0	1	24
Kingfisher/Kookaburra	0	1	14
Myna	0	1	11
Wader	0	1	11
Swan	0	1	7

7.3 Size of birds struck

7.3.1 Total birdstrikes by bird size

As discussed in section 5.3, the size classifications have been redefined for this report. As such significant changes to tables and figures in the following section can be expected in comparison to those in the last edition of this report. Figure 31 shows that medium sized birds have been by far

the most frequently stuck in the ten years between 2006 and 2015. The number of birdstrikes involving small birds has been the next most frequent. This latter group have also doubled in numbers struck of the last ten years. Birdstrikes with large and very large birds have remained consistently relatively low. However, both have been declining since 2011. It is possible that these trends may suggest that recent mitigation strategies appear to be effective at reducing strikes involving the higher risk medium and larger sized birds. However, the number of reported birdstrikes with birds of unknown size (data not shown), make it difficult to draw any definitive conclusions from Figure 31.

Figure 31: Number of birdstrikes by bird size, 2006 to 2015

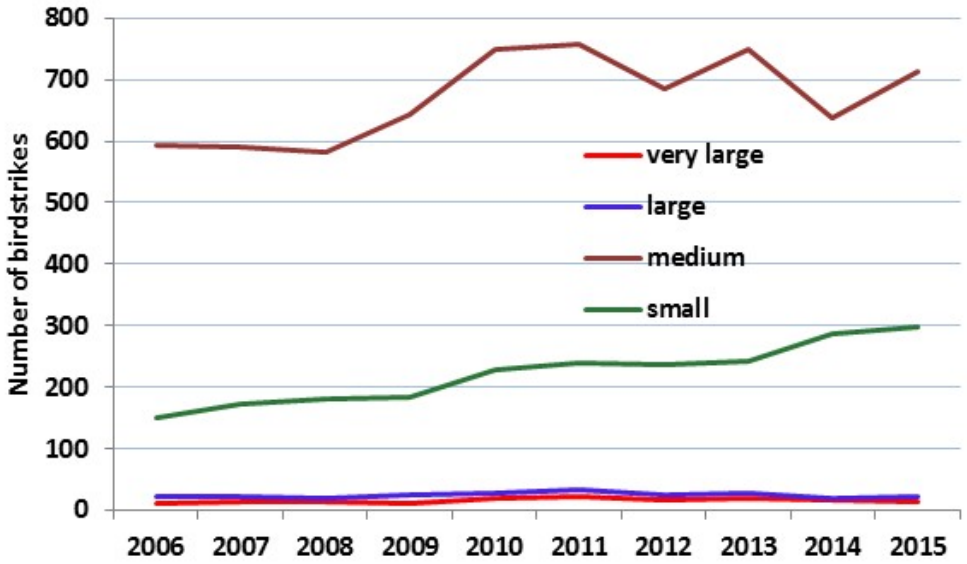


Table 21 shows that in all transport modes, where bird size is known, medium-sized birds were struck the most often, followed by small birds. General aviation had proportionally more birdstrikes involving large and very large birds, with about 6 per cent of birds struck being either large or very large compared with 3 per cent for low capacity operations, 2 per cent for high capacity and 1 per cent for military operations.

Table 21: Number of birdstrikes by bird size and operation type, 2006 to 2015

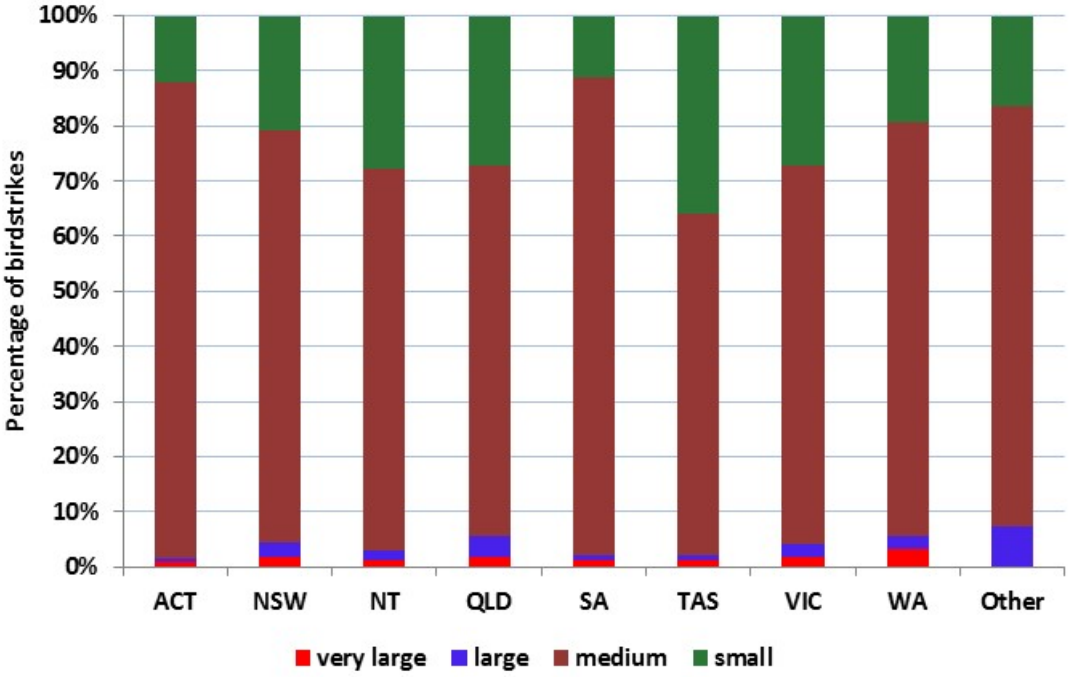
Operation Type	Bird size	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total
High capacity air transport	very large	5	6	3	3	5	7	11	7	8	6	**61**
	large	9	8	12	11	10	18	14	12	11	13	**118**
	medium	235	239	233	280	345	330	346	359	334	355	**3,056**
	small	91	97	122	123	160	160	158	187	210	194	**1,502**
	unknown	292	300	396	401	450	468	441	431	735	655	**4,569**
Low capacity air transport	very large	4	4	6	1	5	3	2	2	5	3	**35**
	large	4	8	2	5	4	7	6	7	2	4	**49**
	medium	124	116	129	131	159	195	124	163	126	150	**1,417**
	small	8	18	19	17	21	30	36	22	25	43	**239**
	unknown	58	65	57	92	65	97	80	109	89	106	**818**
General Aviation	very large	2	0	4	7	7	10	5	9	2	6	**52**
	large	6	4	4	8	2	4	3	6	4	2	**43**
	medium	41	67	80	83	75	87	76	105	84	88	**786**
	small	5	11	10	8	10	8	10	8	10	16	**96**
	unknown	37	48	60	79	59	53	58	64	78	81	**617**
Military	very large	0	2	1	0	1	1	0	0	0	0	**5**
	large	0	0	0	0	0	1	1	1	0	0	**3**
	medium	7	10	5	11	17	12	11	19	10	8	**110**
	small	1	1	0	6	5	7	7	9	13	9	**58**
	unknown	7	17	4	40	63	52	77	82	57	53	**452**
Unknown	very large	1	2	1	0	2	1	0	1	1	0	**9**
	large	4	2	1	2	11	3	2	2	3	4	**34**
	medium	185	158	134	137	154	133	128	102	83	112	**1,326**
	small	44	45	29	30	33	35	26	17	30	35	**324**
	unknown	64	30	27	32	36	25	15	17	13	27	**286**

Figure 32 shows a breakdown by state and territory of the percentage of birds struck by bird size (where the bird size was known). This generally correlated with the particular bird types struck that are common to each state,[8] as shown in Table 14 on page 39. A full list of the number of birds struck by size in each state and territory is provided in Appendix D (Table 40). From Figure 32 it can be seen that in an average year between 2006 and 2015, medium sized birds are the most

[8] Some bird types may include several species of significantly different sizes (for example, bats and flying foxes); however, for the majority of bird types, the bird species within that type are of similar mass and dimensions.

commonly stuck in every state and territory. Tasmania had the highest proportion of small birds struck with just over 35 per cent. Western Australia had the most number of very large birds struck, with 3.3 per cent of strikes between 2006 and 2015 involving very large birds. This was followed by Victoria (1.9%), and Queensland and New South Wales, both with 1.7 per cent of birdstrikes involving very large birds.

Figure 32: Percentage of birds struck by bird size for each state for the 2006 – 2015 period



7.3.2 Damaging birdstrikes by bird size

Damaging birdstrikes by bird size and operation type

Table 22 shows that the larger the bird size, the more likely a birdstrike will result in aircraft damage. This is irrespective of the type of operation the aircraft is conducting. However, as a proportion of total birdstrikes, those aircraft involved in high capacity air transport operations are less likely to be involved in a damaging birdstrike than those being used for low capacity air transport. These in turn are less likely to be involved in a damaging birdstrike than general aviation aircraft. This is related to the size and construction of typical aircraft in these operation type categories, as shown in Figure 33 on page 55.

Table 22: Bird size by aircraft damage and operation type for the 2006 – 2015 period

Operation type	Aircraft damage	Very large bird	Large bird	Medium bird	Small bird
High capacity air transport	Destroyed	0	0	0	0
	Substantial	0	0	0	0
	Minor	10	11	165	34
	Nil	42	76	2,268	1,252
Low capacity air transport	Destroyed	0	0	0	0
	Substantial	1	0	0	0
	Minor	13	14	184	11
	Nil	20	32	1,127	203
General Aviation	Destroyed	1	0	0	0
	Substantial	5	2	2	0
	Minor	30	18	132	21
	Nil	15	20	560	66
Military	Destroyed	0	0	0	0
	Substantial	0	0	0	0
	Minor	3	0	7	3
	Nil	2	3	79	50

Damaging birdstrikes by bird size and aircraft maximum weight

Figure 33 shows that lighter aircraft are generally more susceptible to damage than heavier aircraft, particularly as the size of the bird involved in the birdstrike increases. However, aircraft with a maximum take-off weight above 272,000 kg appear to be more susceptible to damage than aircraft in the 5,700-272,000 kg weight category (although the number of birdstrikes is considerably lower in the very large weight category). In the very large weight category, the Boeing 747 and the Boeing 777 were mostly commonly damaged, with the majority of damage being incurred on the wings of the aircraft, followed by the engines. Table 23 shows the number of strikes reported by bird size and aircraft weight category where the report indicated that the aircraft incurred some damage.

Figure 33: Percentage of damaging birdstrikes for bird size by aircraft maximum weight, 2006 – 2015

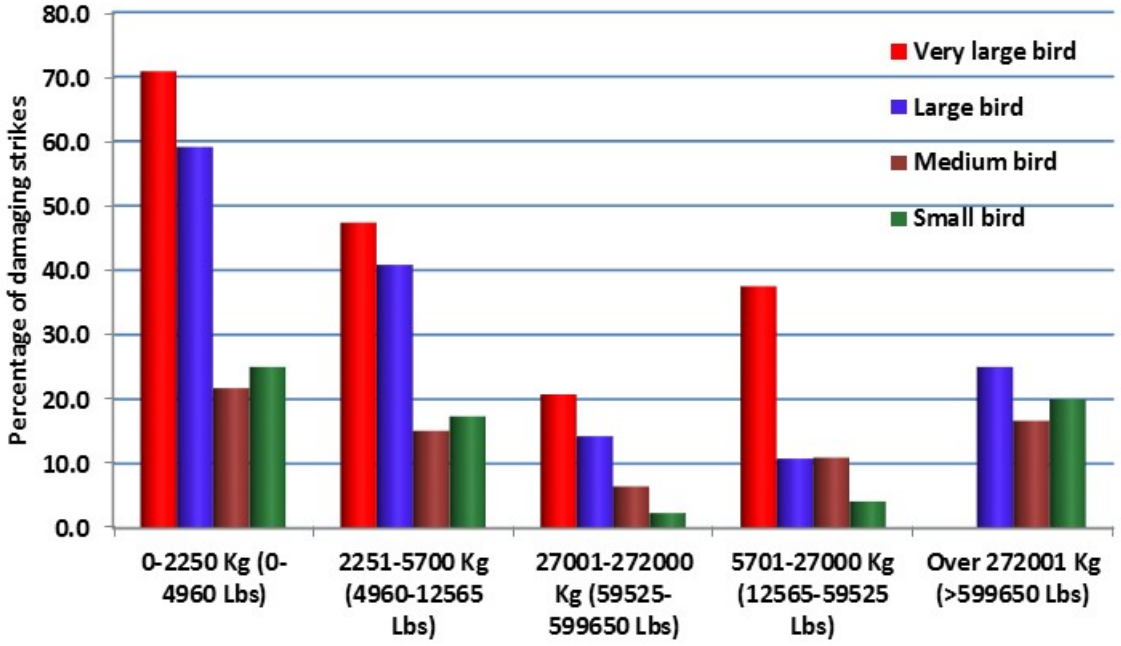


Table 23: Number of damaging birdstrikes by aircraft weight and bird size for the 2006 – 2015 period

Maximum takeoff weight	Was aircraft damage reported?	Very large bird	Large bird	Medium bird	Small bird
Less than 2,250 kg	Aircraft damaged	34	13	96	14
	No damage	14	9	346	42
2,251 - 5,700 kg	Aircraft damaged	9	20	101	13
	No damage	10	29	567	62
5,701 - 27,000 kg	Aircraft damaged	9	4	149	13
	No damage	15	33	1,213	299
27,001 - 272,000 kg	Aircraft damaged	11	11	140	28
	No damage	42	66	2,023	1,167
Over 272,001 kg	Aircraft damaged	0	1	7	2
	No damage	0	3	35	8

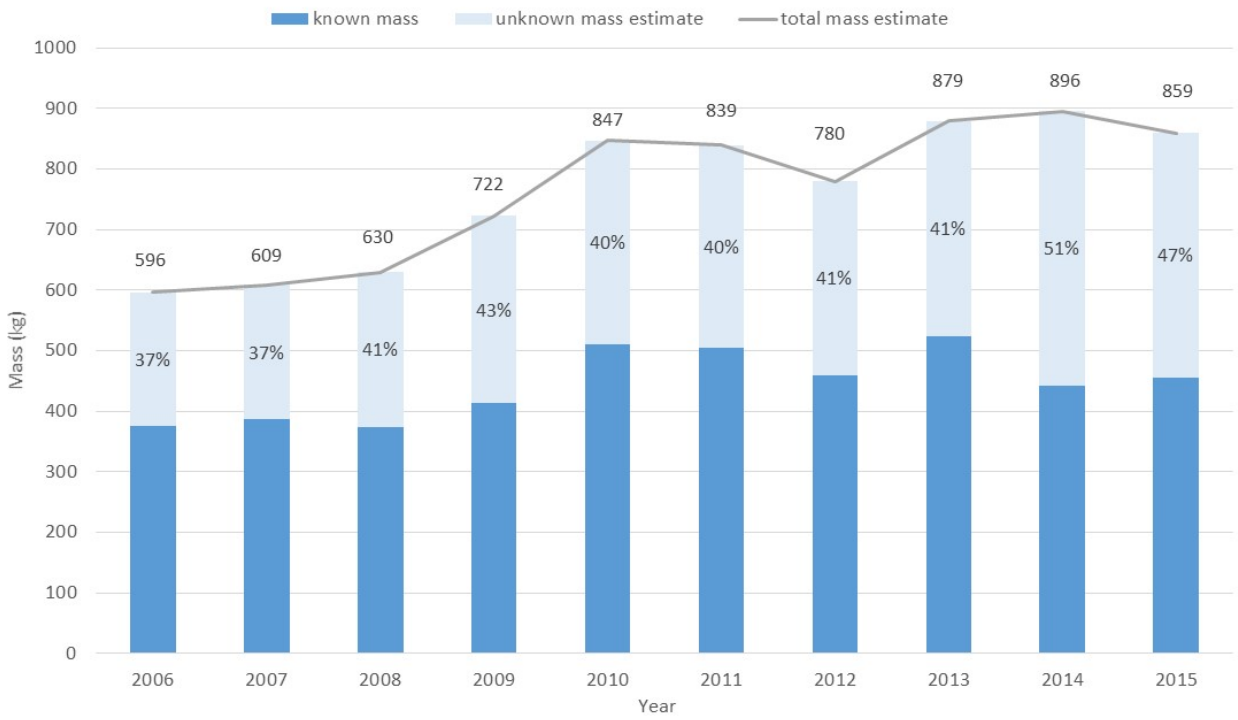
7.4 Bird mass analysis

The redefinition of the bird size categories based on bird mass used in this report, necessitated the assigning of an average mass for each bird species in the ATSB database. Once this was achieved the size categories could be redefined based specifically on defined ranges of masses (see section 5.3). In addition, the allocation of an average mass per species also facilitates new methods of analysing the mass of birds struck in Australia.

Firstly, an estimate of the total mass of flying animals struck in Australia is shown in Figure 34. Shown in dark blue is the mass of the known species struck. Over the ten year period, on average, 42 per cent of all birdstrike reports to the ATSB had no species information. Many of these reports are from flight crew that report striking a bird but do not have sufficient time to identify the animal struck. For each individual year, the percentage of unknown species struck is shown in the light blue portion of the graph. For each year the average mass of the known species is multiplied by the number of birdstrikes with unknown species information. This enables an estimate of the mass of unknown species struck for each year. This estimate is shown in light blue in Figure 34. The addition of the known species mass and unknown species mass estimate yields an estimate of the total flying animal mass struck each year, shown by the grey line and the data labels at the top of each column.

The mass estimate peaked in 2014 with 896 kg of flying animals struck. Averaged over the ten years between 2006 and 2015, 766 kg of flying animals were struck per year by aircraft in Australia.

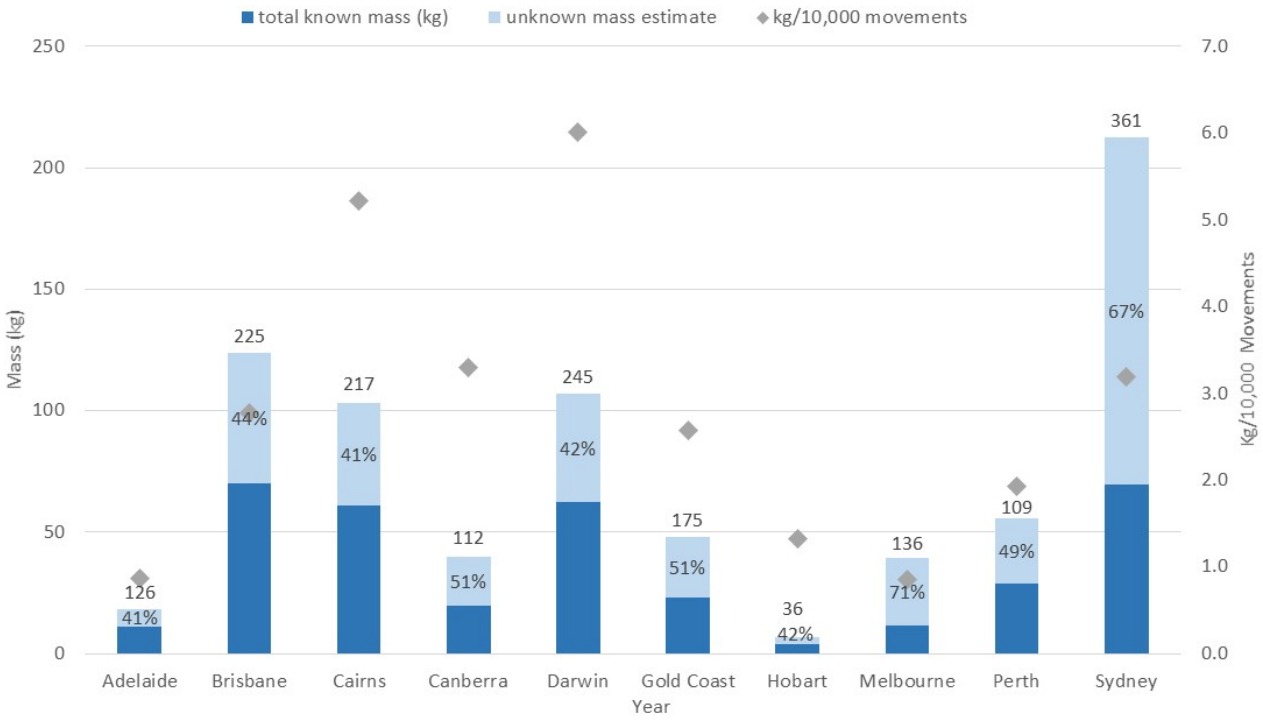
Figure 34: Estimate of the mass for flying animals struck per year in Australia, 2006 – 2015. Averaged over the ten years between 2006 and 2015, 766kg of flying animals were struck per year by aircraft in Australia.



Next, masses struck by location are also examined. Figure 35 shows an estimate of the flying animal mass struck at major aerodromes in Australia for the 2014 – 2015 period. For each of the ten aerodromes, the dark blue portion of the columns show the mass of the known species struck. For these ten aerodromes, on average over the past two years (2014 – 2015), 50 per cent of birdstrike reports have no species information. The percentages of unknown species for each location are shown in the light blue portion on the columns. Although the average is 50 per cent, it can be seen that there is significant variation in the amount of species information being reported. Adelaide, Cairns and Hobart all have the highest proportion of reports containing species information. In contrast, 67 per cent of the reports from Sydney and 71 per cent of the reports from Melbourne have no species information. For each location the average mass of the known species is multiplied by the number of birdstrikes with unknown species. This enables an estimate of the mass of unknown species struck for each location. This estimate is shown by the light blue

portion of the columns in Figure 35. The total number of strikes reported from each location over the two years are also shown by the data labels at the top of each column. Also shown in Figure 35 by the grey data points and the right vertical axis, is an estimate of the mass struck per 10,000 movements for each location. Sydney, for example, reported 361 birdstrikes in the 2014 – 2015 period, with an estimated 212 kg of flying animals struck in this time. However, the mass strike rate was only 3.18 kg/10,000 movements. Comparing this to Cairns and Darwin for example, both reported fewer birdstrikes and less mass struck of the same time than Sydney. However, the mass strike rates at these locations are much higher, 5.22kg/10,000 movements for Cairns and 6.00 kg /10,000 movements for Darwin. This indicates that although there are fewer birdstrikes at these locations, for each individual birdstrike, the likelihood of striking larger birds is higher at these locations.

Figure 35: Estimate of the flying animal mass struck at major aerodromes in Australia for the 2014 – 2015 period.



Finally, with the species masses coded, damaging birdstrikes by species mass was examined. Figure 36 shows the relationship between average species mass and the likelihood of a birdstrike resulting in aircraft damage. To obtain this relationship, the birdstrikes for each species over the last ten years was considered. To reduce errors in the final figure, only species that had recorded more than 20 birdstrikes in the ten years were considered. Additionally, all occurrences where aircraft damage level was unknown were removed. The proportion of birdstrikes causing aircraft damage for each species was then plotted against the average mass for each species. A linear regression was then fit to establish the relationship between bird mass and the likelihood of a birdstrike causing damage.

This relationship, shown in Figure 36, shows that for every 1 kg increase in bird mass, the likelihood of a birdstrike causing damage increases by 12.5 per cent.

Figure 36: Percentage of damaging birdstrikes as a function of average bird mass. For every 1 kg increase in bird mass, the likelihood of a birdstrike causing damage increases by 12.5%.

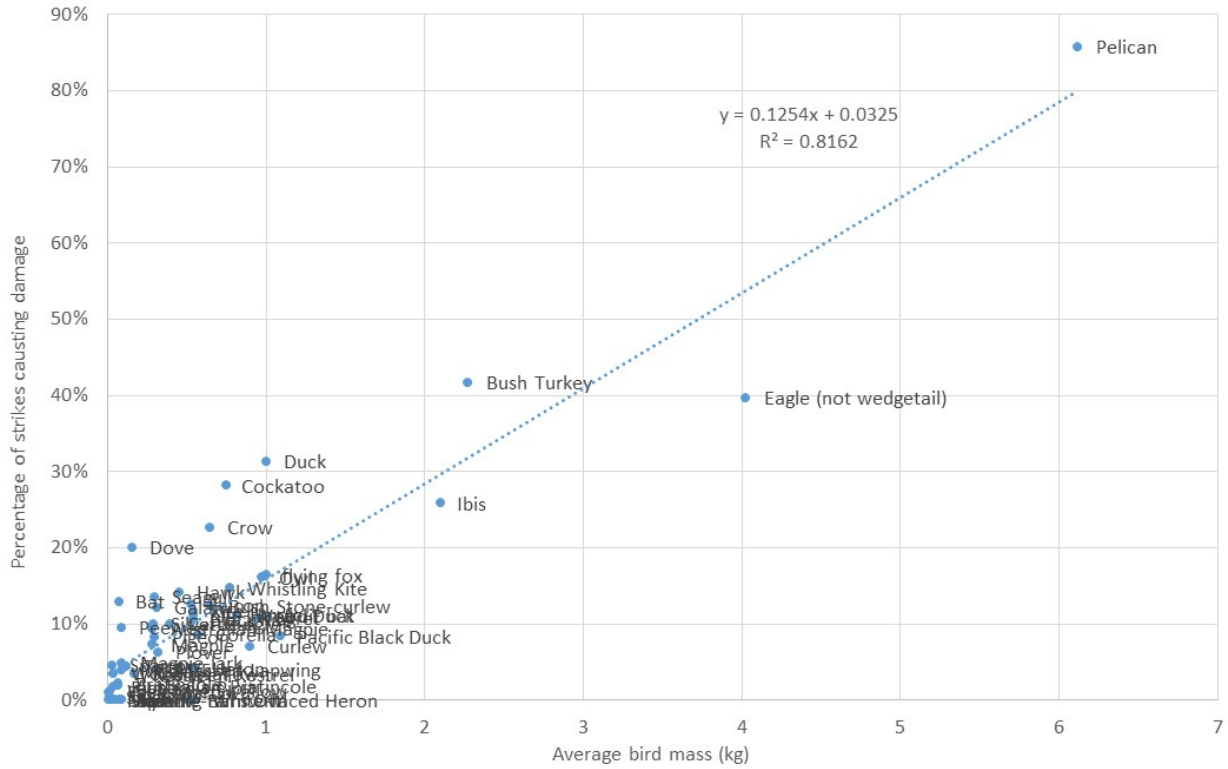


Figure 37: Percentage of damaging birdstrikes as a function of average bird mass. Zoomed section of the Figure above.

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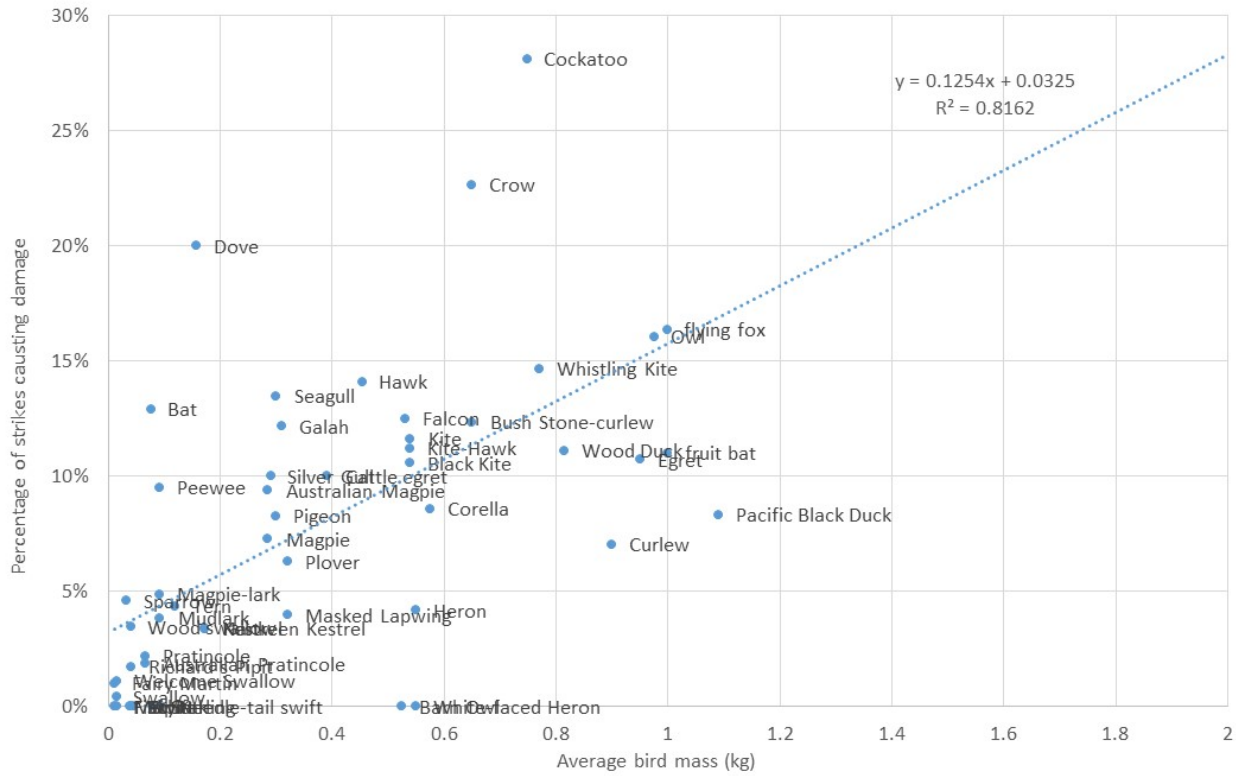


8. Non-flying animal strikes

When compared with birdstrikes (which are the most commonly reported type of air safety occurrence to the ATSB), cases of an aircraft striking a ground-based animal are not commonly reported. While infrequent, there is a relatively high possibility that animal strikes could more frequently result in significant aircraft damage when compared with birdstrikes.

8.1 Number of animals struck

From Table 24 it can be seen that the total number of animal strikes continued to fluctuate from year to year, but overall remained relatively low when compared to flying animal strikes. There was a slight reduction in the number of animal strikes in 2014 but in 2015 the number reached a ten year maximum of 53. The recent increase appears driven mostly from the high capacity sector which also reached a ten year high in 2015 of 24, double that of 2014. Low capacity air transport and general aviation have also had slight increases in animal strikes in the past two years (2014 – 2015) relative to the 10-year average of 2006 – 2015, as shown in Figure 38.

Table 24: Number of animal strikes per year by operation type, 2006 to 2015

Operation Type	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Average
High capacity air transport	13	13	13	12	22	18	8	17	12	24	**15.2**
Low capacity air transport	10	10	6	9	5	3	6	10	10	9	**7.8**
General Aviation	5	12	6	13	9	8	12	8	13	14	**10**
Military	1	0	1	0	1	0	0	0	0	0	**0.3**
Unknown	5	6	8	6	11	3	7	7	3	6	**6.2**
Total	**34**	**41**	**34**	**40**	**48**	**32**	**33**	**42**	**38**	**53**	**39.5**

Figure 38: Average animals struck per year by operation type for the 2006 – 2015 period

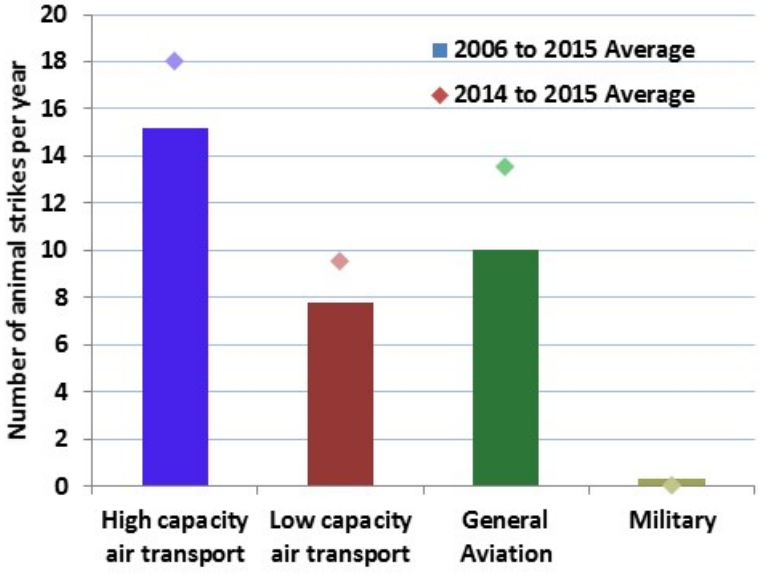


Table 25 shows that Queensland had the highest rate of animal strikes over the last 10 years, followed by New South Wales and Western Australia. Hares and rabbits were the most common animals struck, followed by kangaroos, wallabies, dogs and foxes.

Table 25: Animal strikes by animal type and state, 2006 – 2015

Animal Type	ACT	NSW	NT	QLD	SA	TAS	VIC	WA	Total
Hare/Rabbit	2	32	0	42	29	9	21	10	**145**
Kangaroo	0	17	9	24	4	0	3	14	**71**
Wallaby	0	5	9	18	1	2	0	7	**42**
Dog/fox	2	13	3	6	6	0	6	4	**40**
Lizard/snake	0	5	7	13	1	0	0	5	**31**
Goanna/Monitor	0	0	1	2	0	0	0	11	**14**
Turtle	0	2	0	3	1	0	0	2	**8**
Bandicoot	0	0	2	2	0	0	0	3	**7**
Echidna	0	0	0	4	0	1	1	0	**6**
Livestock	0	0	1	3	0	0	1	1	**6**
Frog/Toad	0	0	2	2	0	0	0	0	**4**
Possum	0	0	1	2	0	1	0	0	**4**
Mouse/Rat	0	0	0	0	0	1	1	0	**2**
Large Flightless bird	0	0	0	0	2	0	0	0	**2**
Cat	0	0	0	1	0	0	0	0	**1**
Wombat	0	0	0	0	0	1	0	0	**1**
Other	0	0	0	0	0	0	0	2	**2**
Total	**4**	**74**	**35**	**122**	**44**	**15**	**33**	**59**	**386**

Table 26 shows the number of animal strikes by state in the last 2 years only (2014 and 2015). Aside from a very slight reduction in the number of dogs and foxes struck, the animals struck and the proportions thereof were very similar for the last two years (Table 26) in comparison to the last ten years (Table 25).

Table 26: Animal strikes by animal type and state, 2014 – 2015

Animal Type	ACT	NSW	NT	QLD	SA	TAS	VIC	WA	Total
Hare/Rabbit	0	6	0	7	9	1	7	3	**33**
Kangaroo	0	6	0	6	1	0	2	3	**18**
Wallaby	0	1	3	1	0	0	0	3	**8**
Lizard/snake	0	2	2	3	0	0	0	0	**7**
Dog/fox	0	5	0	2	0	0	0	0	**7**
Goanna/Monitor	0	0	0	0	0	0	0	4	**4**
Bandicoot	0	0	0	1	0	0	0	2	**3**
Turtle	0	0	0	1	1	0	0	1	**3**
Possum	0	0	0	0	0	1	0	0	**1**
Echidna	0	0	0	0	0	0	1	0	**1**
Frog/Toad	0	0	1	0	0	0	0	0	**1**
Large Flightless bird	0	0	0	0	1	0	0	0	**1**
Livestock	0	0	0	1	0	0	0	0	**1**
Total	**0**	**20**	**6**	**22**	**12**	**2**	**10**	**16**	**88**

8.2 Aircraft damage from animal strikes

8.2.1 Damage by animal type

Animal strikes can cause a relatively large amount of damage compared with birdstrikes. This is due to the larger size and mass of many of the animals involved.

The majority of animal strikes where damage was reported involved kangaroos (Table 27), with 43 out of 66 strikes resulting in either substantial or minor damage. All of the five livestock strikes since 2006 have resulted in aircraft damage, three of which was substantial in nature. Livestock strikes that occur away from licensed aerodromes and involve general aviation aircraft are currently only reportable to the ATSB under the Transport Safety Investigation Regulations when they result in aircraft damage or injury, so it is probable that the actual number of animal strikes involving livestock is higher than the reported figure.

Table 27: Aircraft damage from animal strikes (where damage is known) by animal type, 2006 - 2015

Animal Type	Destroyed	Substantial	Minor	Nil	Total
Kangaroo	0	4	39	23	**66**
Wallaby	0	3	9	23	**35**
Livestock	0	3	2	0	**5**
Dog/fox	0	2	3	22	**27**
Hare/Rabbit	0	0	3	99	**102**
Unknown	0	1	1	2	**4**
Large Flightless bird	0	0	1	1	**2**
Lizard/snake	0	0	0	27	**27**
Goanna/Monitor	0	0	0	10	**10**
Bandicoot	0	0	0	5	**5**
Other	0	0	0	3	**3**
Possum	0	0	0	3	**3**
Turtle	0	0	0	3	**3**
Echidna	0	0	0	2	**2**
Frog/Toad	0	0	0	2	**2**

Serious aircraft damage and injury

Since 2006, there have been 13 animal strikes that caused serious damage to aircraft. Two of these occurred during 2014 – 2015 and are summarised below.

Cessna 172, kangaroo strike

The Cessna 172 was being used for flight training at Murray Field Aerodrome WA. On the fourth circuit to runway 05, during the landing roll the aircraft struck a kangaroo. The aircraft was substantially damaged including buckling of the fuselage and a twisted horizontal stabiliser (12 June 2014).

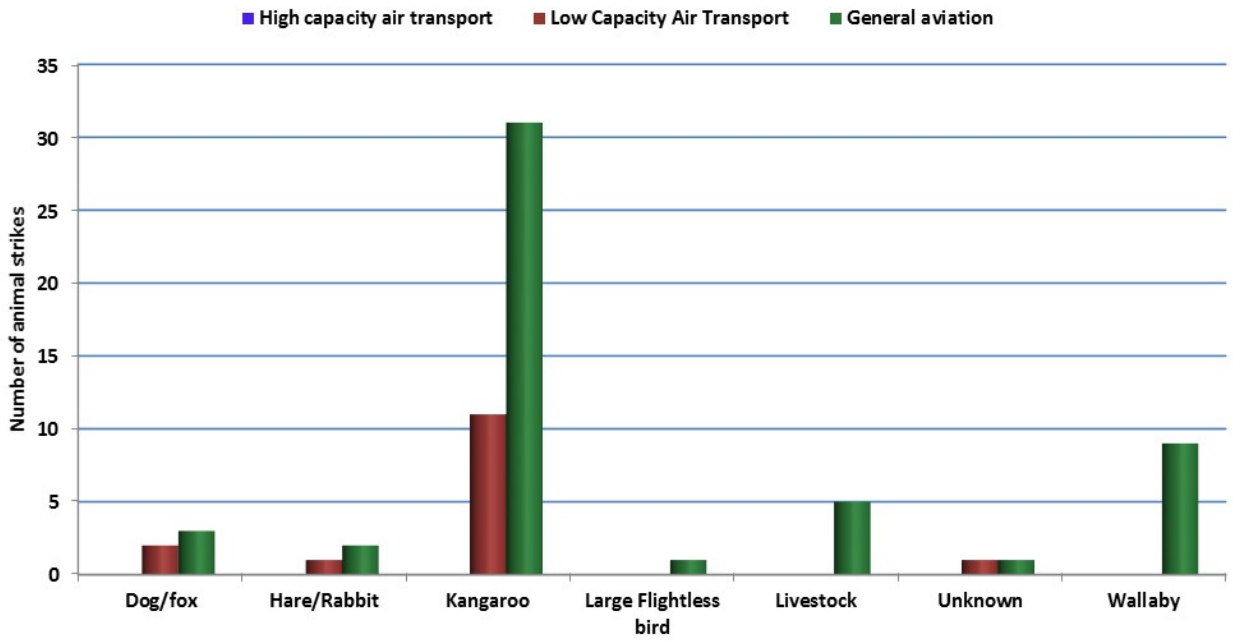
Robinson R22, horse strike

After landing at Rawbelle Station (30nm SE of Thangool Qld), the pilot commenced cooling and shutting down of the helicopter. The passenger got out of the helicopter and stood approximately 8-10 m away from the aircraft. With the helicopter drive belts disengaged and the engine at a low idle, a horse appeared from behind station buildings. In a panic it ran into the tail of the helicopter resulting in damage to the tail cone and tail rotor (14 April 2015).

All three of the livestock strikes where substantial aircraft damage resulted occurred in general aviation and all occurred at remote landing sites (one aeroplane landing area[9] and two private airfields) which may not have been distinctly separated from the surrounding environment. This might include landing in a paddock, or at landing areas adjacent to grazing paddocks where fences did not exist or were inadequate to separate livestock from aircraft operations.

Figure 39 shows animal-related aircraft damage mainly involved general aviation aircraft, and some low capacity air transport aircraft. The lack of any damaging animal strikes in high capacity air transport may be due to the generally more secure airports that these aircraft fly into. Kangaroos and wallabies make up the majority of damaging animal strikes in low capacity air transport and general aviation operations.

Figure 39: Aircraft damage by animal type and operation type for the 2006 – 2015 period



8.2.2 Damage by aircraft component damaged

A review of the aircraft components damaged in animal strikes shows (Table 28 below) that the lower areas of an aircraft are more susceptible to damage in an animal strike due to their proximity to the ground. For both low capacity and general aviation, landing gear and propellers were the two most commonly stuck aircraft parts. In low capacity operations, they were followed by engines and tail damage. In general aviation, wing/rotors and fuselage were the next most commonly struck, followed by engines, nose and tails.

[9] Aeroplane landing areas are unlicensed aerodromes that have been determined as suitable for landing, however, may not meet the full requirements for a licensed aerodrome.

Table 28: Number of animal strikes by part damaged (where known) and operation type for the 2006 – 2015 period

Operation type	Part Damaged	Animal Strikes
Low capacity air transport	Landing gear	7
	Propeller	3
	Engine	2
	Tail	1
	Other	1
General Aviation	Propeller	15
	Landing gear	11
	Wing/Rotor	9
	Fuselage	4
	Engine	3
	Nose	1
	Tail	1
	Other	1

9. Insect Occurrences

Due to growing industry interest in occurrences involving insects, the last edition of this wildlife strike report introduced a new chapter on insect related occurrences. Of particular concern were those occurrences where insects have found their way into pitot tubes[10] and affected flight instruments. In response to these inquiries, a search of the ATSB aviation occurrence database was conducted and revealed 51 occurrences between 2006 and 2015 where insects were reported to have been struck or otherwise adversely affected normal flight operations. One of the difficulties in conducting this search is that an insect strike in itself is not a reportable matter to the ATSB and so it is only when the insects are combined with some other type of occurrence, or when the insect has contributed to other consequences, that they would be reported. It is therefore likely the there are many more insect events that have not been reported to the ATSB.

Not surprisingly, occurrences involving aircraft striking insects usually are not damaging to aircraft or do not affect the outcome of the flight. Indeed, of the ten occurrences that were reported simply as insect strikes, nine had no effect on the flight. One did involve an air-return when the pilot mistakenly interpreted the insect smears as a hydraulic leak and declared a Pan. More serious, however, are occurrences where insects have blocked some part of either the pitot-static system or the fuel lines.

The pitot-static system provides the static and dynamic pressures that are vital for several key flight instruments (the air speed indicator, the altimeter and the vertical speed indicator). In larger aircraft, these instruments are in turn vital for the correct functioning of the autopilot. Thus, any blockage of either the pitot tube or the static ports could result in potentially significant consequences. Worldwide over the past few decades there have been a number of accidents resulting from a blockage in the pitot static system, either by atmospheric icing (Northwest Airlines Flight 6231, USA, 1974 and Air France Flight 447, Atlantic Ocean, 2009) or by a maintenance related issue (AeroPeru Flight 603, Pacific Ocean, 1996). There has been one significant accident in recent history where the blockage was thought to have been attributed to a wasp nest, although, as the pitot tubes were unrecoverable, it could not be proven (Birgenair Flight 301, Dominican Republic, 1996).

Of the 51 occurrences in Australia between 2006 and 2015:

- 26 were identified as involving a blockage of the pitot-static system (25 blocked pitot tubes and one block static port)
- 12 were reported simply as an insect strike
- 8 involved a blockage in the fuel system
- 2 involved blocked air intakes
- 2 involved fumes or smoke in the cabin or cockpit, and
- 1 involved a number of insects on the windshield that impaired the pilot's visibility.

Table 29 shows the insect type involved by each type of occurrence above.

[10] Open-ended tube facing forwards into fluid flow, thus generating internal pressure equal to stagnation pressure (in case of supersonic flow, that downstream of normal shock).

Table 29: Types of occurrences involving insects by insect type, reported to the ATSB between 2006 and 2015.

Occurrence type	Wasp	Moth	Locust	Caterpillar	Bee	Unknown	Total
Blocked pitot tube	14	1	0	1	1	8	25
Insect strike	0	0	2	0	0	10	12
Fuel blockage	4	0	0	0	0	4	8
Fumes | Smoke	0	1	0	0	0	1	2
Blocked air intake	0	0	0	0	0	2	2
Blocked static system	0	0	0	0	0	1	1
Reduced visibility	0	0	0	0	0	1	1
Total	**18**	**2**	**2**	**1**	**1**	**27**	**51**

In 33 of the 51 insect occurrences, there were some consequential events or adverse effects on the flight:

- 12 cases (all blocked pitot tubes) resulted in rejected take-offs
- 9 resulted in air-returns (6 due to blocked pitot tubes, and one each due to blocked static system, insect strike and fumes/smoke)
- 6 involved an engine failure or malfunction (two followed by a forced landing, one causing the take-off to be rejected, and one resulting in an air-return)
- 2 resulted in fuel starvations followed by forced / precautionary landings
- 2 involved a stick-shaker[11] (stall warning) followed by an air-return
- 1 ground return due to a fuel blockage
- 1 diversion due to a fuel blockage.

The east coast of Australia continues to be the most common locations for insect related occurrences with 13 reported at Brisbane and 5 at Sydney. Three occurrences were reported from both Darwin, Alice Springs and Tamworth, and two each from Melbourne, Jandakot and Rockhampton. The remaining 18 occurrences were each reported from different locations across the country. Two of these occurrences that were investigated by the ATSB are detailed here:

Boeing 737, 3 April 2014 Brisbane
ATSB Investigation AO-2013-212

During take-off, while accelerating through 90 kt, caution message "EEC ALT"[1] annunciated. As engine thrust was normal, the captain continued the take-off. Once airborne, "IAS Disagree" and "ALT Disagree" messages were displayed on the crew's PFDs and the captain's stick-shaker operated intermittently. Comparison between the captain's, first officer's and standby airspeed indications showed that the captain's airspeed was under-reading significantly. Control of the aircraft was handed over to the first officer and the aircraft levelled at 7,000 ft before returning for landing at Brisbane. Later investigation showed that the inlet of the captain's pitot probe was partly obstructed by material consistent with a mud-dauber wasp nest.

[1] Electronic Engine Control (EEC) has reverted to alternate (ALT) mode.

11 A tactile warning system designed to alert flight crew when the aircraft is at or near aerodynamic stall.

Air data system failure involving Airbus A330-243, A6-EYJ, near Brisbane Airport, Qld on 21 November 2013

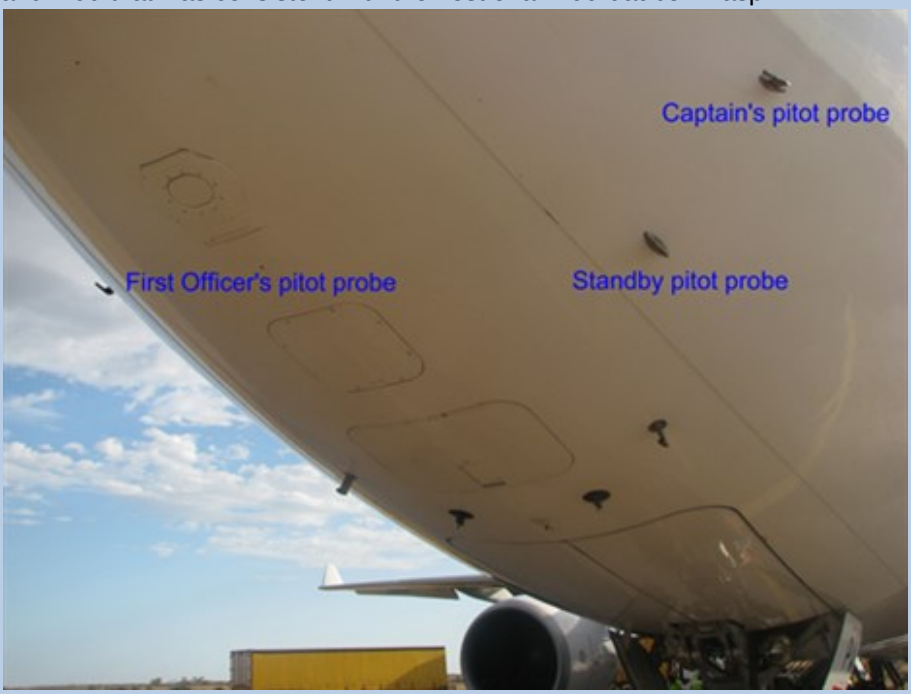
ATSB Investigation AO-2013-212

On 21 November 2013, after a flight from Singapore, an Airbus A330 landed at Brisbane Airport and was taxied to the terminal. It came to a stop at 0949 Eastern Standard Time (EST). At 1152, the aircraft was pushed-back for the return flight to Singapore. At 1204, the captain discontinued (rejected) the take-off after observing an airspeed indication failure on his display. The maximum airspeed recorded by the flight data recorder during the rejected takeoff was 88 kt.

The aircraft taxied back to the terminal where trouble-shooting was carried out. As part of this work, ADIRU[1] 1 and ADIRU 2 were transposed and the aircraft was dispatched with the air data reference part of ADIRU 2 inoperative in accordance with the MEL[2]. The first officer's air data source was switched from ADIRU 2 to ADIRU 3. The captain's air data source remained switched to the normal (ADIRU 1) position.

At 1345, during the second take-off, the crew became aware of an airspeed discrepancy after the V1 rejected take-off decision speed and the take-off was continued. Once airborne, the crew declared a MAYDAY and decided to return to Brisbane where an overweight landing[3] was carried out.

Subsequently, the pitot probes (which measure airspeed information that is sent to the ADIRUs) were visually inspected. The inspection found that there was an internal obstruction of the captain's probe, while the first officer's and standby probes were clear. The captain's probe was removed from the aircraft and sent to the probe manufacturer in the USA. Examination showed that it had been almost completely blocked by an insect nest, composed of sand and mud that was consistent with the nest of a 'mud-dauber' wasp.



Locations of pitot probes. Source ATSB

[1] Air data and inertial reference unit, which supplies air data and inertial reference information to the pilots' flight instrument displays and other aircraft systems.
[2] A minimum equipment list (MEL) is a list of aircraft equipment and systems that may be inoperative for flight, subject to specified conditions.
[3] The actual landing weight was 199.7 tonnes while the maximum landing weight was 182 tonnes. After an overweight landing, depending on the vertical speed and acceleration at touchdown, an aircraft inspection may be required.

Appendices

Appendix A – Species in types

Table 30: Bird types by common name and species name (as reported), 2006 to 2015

Bird type	Name	Count
Australian Brush-turkey	Bush Turkey	27
	Brush Turkey	6
	Scrub Turkey	1
Bat/Flying Fox	bat	517
	flying fox	305
	fruit bat	218
	micro bat	20
	Freetail bat	3
	Eastern Freetail Bat	2
	Mouse-eared bat	2
Bee-eater	Rainbow Bee-eater	3
Bustard	Australian Bustard	15
	Bustard	15
Cockatoo	Cockatoo	40
	Black Cockatoo	17
	Sulphur crested cockatoo	4
	White Cockatoo	4
	Pink Cockatoo	1
Cormorant	Cormorant	17
	Pied Cormorant	7
	Little pied cormorant	1
Crow/Raven	Crow	74
	Raven	14
	Butcherbird	10
	Currawong	3
Cuckoo	Cuckoo-shrike	2
	Cuckoo	1

Continued

Bird type	Name	Count
Curlew/Sandpiper	Bush Stone-curlew	119
	Curlew	82
	Sandpiper	18
	Little curlew	13
	Bush Curlew	2
	Stone-curlew Plover	2
	Whimbrel	2
	Bush Thick-knee	1
Darter	Darter	5
Dove	Pigeon	173
	Dove	31
	Rock Dove	14
	Crested pigeon	8
	Turtle Dove	3
	Diamond dove	1
	Homing pigeon	1
Duck	Duck	143
	Wood Duck	42
	Pacific Black Duck	32
	Black Duck	11
	Grey Duck	2
	Blackie	1
Eagle	Eagle (not Wedge-tailed)	61
	Brahminy Kite	12
	Sea Eagle	12
	Little Eagle	2
Falcon	Falcon	32
	Brown falcon	28
	Australian Hobby	10
	Peregrine Falcon	6
	Hobby	1
Finch	Finch	71
	Zebra Finch	18
	Goldfinch	5
Frigate	Frigate	10
Galah	Galah	829

Continued

Bird type	Name	Count
Hawk	Hawk	267
	Goshawk	12
	Sparrowhawk	11
	Chicken hawk	8
	Osprey	7
	Swamp Harrier	7
	Collared Sparrowhawk	3
	Spotted Harrier	2
	Harrier	1
Hen	Swamphen	11
	Native Hen	9
	Tasmanian Native-hen	1
Heron/Egret	Cattle egret	38
	Egret	37
	White-faced Heron	32
	Heron	26
	Nankeen Night Heron	26
	Crane	6
	Jabiru	4
	Brolga	3
Honeyeater/Chat	Honeyeater	2
	Black honeyeater	1
	Orange chat	1
	Red Wattlebird	1
House Sparrow	Sparrow	177
	House Sparrow	5
Ibis	Ibis	117
	Straw-necked Ibis	15
	White Ibis	5
Kingfisher/Kookaburra	Kookaburra	14
	Kingfisher	1

Continued

Bird type	Name	Count
Kite	Black Kite	347
	Kite	301
	Kite-Hawk	154
	Whistling Kite	105
	Black-shouldered Kite	22
	Brown kite	3
	Speckled Kite	1
	Square-tailed kite	1
Lapwing/Plover	Plover	637
	Masked Lapwing	131
	Oriental Plover	25
	Lapwing	24
	Spur-winged Plover	17
	Dotterel	14
	Banded lapwing	8
	Banded Plover	8
	Masked Plover	5
	Pacific Golden Plover	2
Magpie	Magpie	460
	Australian Magpie	53
Magpie Goose	Magpie Goose	17
	Goose	3
Magpie-lark	Magpie-lark	248
	Peewee	58
	Mudlark	35
	Lark	19
	Murray Magpie	8
	Brown Songlark	2
	Singing bushlark	2
	Flycatcher	1
Myna	Myna	12
Nankeen Kestrel	Kestrel	311
	Nankeen Kestrel	253
	Australian Kestrel	20
Owl	Owl	85
	Barn owl	54
	Frogmouth owl	2
	Masked owl	1

Continued

Bird type	Name	Count
Oystercatcher	Oystercatcher	3
	Pied Oystercatcher	2
Pacific Gull	Pacific Gull	23
Parrot	Corella	39
	Parrot	21
	Rainbow Lorikeet	20
	Little Corella	9
	Lorikeet	9
	Budgerigar	6
	Crimson Rosella	1
Pelican	Pelican	22
Pipit	Richard`s Pipit	165
	Pipit	80
	Australasian Pipit	22
	Australian Pipit	4
	Ground Lark	2
Pratincole	Australian Pratincole	106
	Pratincole	70
	Australian Courser	11
	Swallow-plover	3
Rail	Buff Banded Rail	2
	Dusky Moorhen	1
Robin	Robin	6
Silver Gull	Seagull	173
	Silver Gull	67
	Gull	17
Skylark	Skylark	50
	Common Skylark	3
	Eurasian Skylark	3
Starling	Starling	69
	Common Starling	4

Continued

Bird type	Name	Count
Swallow/Martin	Swallow	293
	Fairy Martin	119
	Welcome Swallow	119
	Martin	60
	Wood swallow	37
	Black-faced Wood Swallow	20
	Barn Swallow	5
Swan	Swan	8
Swift	Swift	46
	Needle-tail swift	24
	Fork-tailed Swift	7
	Australian Swiftlet	4
	Spine tailed swift	3
Tern	Tern	51
	Crested Tern	6
	Little Tern	3
	Sooty tern	3
	Common tern	1
	Whiskered tern	1
Thrush	Blackbird	4
	Thrush	1
Wader	Red-necked Stint	4
	Wader	3
	Courser	2
	Grey tailed tattler	2
	Common greenshank	1
	Godwit	1
	Snipe	1
Wagtail	Willie wagtail	17
	Wagtail	3
Wedge-tailed Eagle	Wedge-tailed Eagle	21
	Eagle-hawk	4
Wren	Wren	5

Continued

Bird type	Name	Count
Other	Chicken	4
	Sanderling	2
	Australasian Fig Bird	1
	Australasian Grebe	1
	Australian Grebe	1
	Bittern, brown	1
	Black-necked stork	1
	Booby	1
	Coot	1
	Eurasian Coot	1
	Grey bunting	1
	Leaf warbler	1
	Noddy	1
	Quail	1
	Ruddy Turnstone	1
	Spangled drongo	1
	Spinifex bird	1
	Spinifexbird	1
	Stork	1
	Stubble Quail	1
	Unknown	6,748

Table 31: Animal types by common and species names (as reported), 2006 to 2015

Animal type	Name	Count
Bandicoot	Bandicoot	7
Cat	Cat	1
Dog/fox	Fox	34
	dog	5
	Dingo	2
Echidna	Echidna	6
Frog/Toad	Cane Toad	2
	Frog/Toad	1
	Toad	1
Goanna/Monitor	Goanna	12
	Monitor	2
Hare/Rabbit	Hare	82
	Rabbit	63
Kangaroo	Kangaroo	70
	Wallaroo	1
Large Flightless bird	Emu	2
Livestock	Horse	2
	Cattle	1
	Cow	1
	Pig	1
	Sheep	1
Lizard/snake	Lizard	17
	Snake	13
	Bearded dragon	2
Mouse/Rat	Mouse	1
	Rat	1
Possum	Possum	4
Turtle	Turtle	8
Unknown	Unknown	6
Wallaby	Wallaby	42
Wombat	Wombat	1
Other	Quokka	2
	Robber Crab	1

Appendix B – Hourly birdstrikes counts and rates, 2014 - 2015

Adelaide

Figure 40: Total hourly birdstrike counts and rates per 10,000 movements for Adelaide aerodrome, 2014 – 2015. The birdstrike rate is displayed in blue (left side axis); the birdstrike count is displayed in red (right side axis).

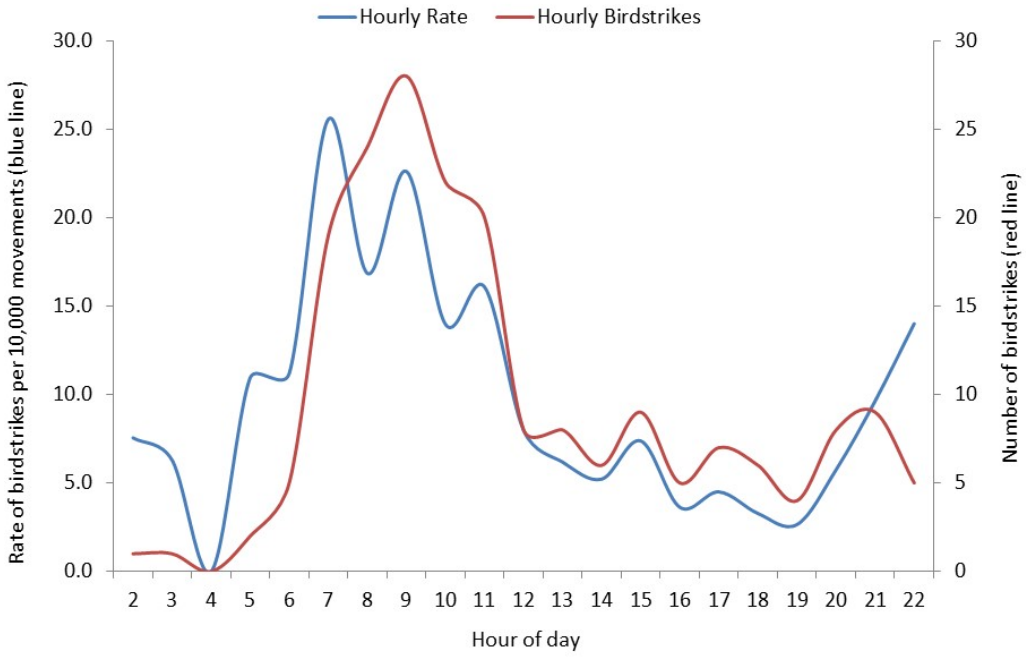
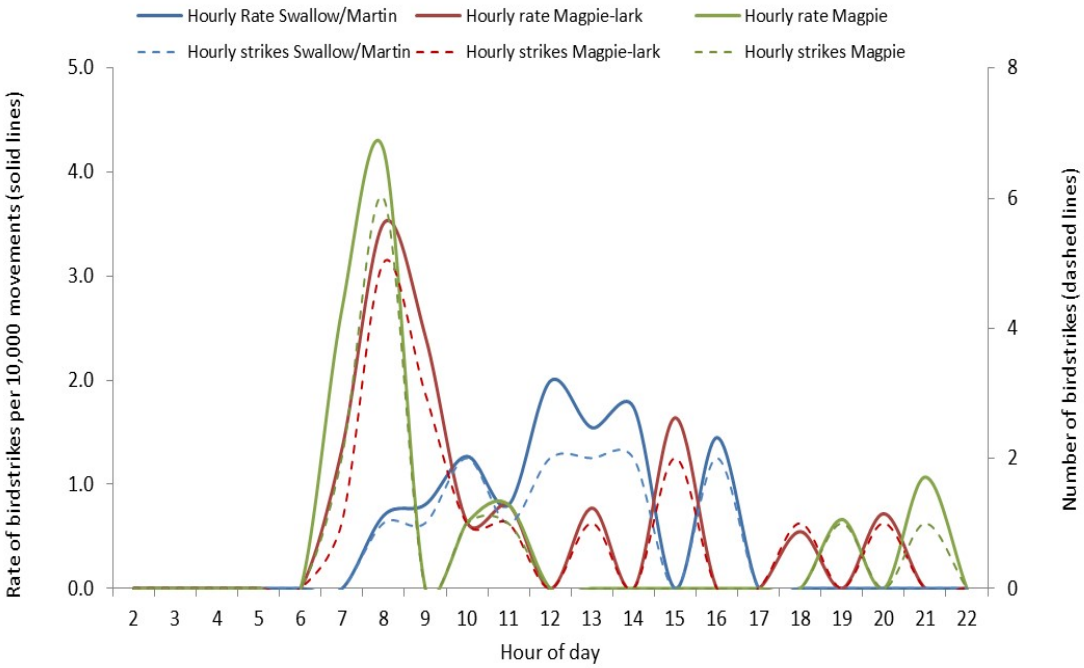


Figure 41: Hourly birdstrike counts and birdstrike rates per 10,000 movements for the top three species (where known) struck at Adelaide aerodrome, 2014 – 2015. The birdstrike rates are displayed by solid lines (left side axis), the birdstrike counts are displayed by dotted lines (right side axis).



Brisbane

Figure 42: Total hourly birdstrike counts and rates per 10,000 movements for Brisbane aerodrome, 2014 – 2015. The birdstrike rate is displayed in blue (left side axis); the birdstrike count is displayed in red (right side axis).

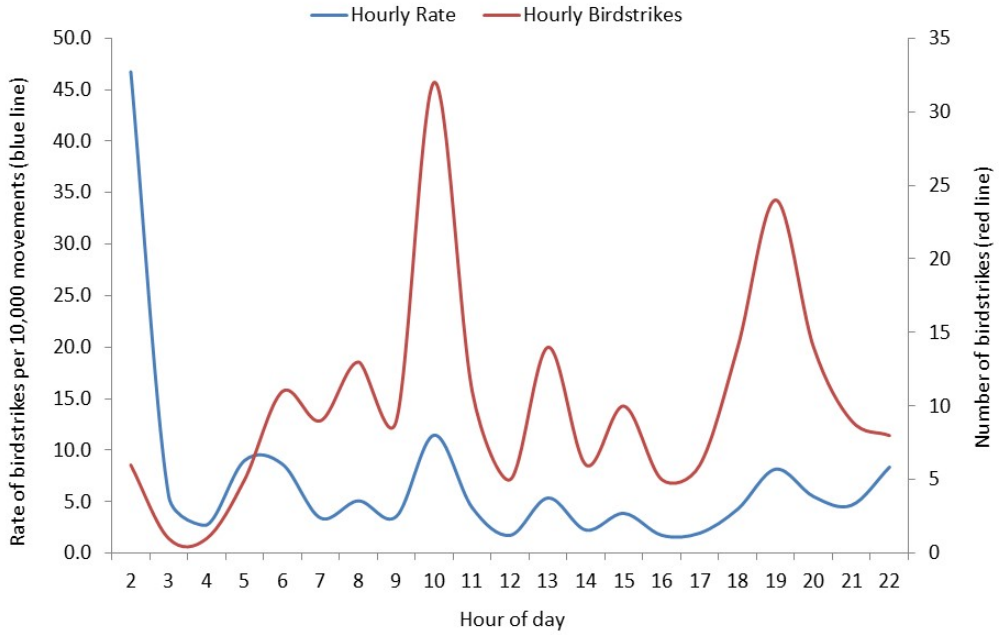
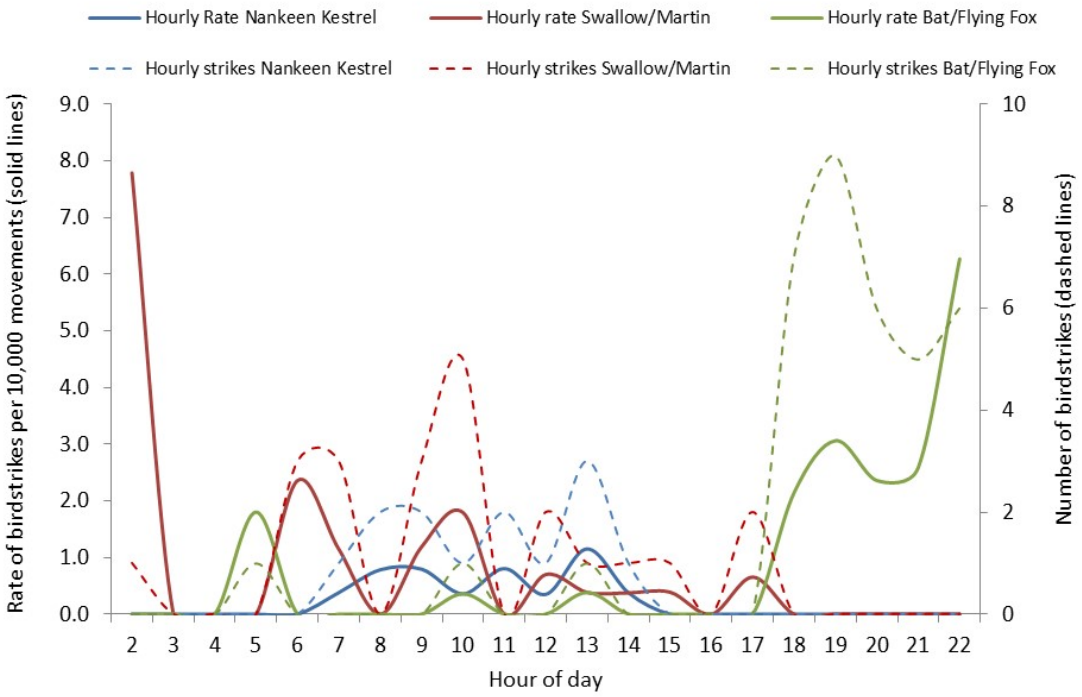


Figure 43: Hourly birdstrike counts and birdstrike rates per 10,000 movements for the top three species (where known) struck at Brisbane aerodrome, 2014 – 2015. The birdstrike rates are displayed by solid lines (left side axis), the birdstrike counts are displayed by dotted lines (right side axis).



Cairns

Figure 44: Total hourly birdstrike counts and rates per 10,000 movements for Cairns aerodrome, 2014 – 2015. The birdstrike rate is displayed in blue (left side axis); the birdstrike count is displayed in red (right side axis).

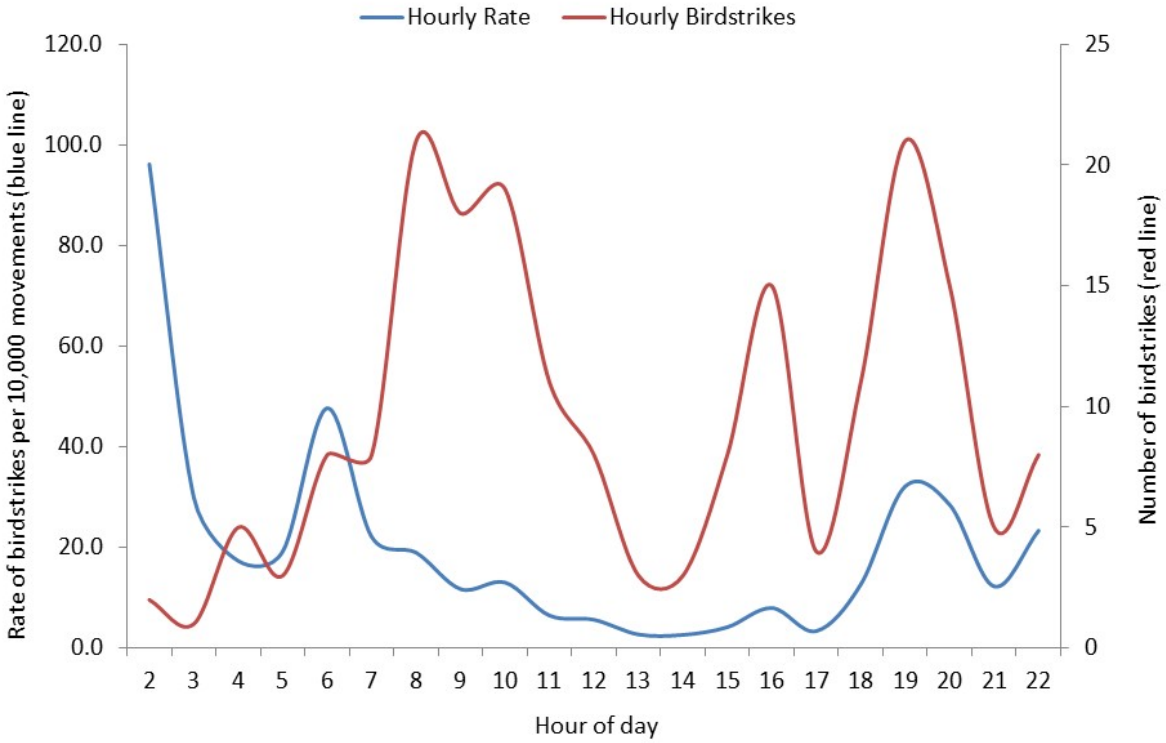
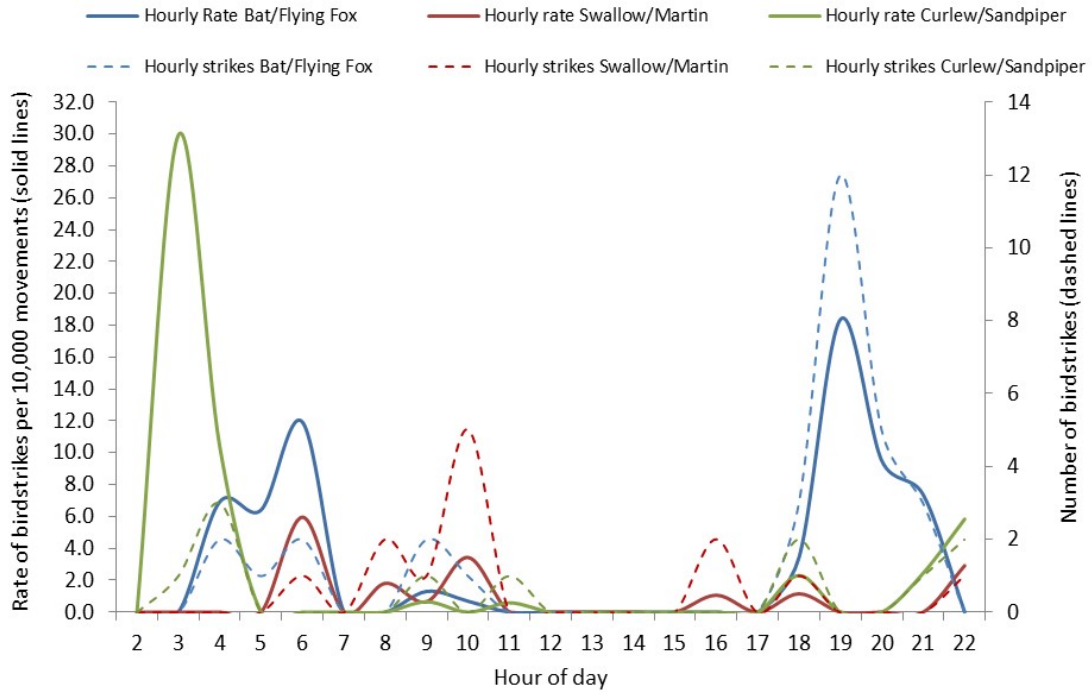


Figure 45: Hourly birdstrike counts and birdstrike rates per 10,000 movements for the top three species (where known) struck at Cairns aerodrome, 2014 – 2015. The birdstrike rates are displayed by solid lines (left side axis), the birdstrike counts are displayed by dotted lines (right side axis).



Canberra

Figure 46: Total hourly birdstrike counts and rates per 10,000 movements for Canberra aerodrome, 2014 – 2015. The birdstrike rate is displayed in blue (left side axis); the birdstrike count is displayed in red (right side axis).

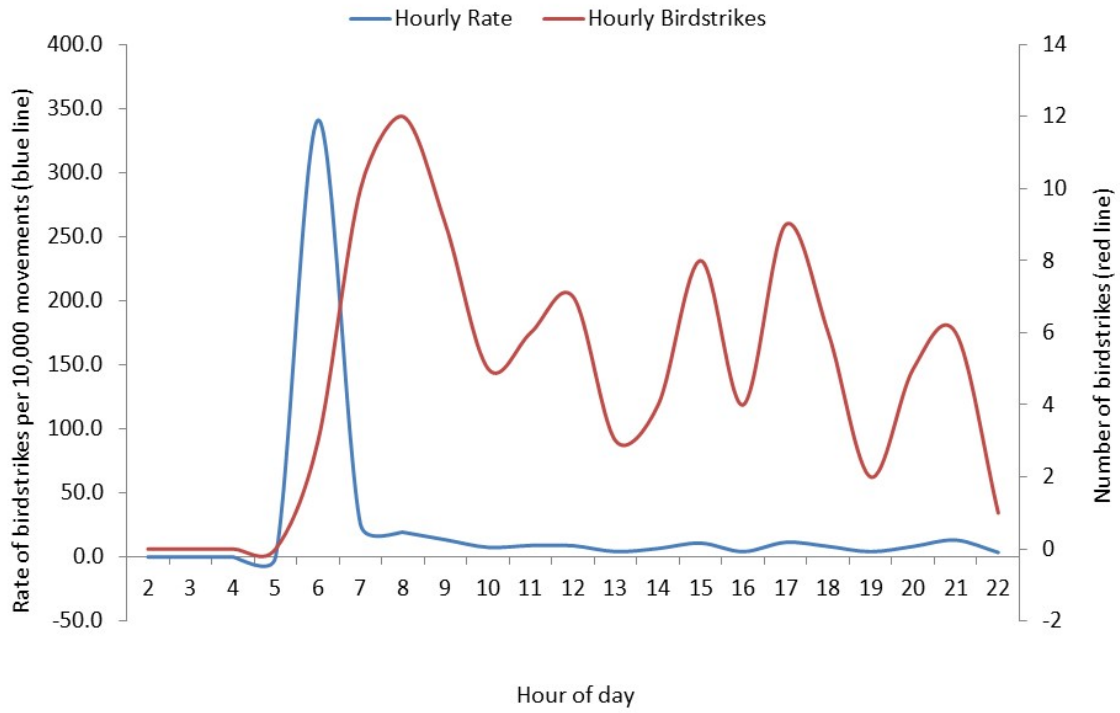
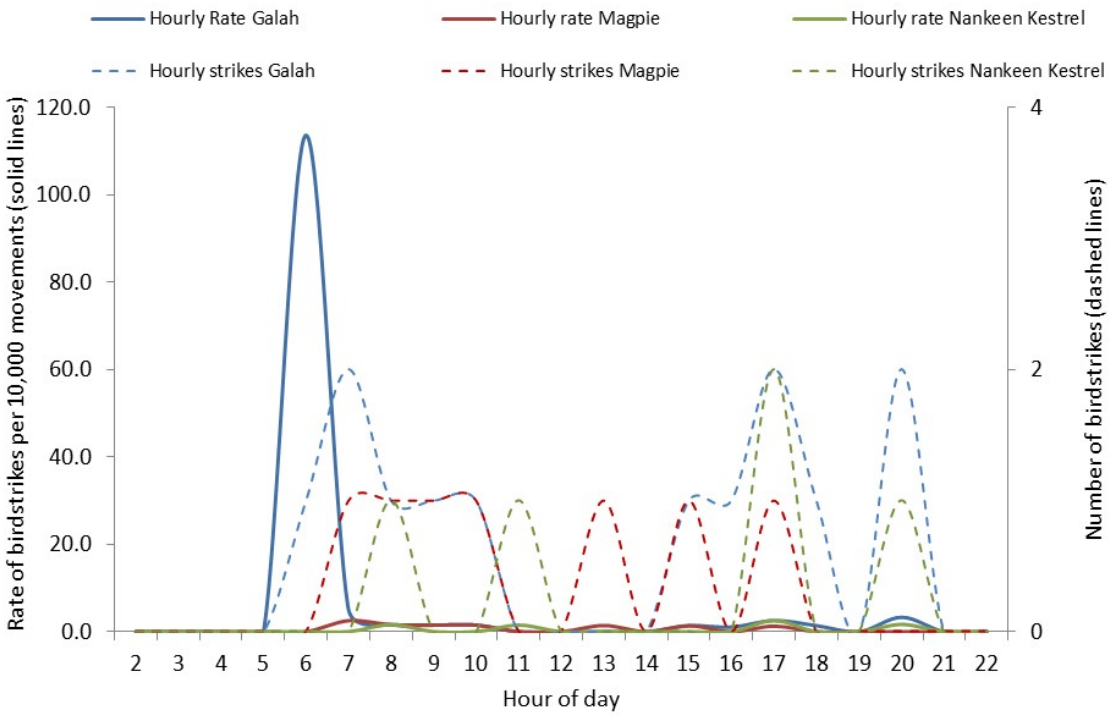


Figure 47: Hourly birdstrike counts and birdstrike rates per 10,000 movements for the top three species (where known) struck at Canberra aerodrome, 2014 – 2015. The birdstrike rates are displayed by solid lines (left side axis), the birdstrike counts are displayed by dotted lines (right side axis).



Darwin

Figure 48: Total hourly birdstrike counts and rates per 10,000 movements for Darwin aerodrome, 2014 – 2015. The birdstrike rate is displayed in blue (left side axis); the birdstrike count is displayed in red (right side axis).

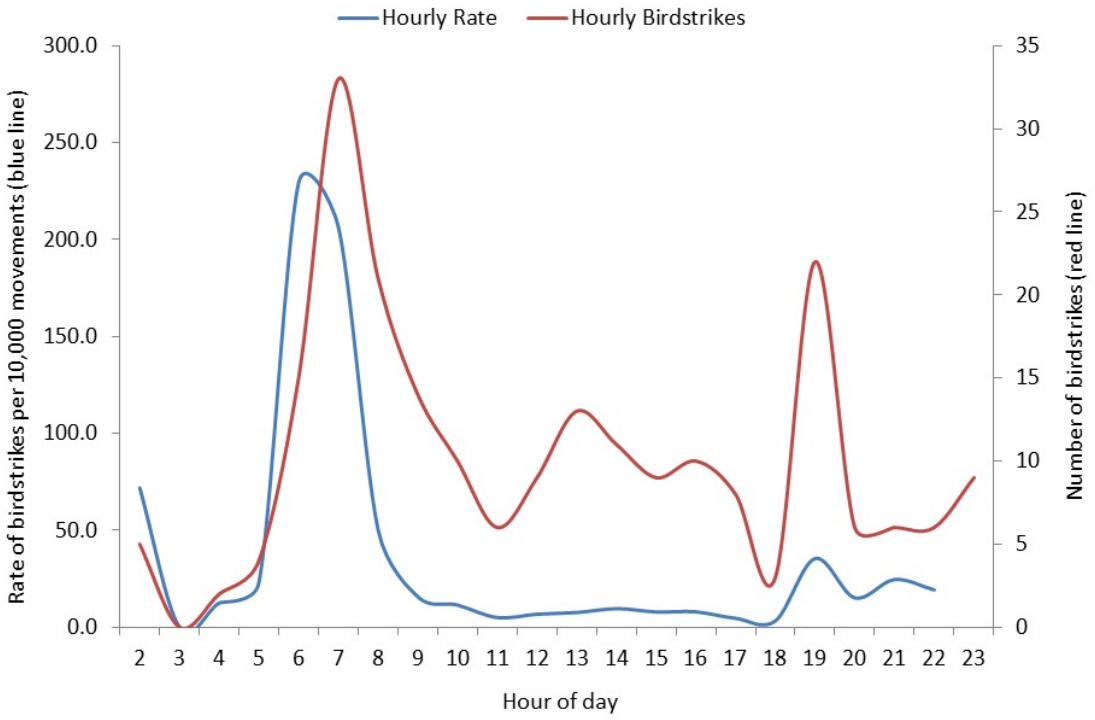
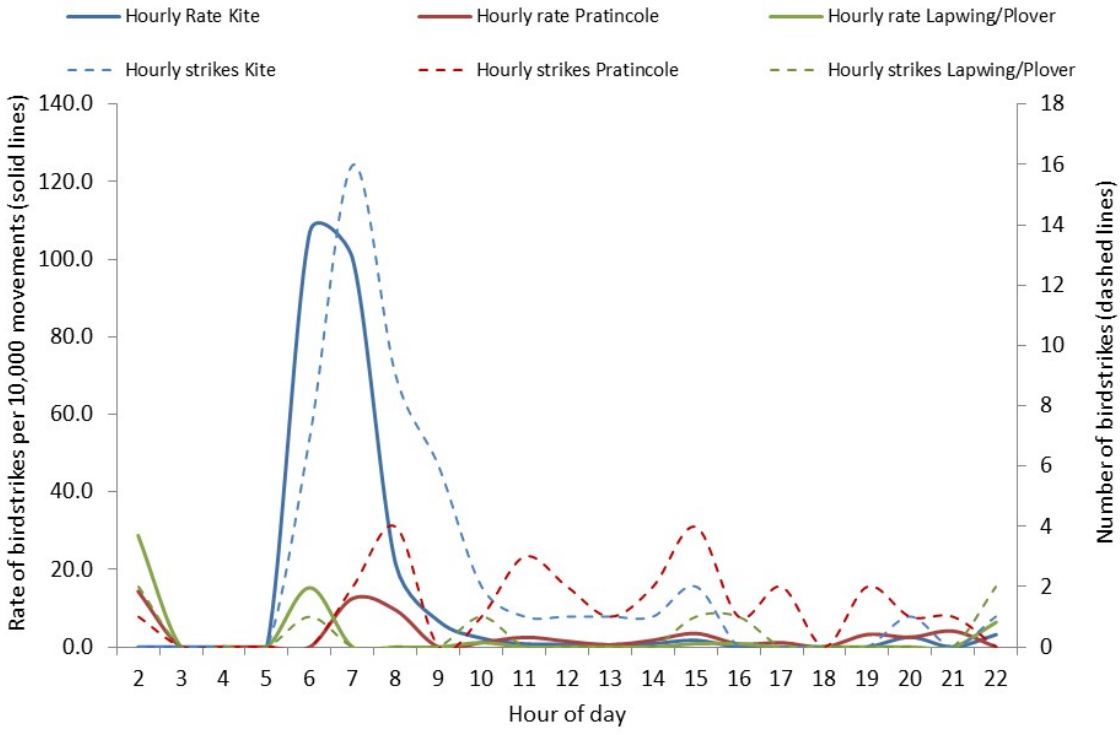


Figure 49: Hourly birdstrike counts and birdstrike rates per 10,000 movements for the top three species (where known) struck at Darwin aerodrome, 2014 – 2015. The birdstrike rates are displayed by solid lines (left side axis), the birdstrike counts are displayed by dotted lines (right side axis).



Gold Coast

Figure 50: Total hourly birdstrike counts and rates per 10,000 movements for Gold Coast aerodrome, 2014 – 2015. The birdstrike rate is displayed in blue (left side axis); the birdstrike count is displayed in red (right side axis).

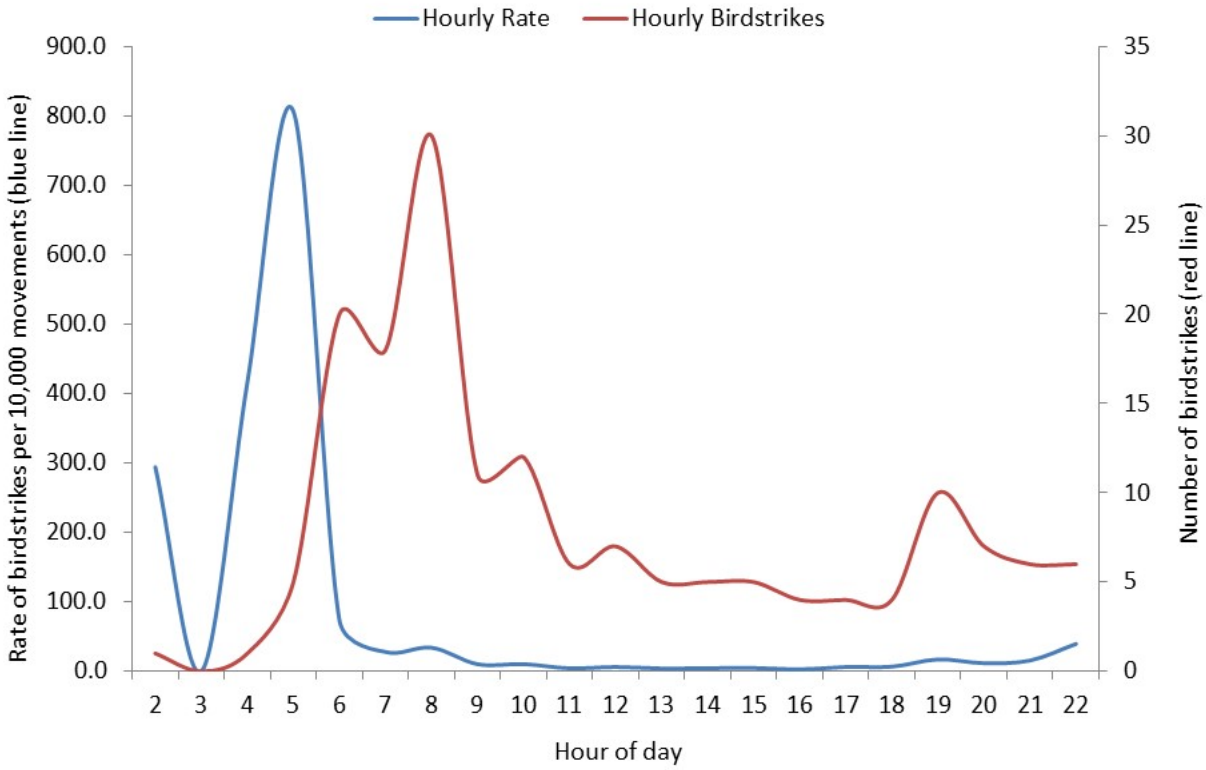
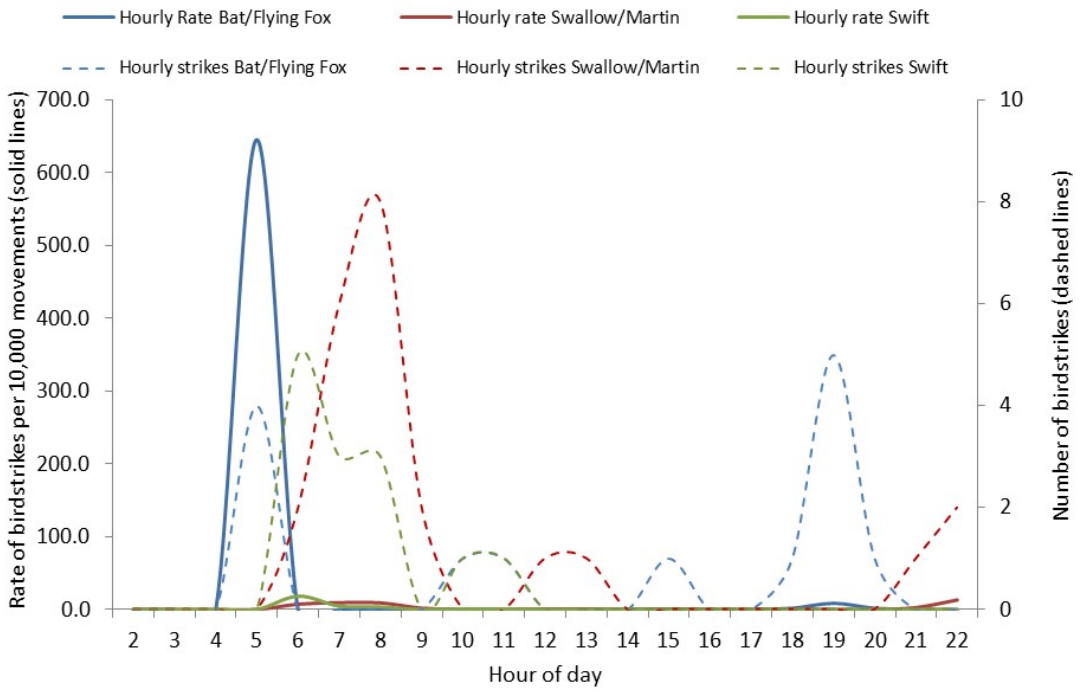


Figure 51: Hourly birdstrike counts and birdstrike rates per 10,000 movements for the top three species (where known) struck at Gold Coast aerodrome, 2014 – 2015. The birdstrike rates are displayed by solid lines (left side axis), the birdstrike counts are displayed by dotted lines (right side axis).



Hobart

Figure 52: Total hourly birdstrike counts and rates per 10,000 movements for Hobart aerodrome, 2014 – 2015. The birdstrike rate is displayed in blue (left side axis); the birdstrike count is displayed in red (right side axis).

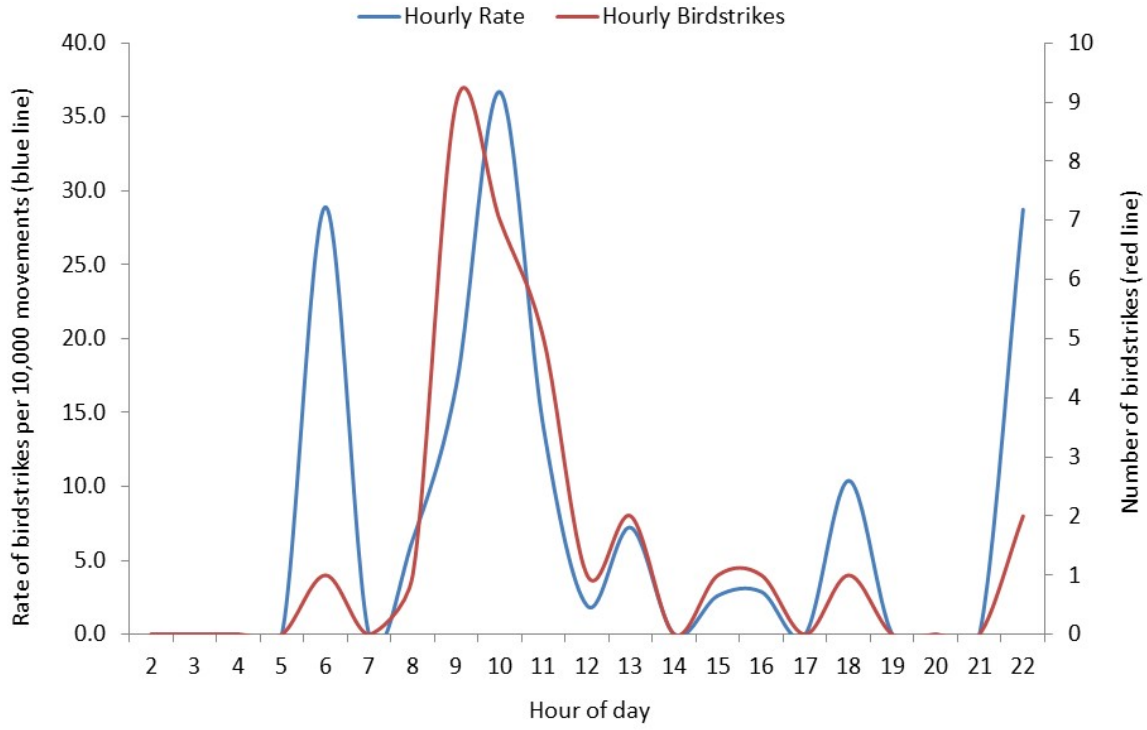
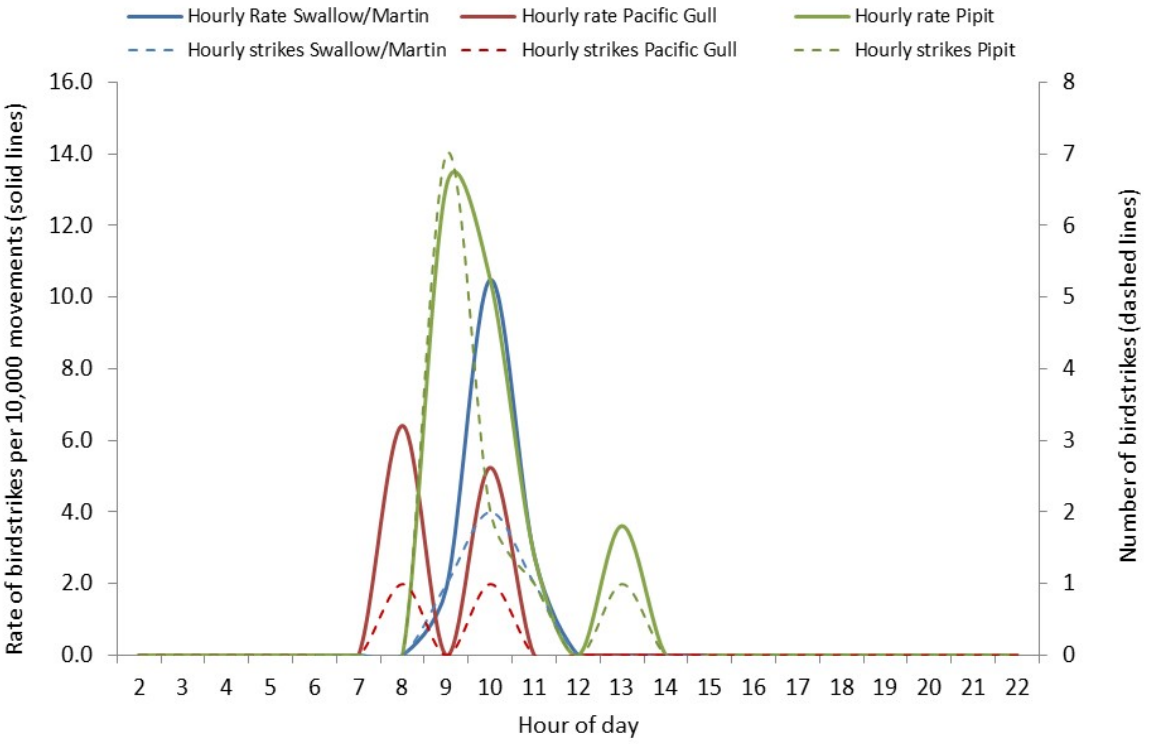


Figure 53: Hourly birdstrike counts and birdstrike rates per 10,000 movements for the top three species (where known) struck at Hobart aerodrome, 2014 – 2015. The birdstrike rates are displayed by solid lines (left side axis), the birdstrike counts are displayed by dotted lines (right side axis).



Melbourne

Figure 54: Total hourly birdstrike counts and rates per 10,000 movements for Melbourne aerodrome, 2014 – 2015. The birdstrike rate is displayed in blue (left side axis); the birdstrike count is displayed in red (right side axis).

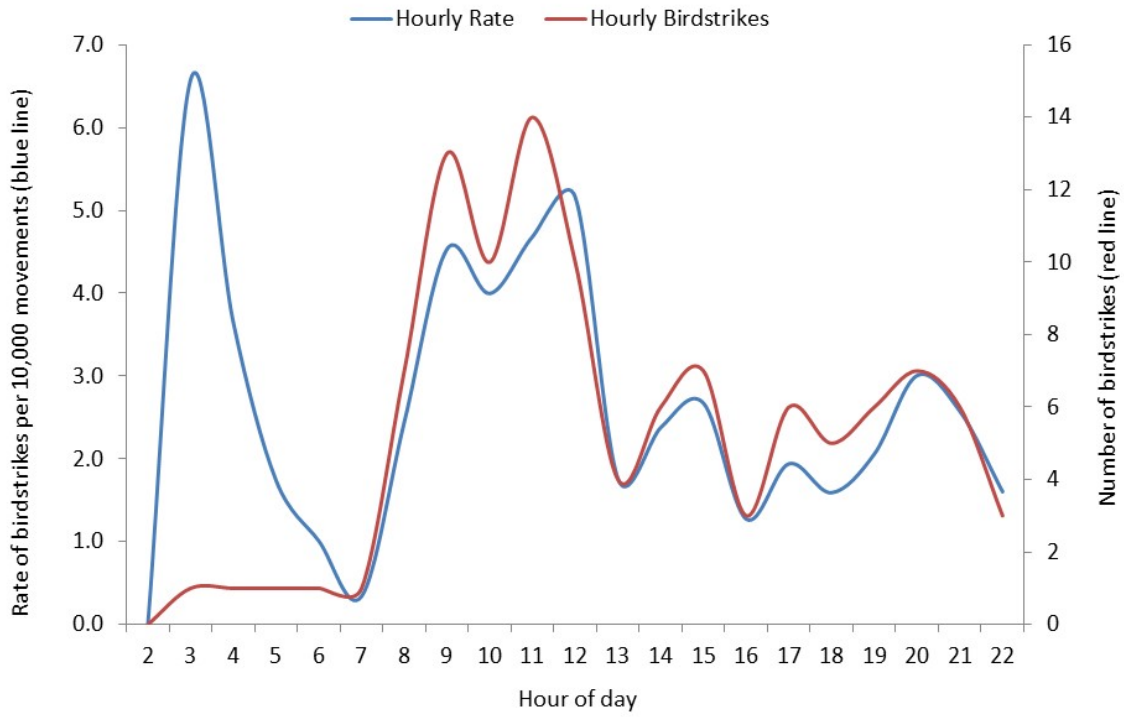
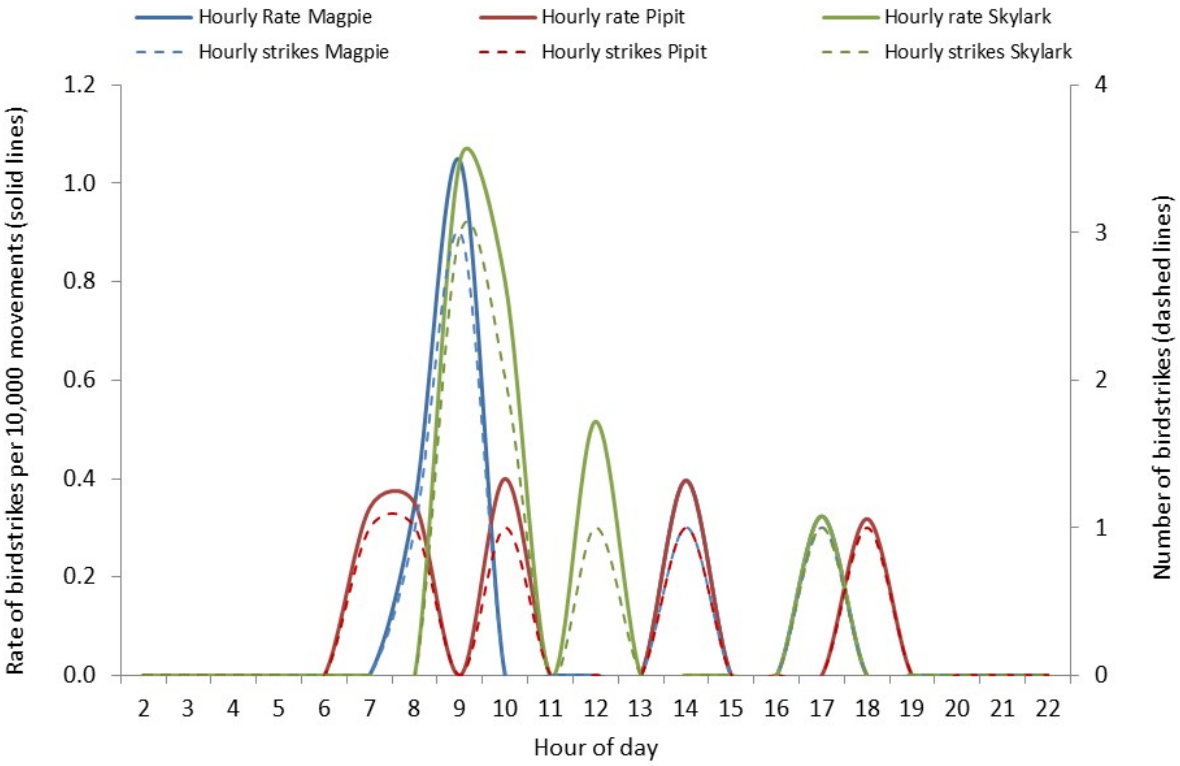


Figure 55: Hourly birdstrike counts and birdstrike rates per 10,000 movements for the top three species (where known) struck at Melbourne aerodrome, 2014 – 2015. The birdstrike rates are displayed by solid lines (left side axis), the birdstrike counts are displayed by dotted lines (right side axis).



Perth

Figure 56: Total hourly birdstrike counts and rates per 10,000 movements for Perth aerodrome, 2014 – 2015. The birdstrike rate is displayed in blue (left side axis); the birdstrike count is displayed in red (right side axis).

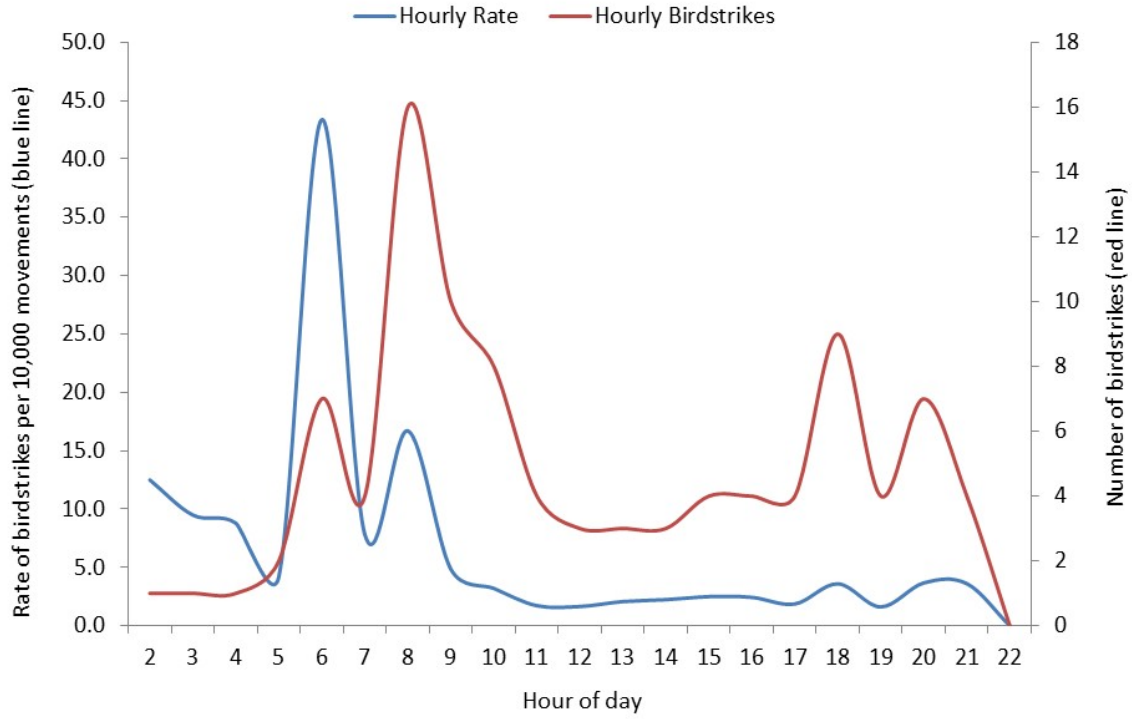
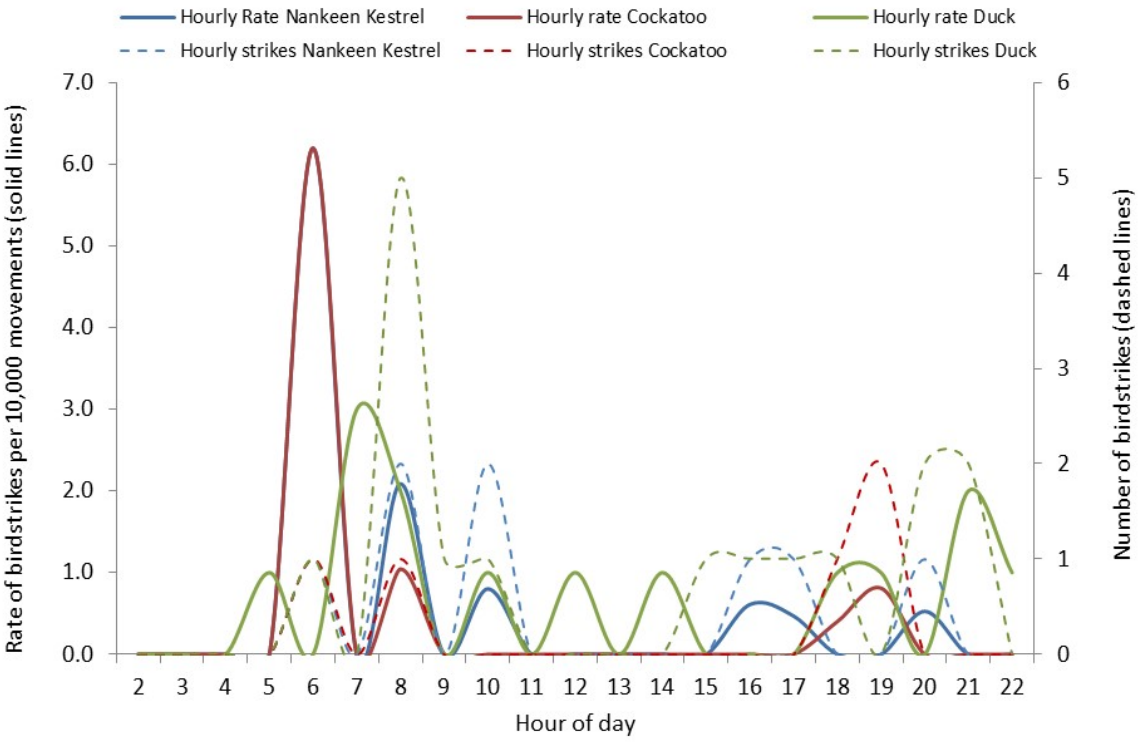


Figure 57: Hourly birdstrike counts and birdstrike rates per 10,000 movements for the top three species (where known) struck at Perth aerodrome, 2014 – 2015. The birdstrike rates are displayed by solid lines (left side axis), the birdstrike counts are displayed by dotted lines (right side axis).



Sydney

Figure 58: Total hourly birdstrike counts and rates per 10,000 movements for Sydney aerodrome, 2014 – 2015. The birdstrike rate is displayed in blue (left side axis); the birdstrike count is displayed in red (right side axis).

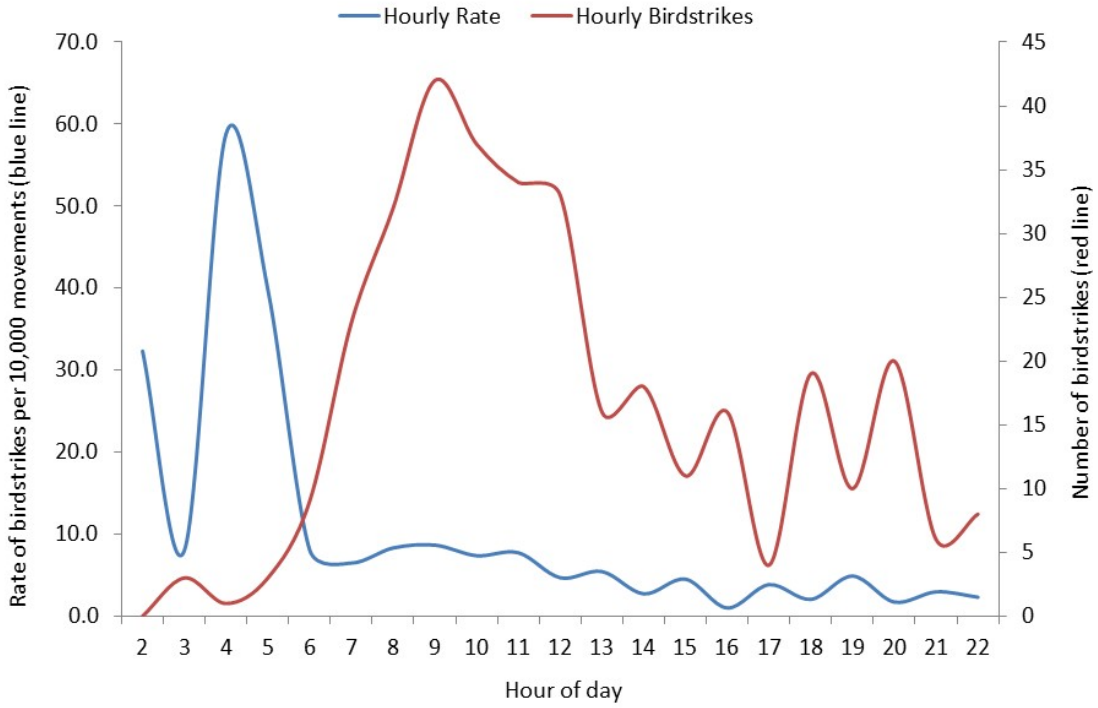
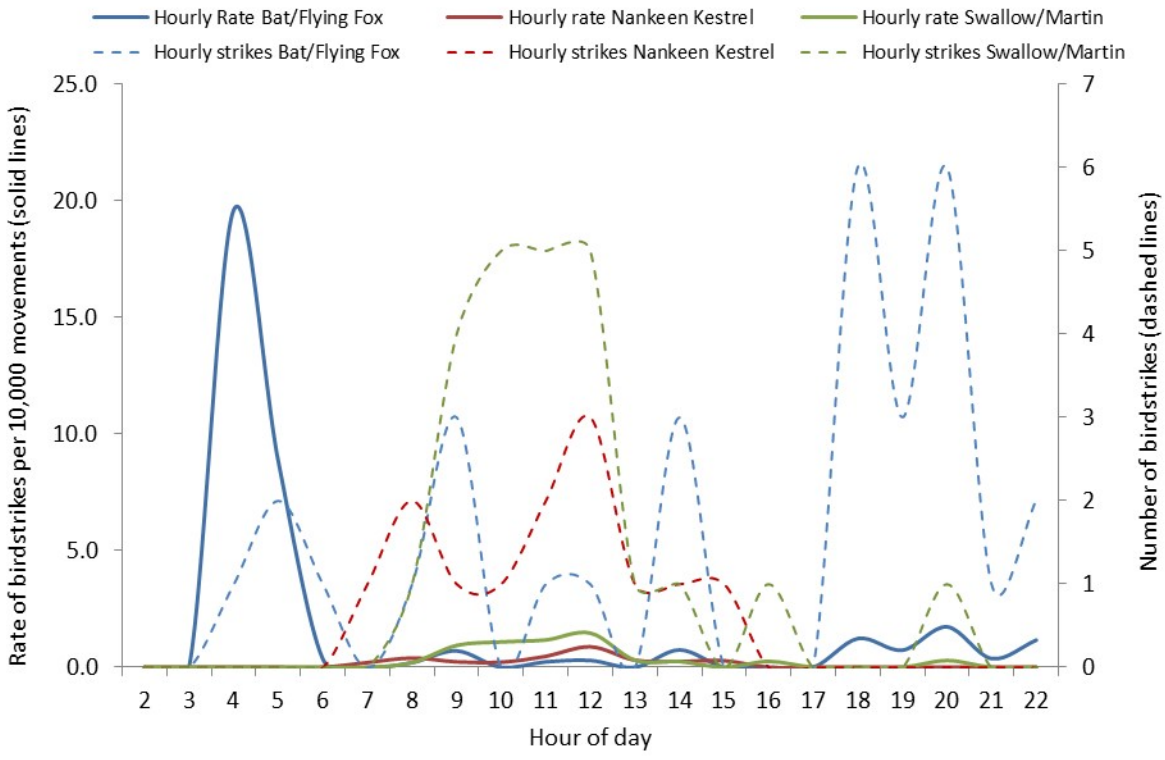


Figure 59: Hourly birdstrike counts and birdstrike rates per 10,000 movements for the top three species (where known) struck at Sydney aerodrome, 2014 – 2015. The birdstrike rates are displayed by solid lines (left side axis), the birdstrike counts are displayed by dotted lines (right side axis).



Appendix C – Monthly birdstrike rates by aerodrome

Major aerodromes

Figure 60: Monthly birdstrike rates for Adelaide aerodrome, 2006 - 2015

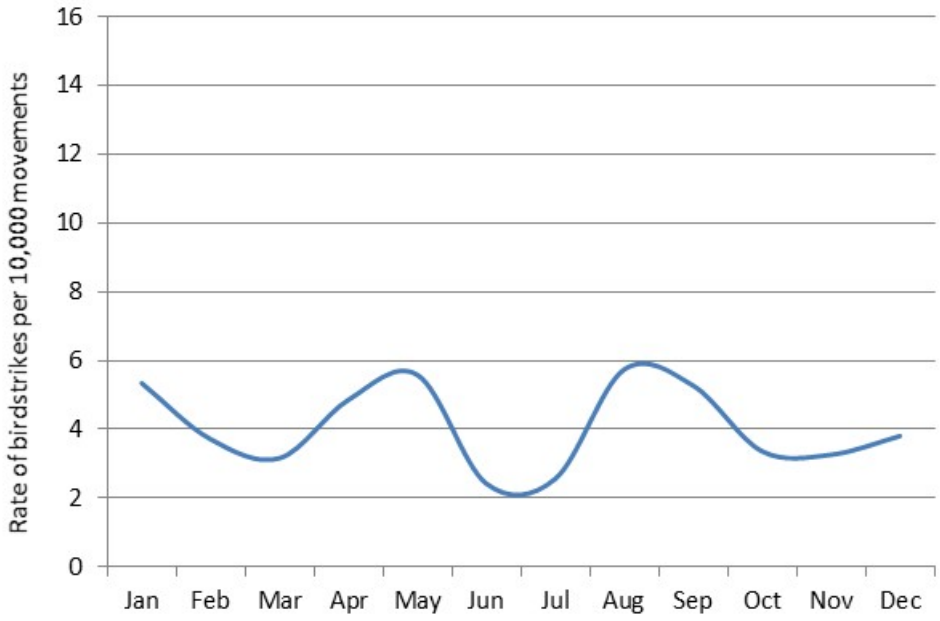


Figure 61: Monthly birdstrike rates for Brisbane aerodrome, 2006 - 2015

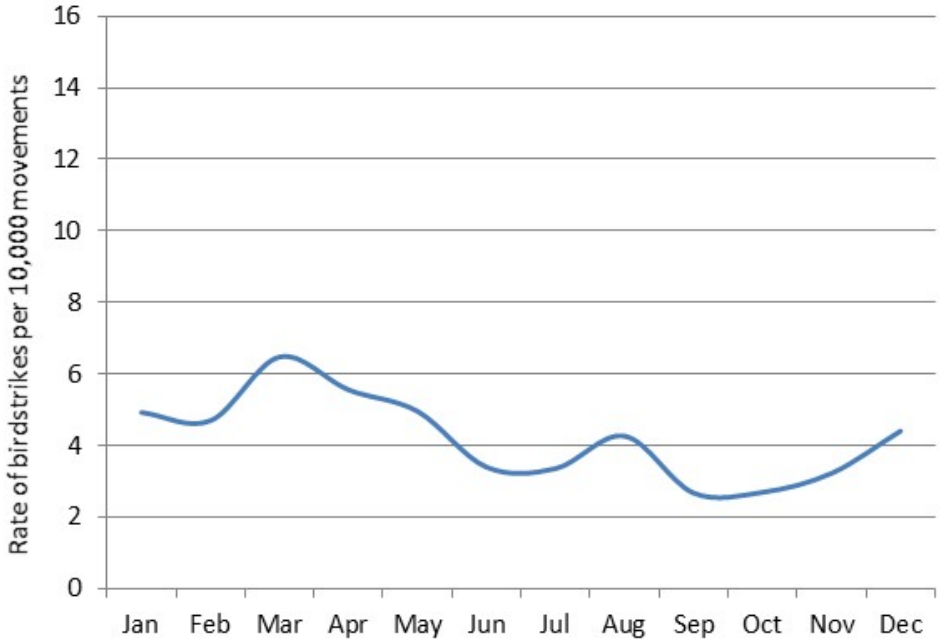


Figure 62: Monthly birdstrike rates for Cairns aerodrome, 2006 - 2015

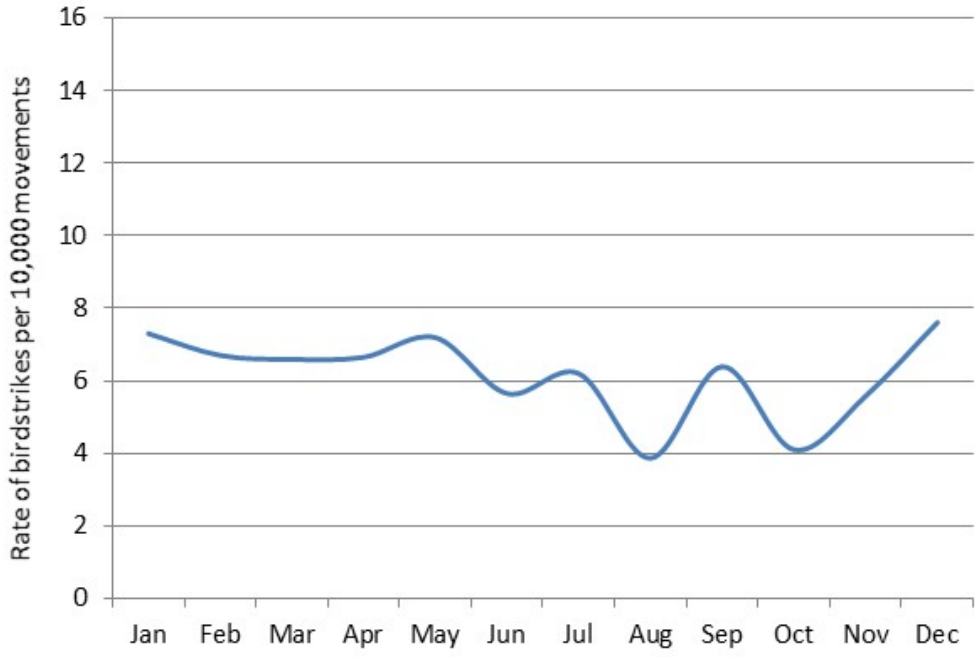


Figure 63: Monthly birdstrike rates for Canberra aerodrome, 2006 - 2015

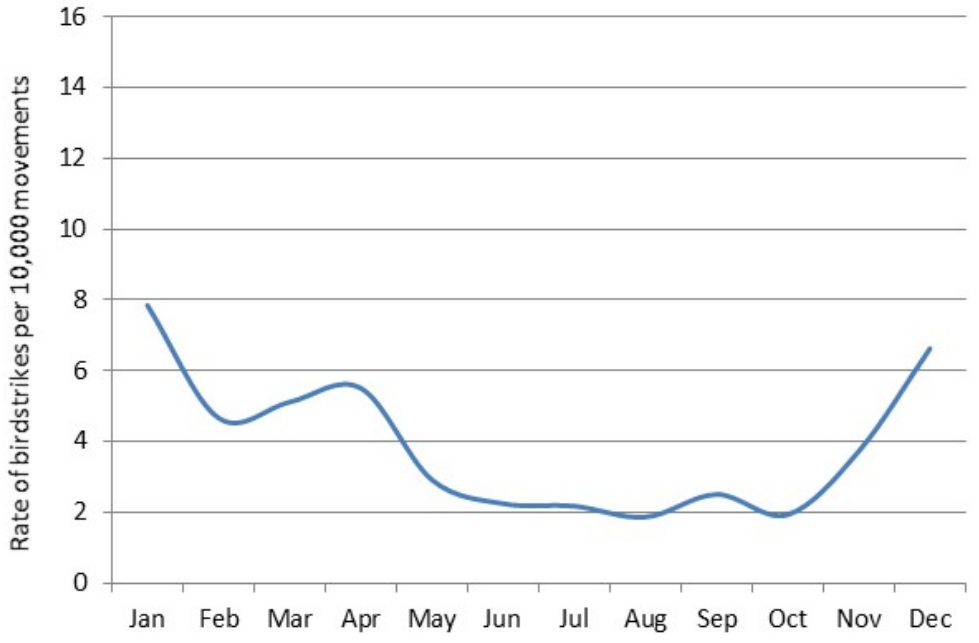


Figure 64: Monthly birdstrike rates for Darwin aerodrome, 2006 - 2015

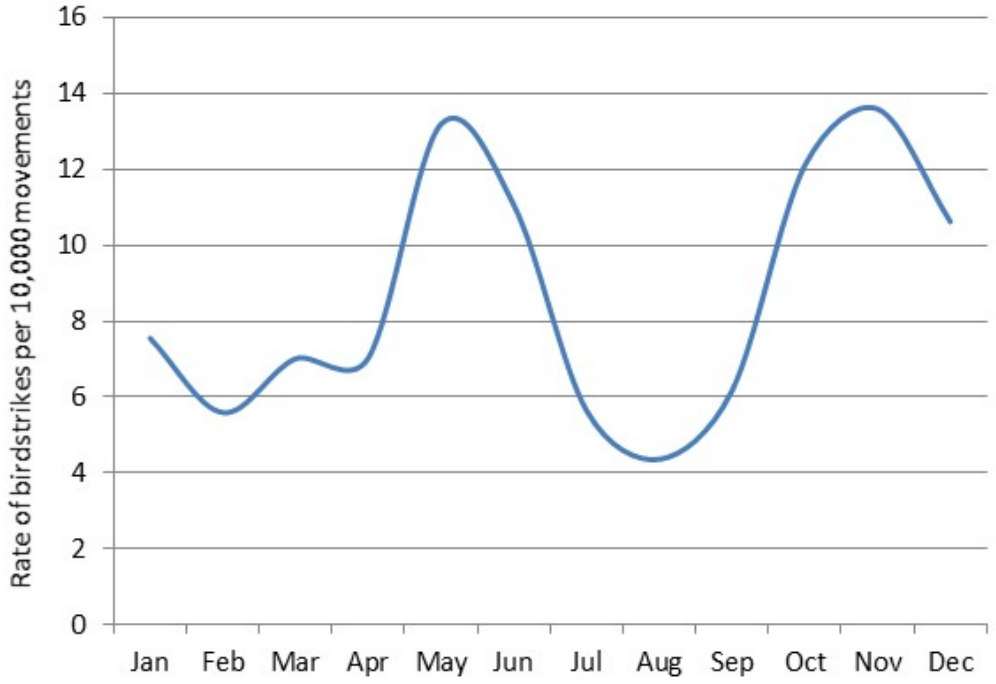


Figure 65: Monthly birdstrike rates for Gold Coast aerodrome, 2006 - 2015

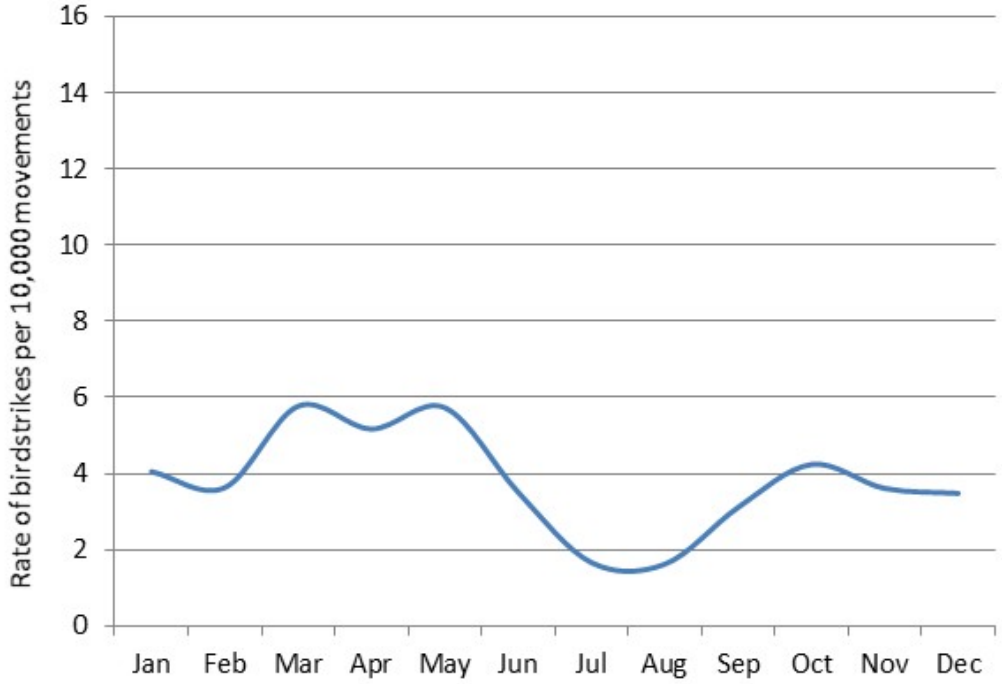


Figure 66: Monthly birdstrike rates for Hobart aerodrome, 2006 - 2015

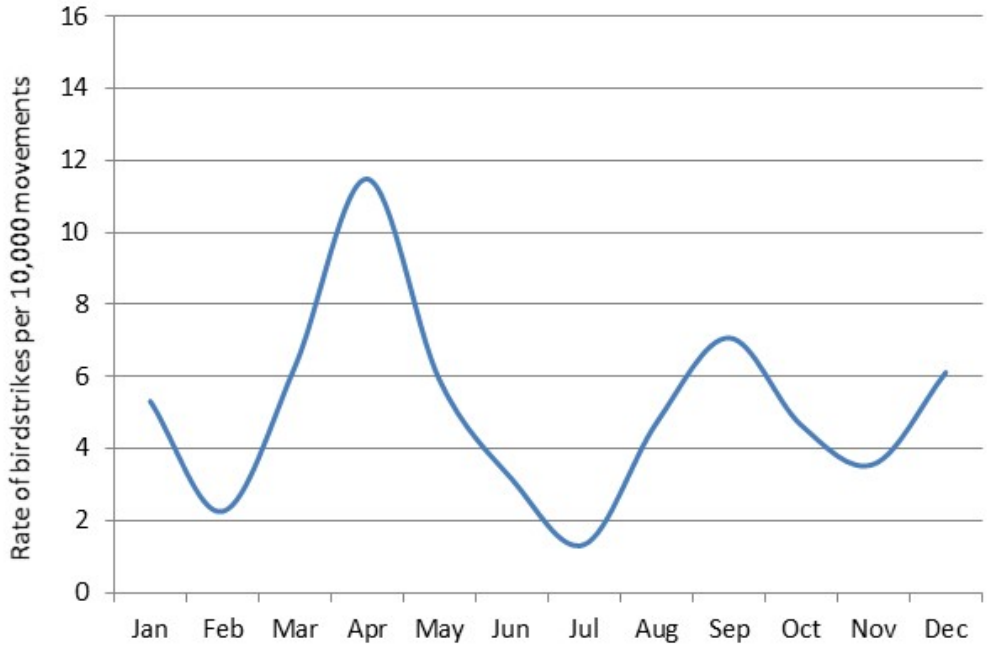


Figure 67: Monthly birdstrike rates for Melbourne aerodrome, 2006 - 2015

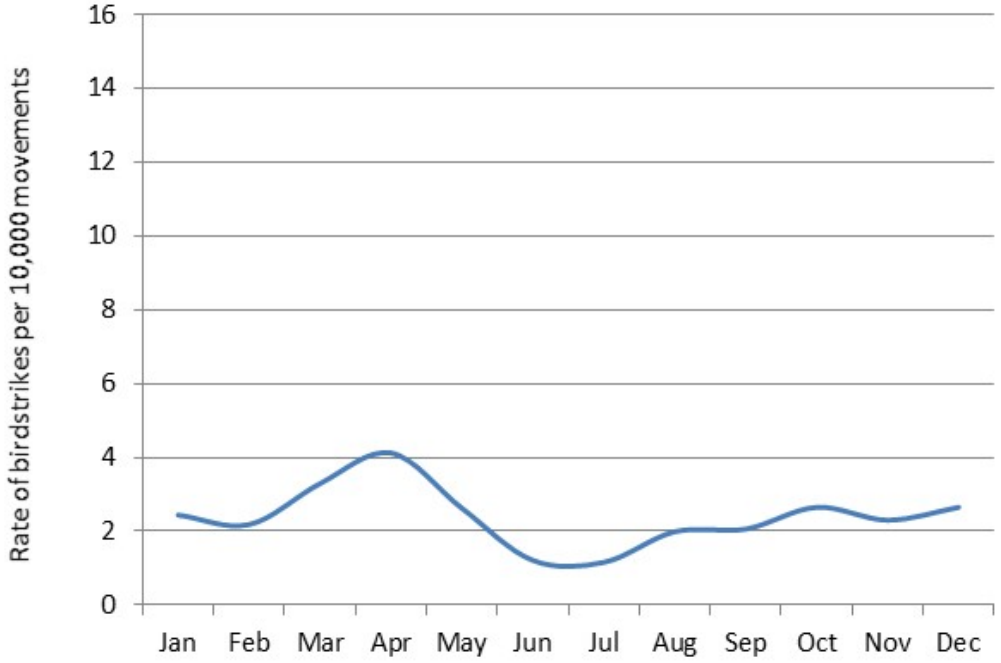


Figure 68: Monthly birdstrike rates for Perth aerodrome, 2006 - 2015

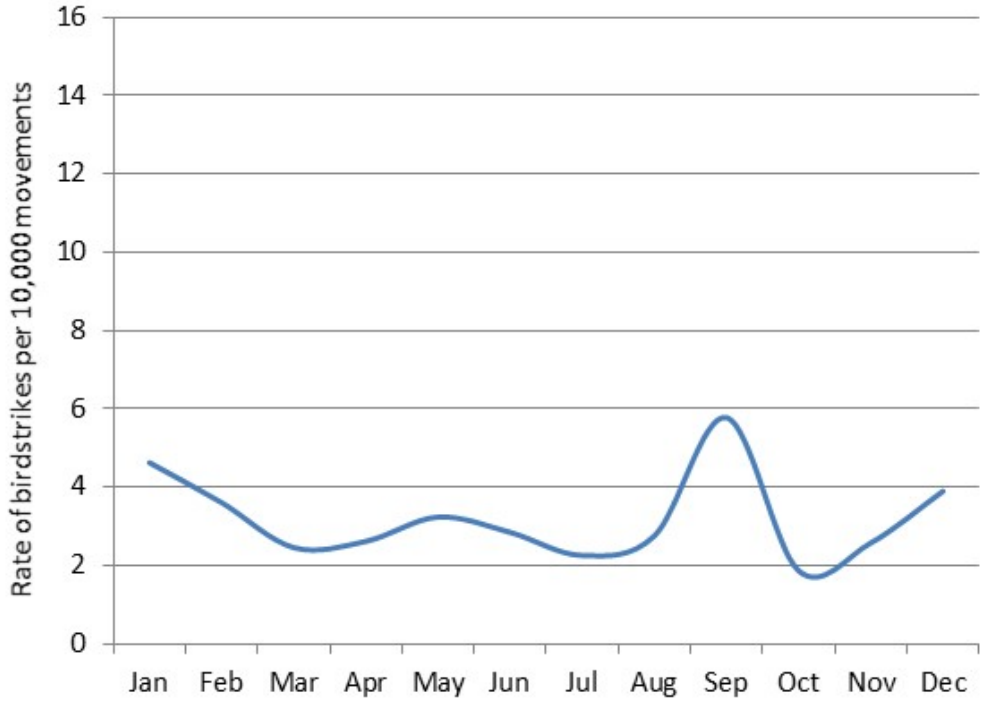
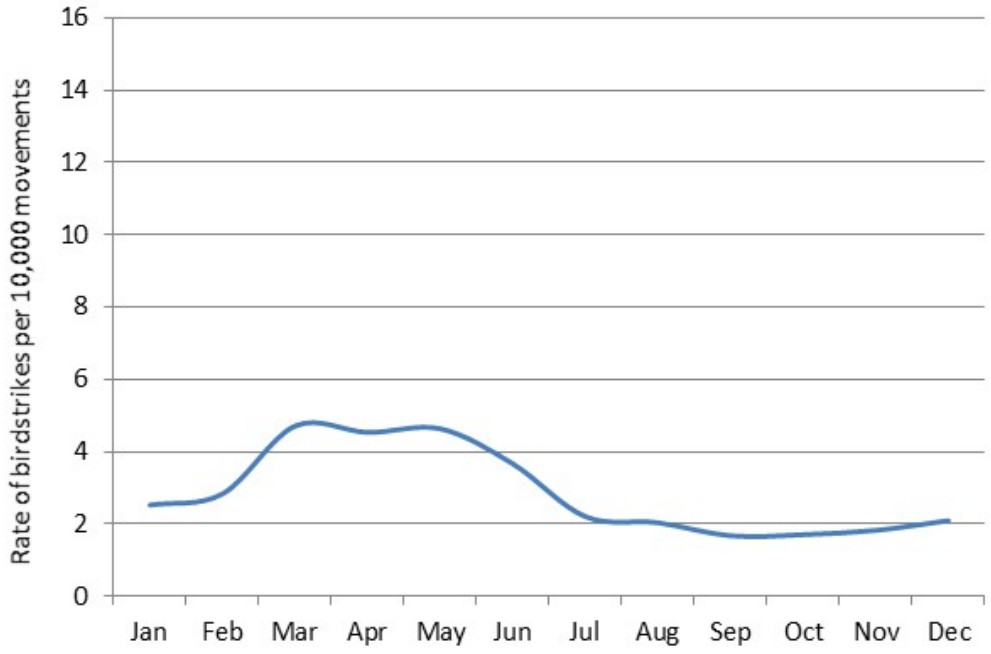


Figure 69: Monthly birdstrike rates for Sydney aerodrome, 2006 - 2015



Towered regional class D aerodromes

Figure 70: Monthly birdstrike rates for Albury aerodrome, 2006 - 2015

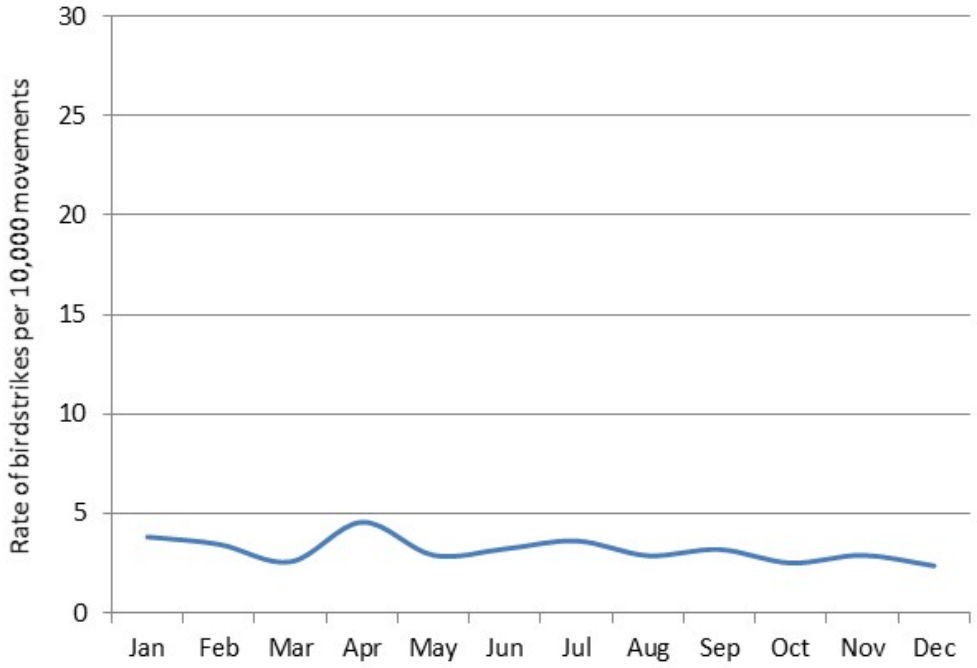


Figure 71: Monthly birdstrike rates for Alice Springs aerodrome, 2006 - 2015

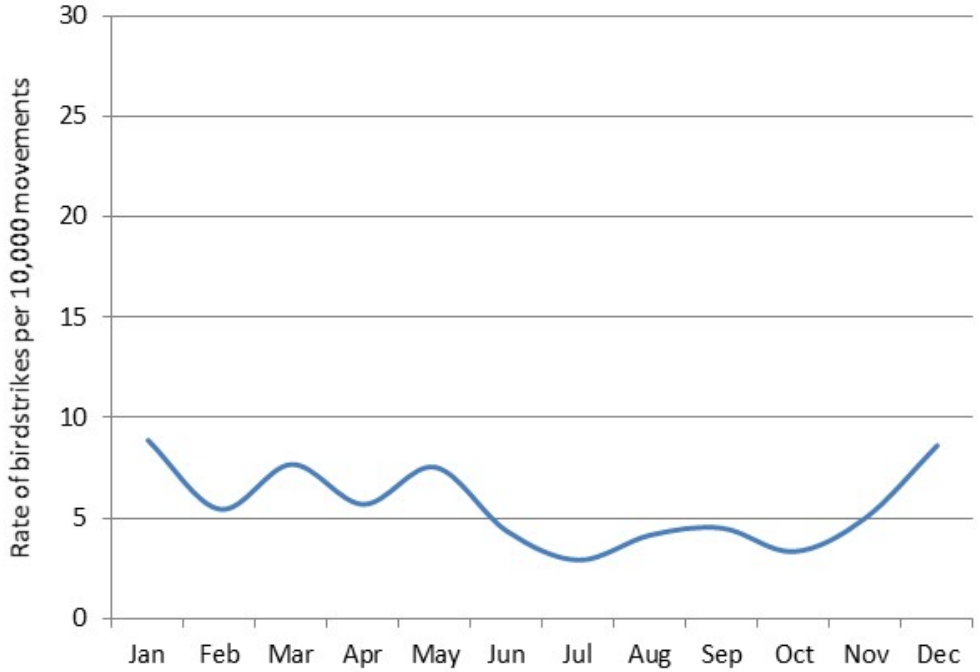


Figure 72: Monthly birdstrike rates for Avalon aerodrome, 2006 - 2015

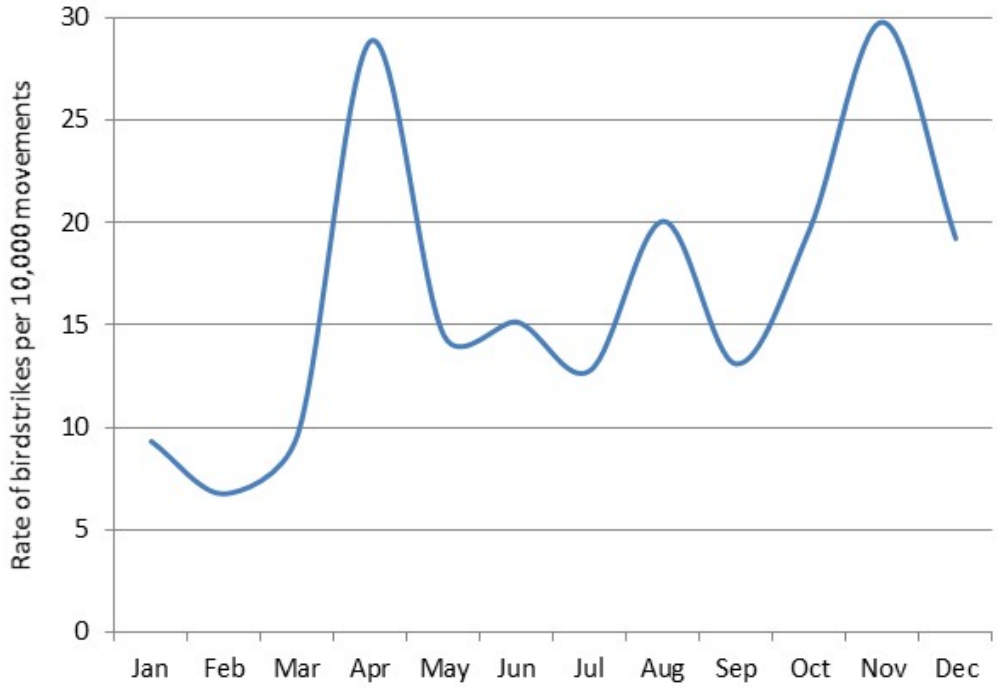


Figure 73: Monthly birdstrike rates for Coffs Harbour aerodrome, 2006 - 2015

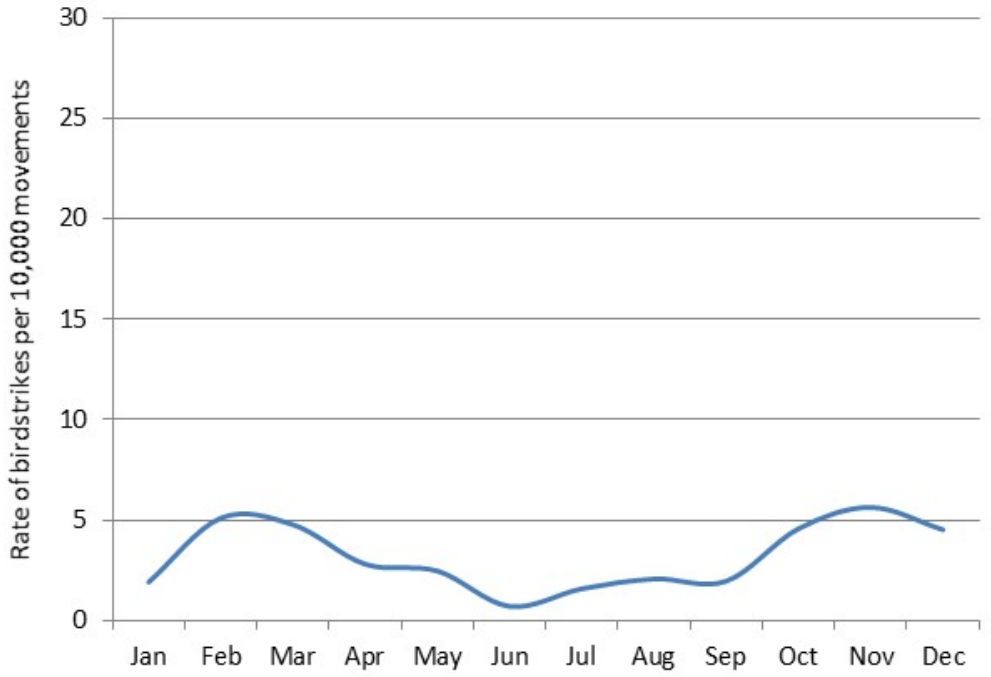


Figure 74: Monthly birdstrike rates for Essendon aerodrome, 2006 - 2015

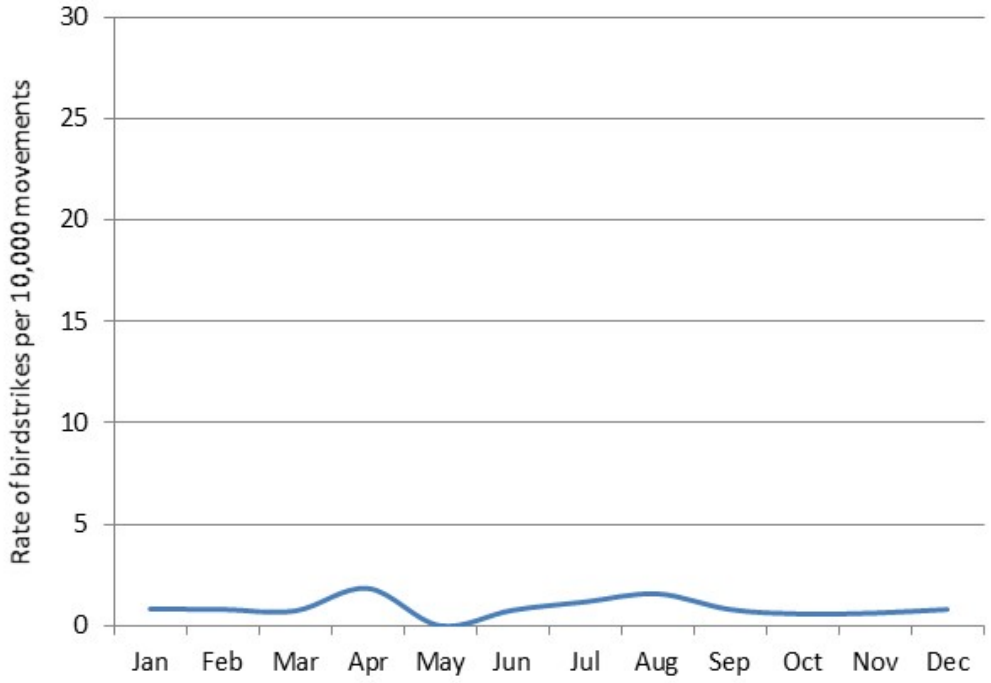


Figure 75: Monthly birdstrike rates for Hamilton Island aerodrome, 2006 - 2015

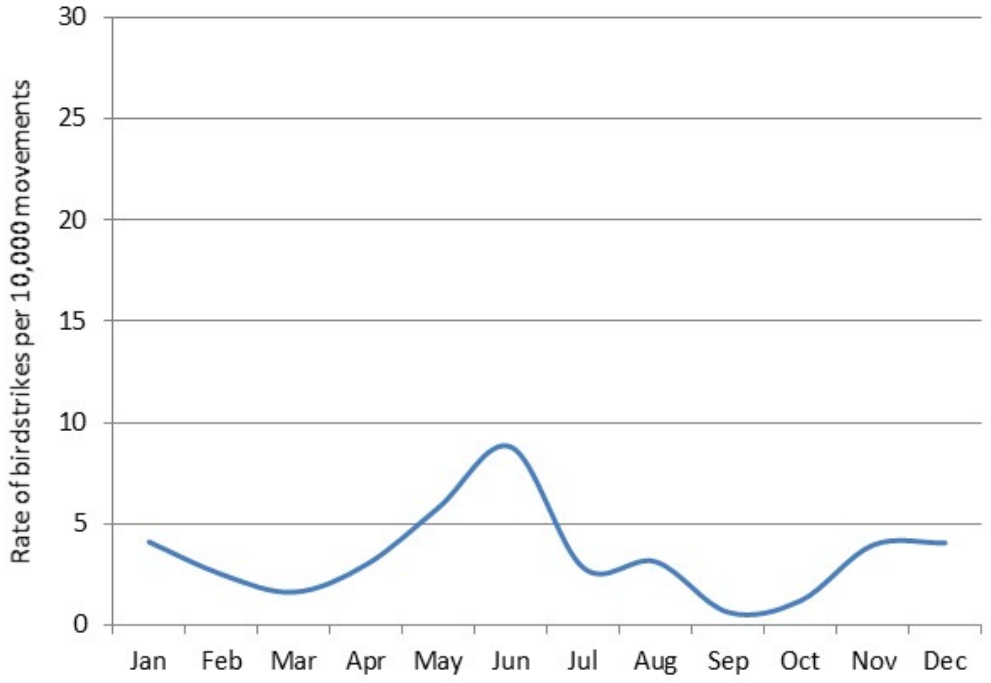


Figure 76: Monthly birdstrike rates for Launceston aerodrome, 2006 - 2015

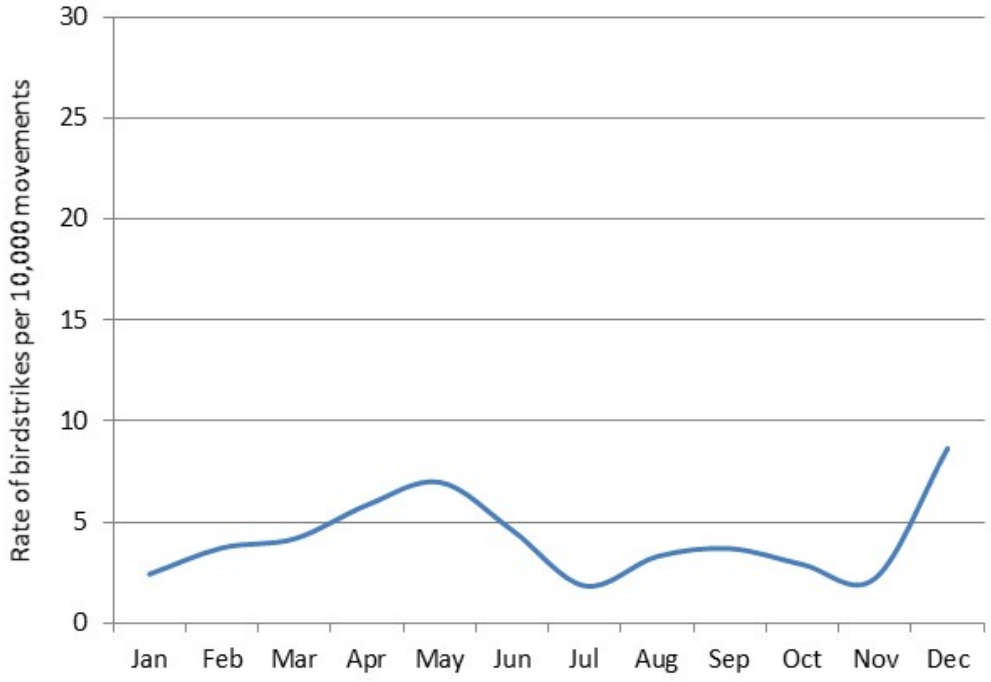


Figure 77: Monthly birdstrike rates for Mackay aerodrome, 2006 - 2015

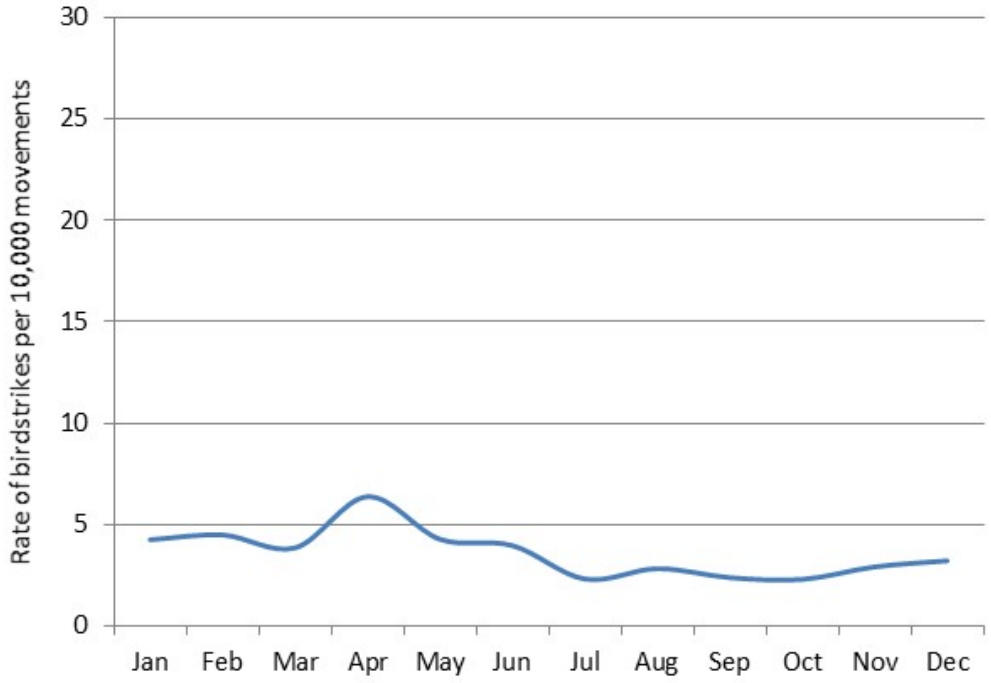


Figure 78: Monthly birdstrike rates for Rockhampton aerodrome, 2006 - 2015

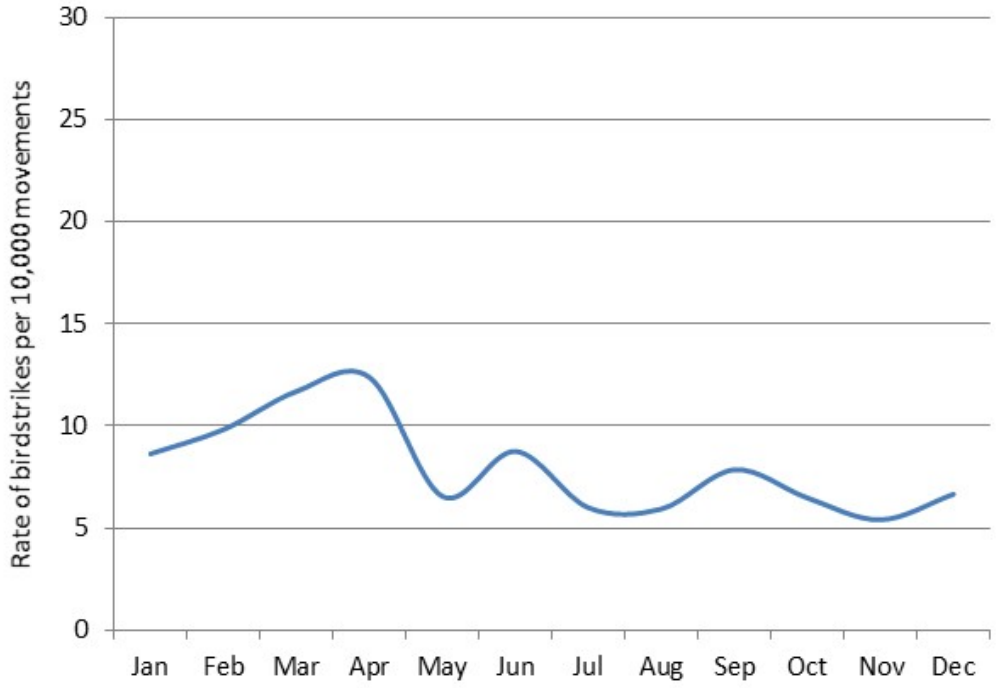


Figure 79: Monthly birdstrike rates for Sunshine Coast aerodrome, 2006 - 2015

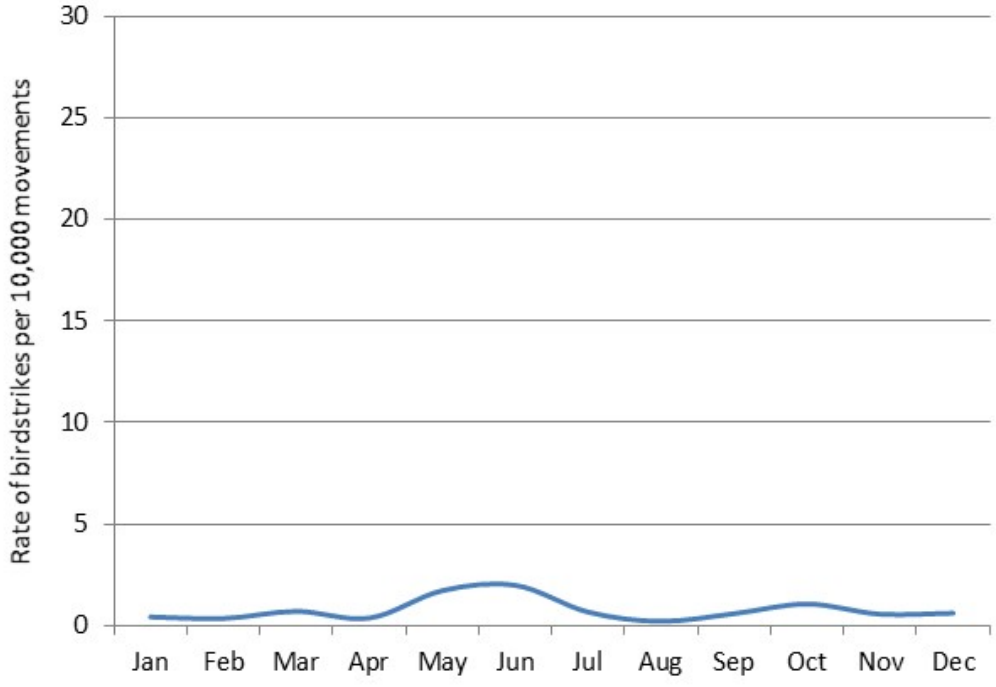


Figure 80: Monthly birdstrike rates for Tamworth aerodrome, 2006 - 2015

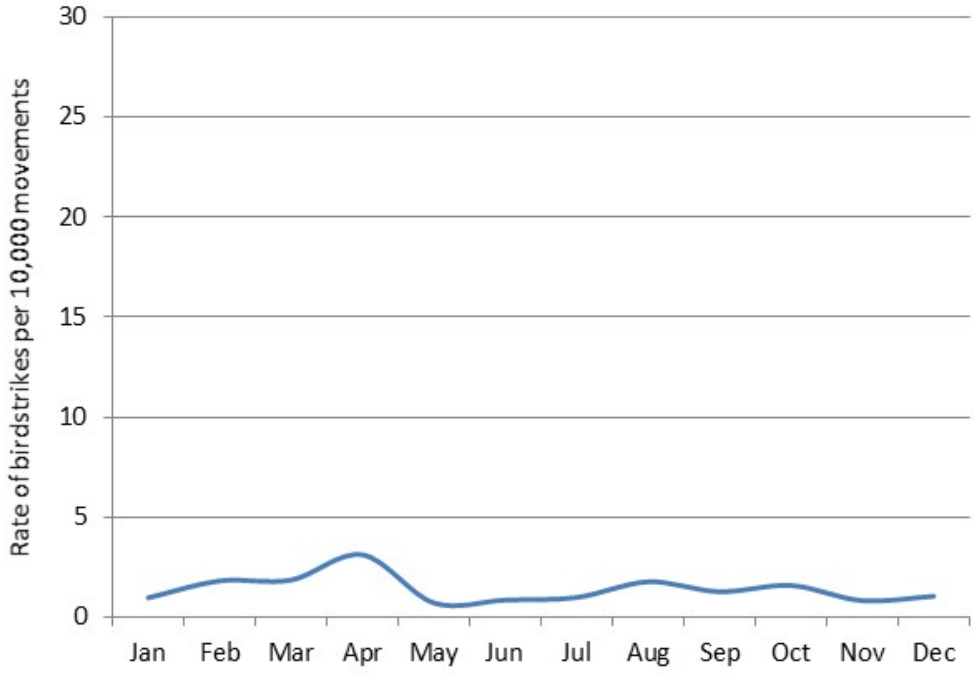
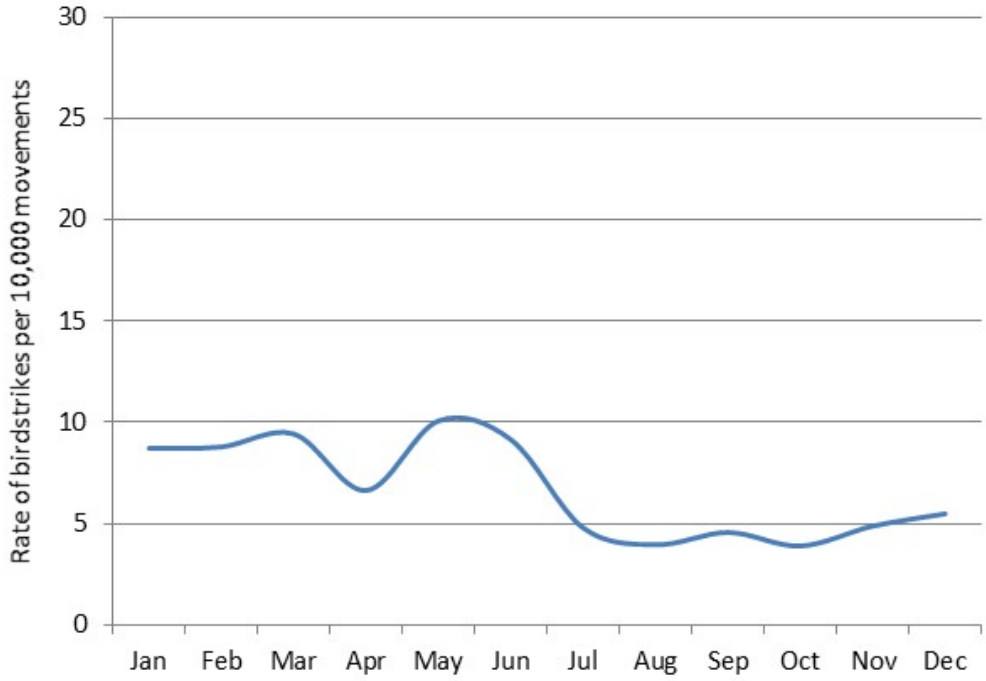


Figure 81: Monthly birdstrike rates for Townsville aerodrome, 2006 - 2015



Metropolitan class D aerodromes

Figure 82: Monthly birdstrike rates for Archerfield aerodrome, 2006 - 2015

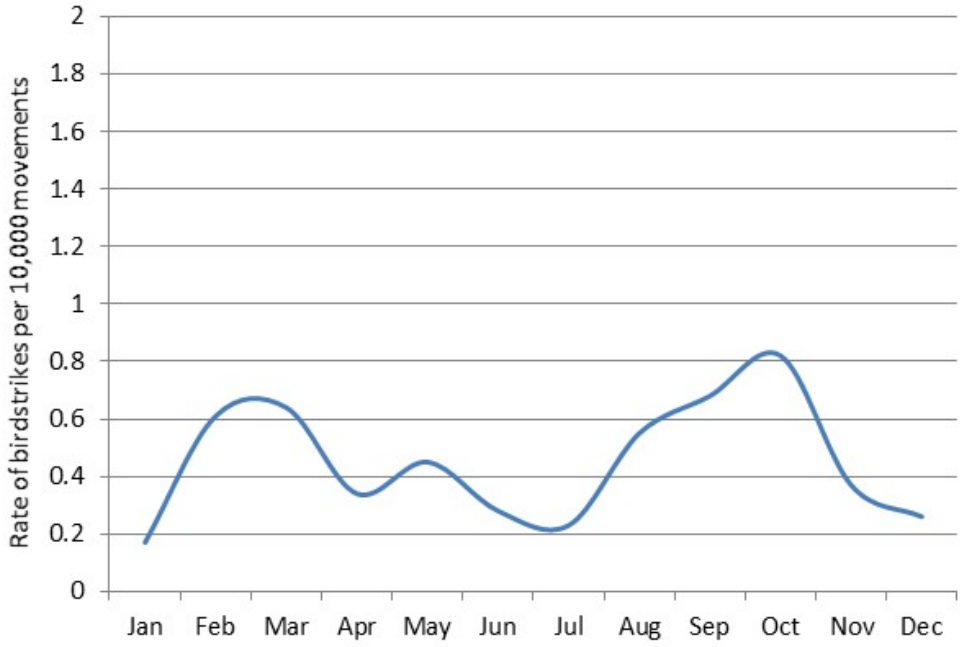


Figure 83: Monthly birdstrike rates for Bankstown aerodrome, 2006 – 2015

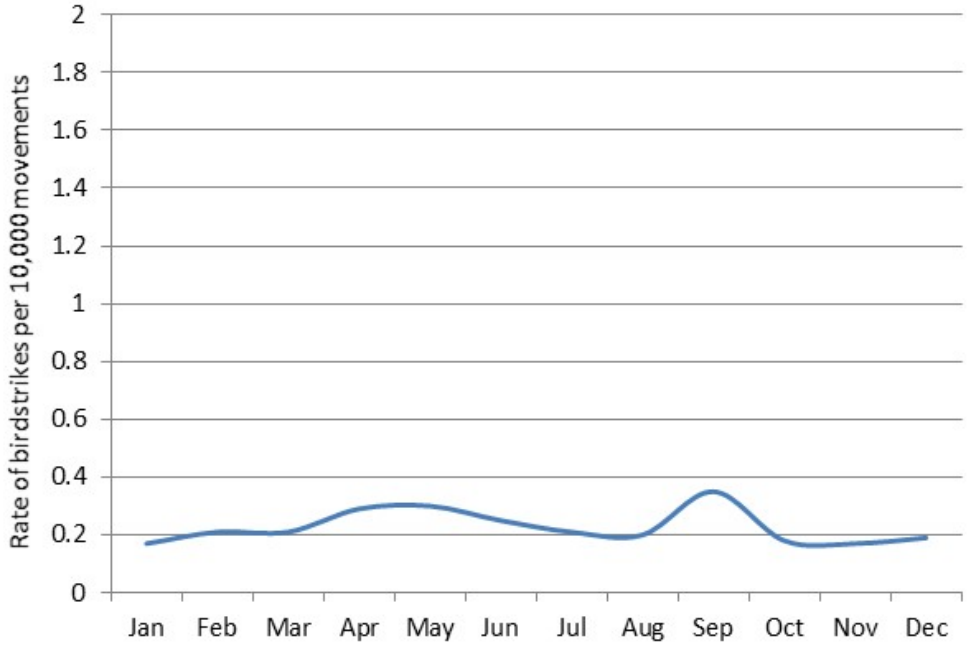


Figure 84: Monthly birdstrike rates for Camden aerodrome, 2006 – 2015

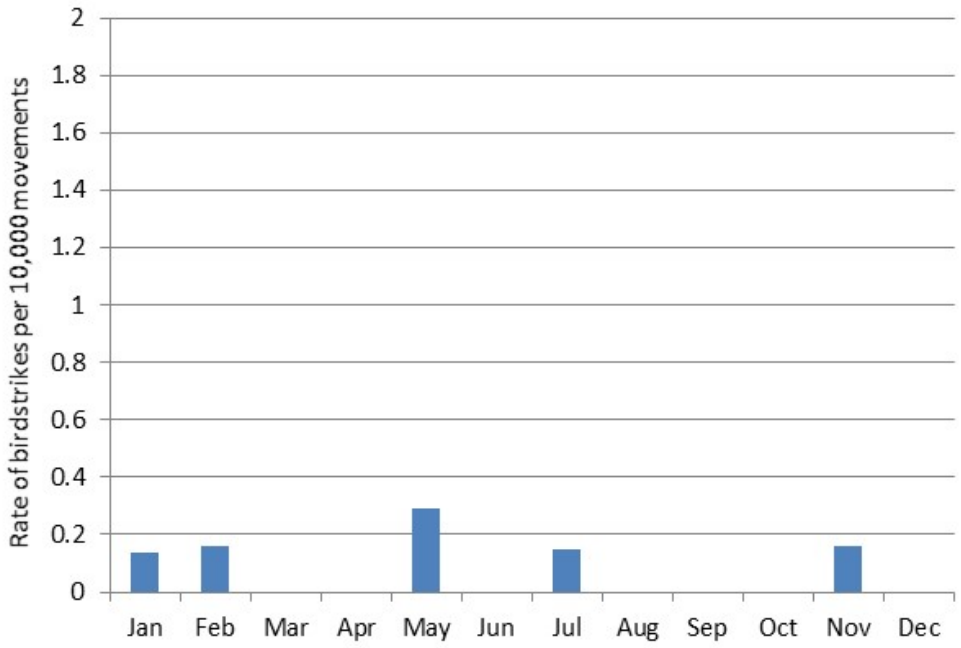


Figure 85: Monthly birdstrike rates for Jandakot aerodrome, 2006 – 2015

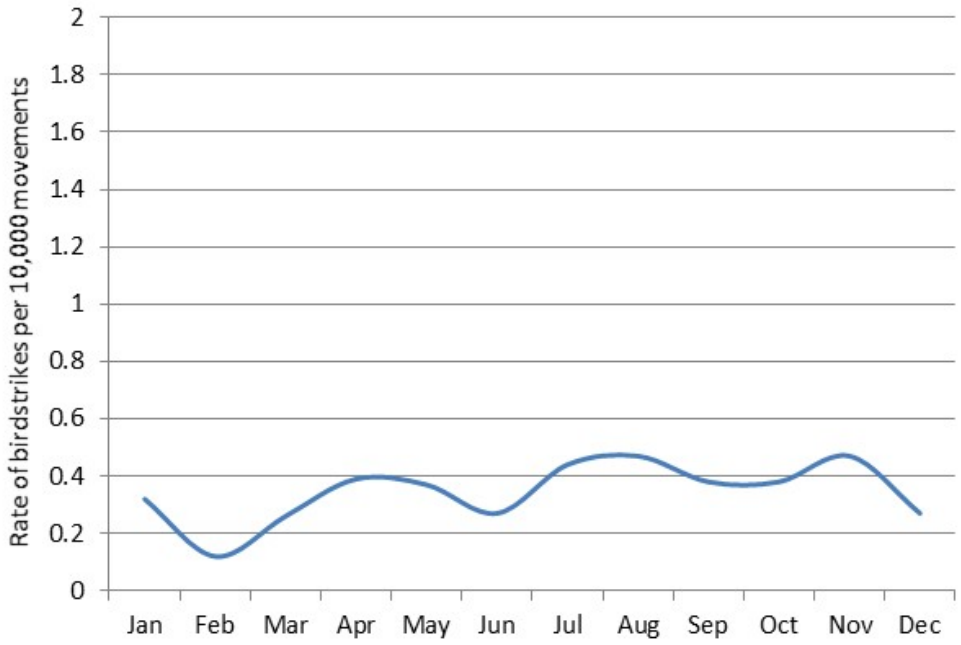


Figure 86: Monthly birdstrike rates for Moorabbin aerodrome, 2006 – 2015

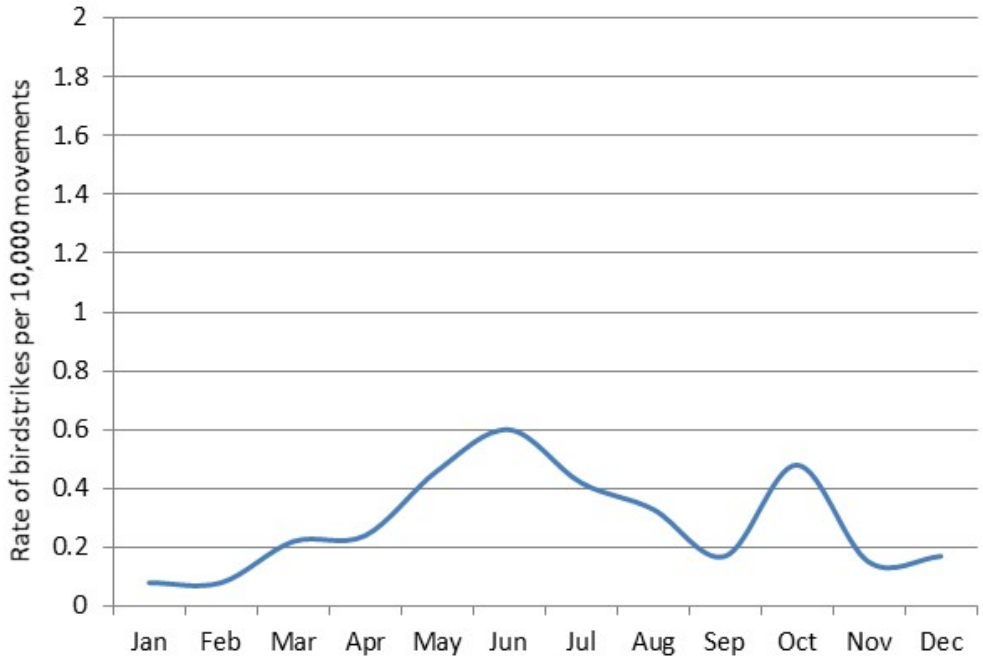
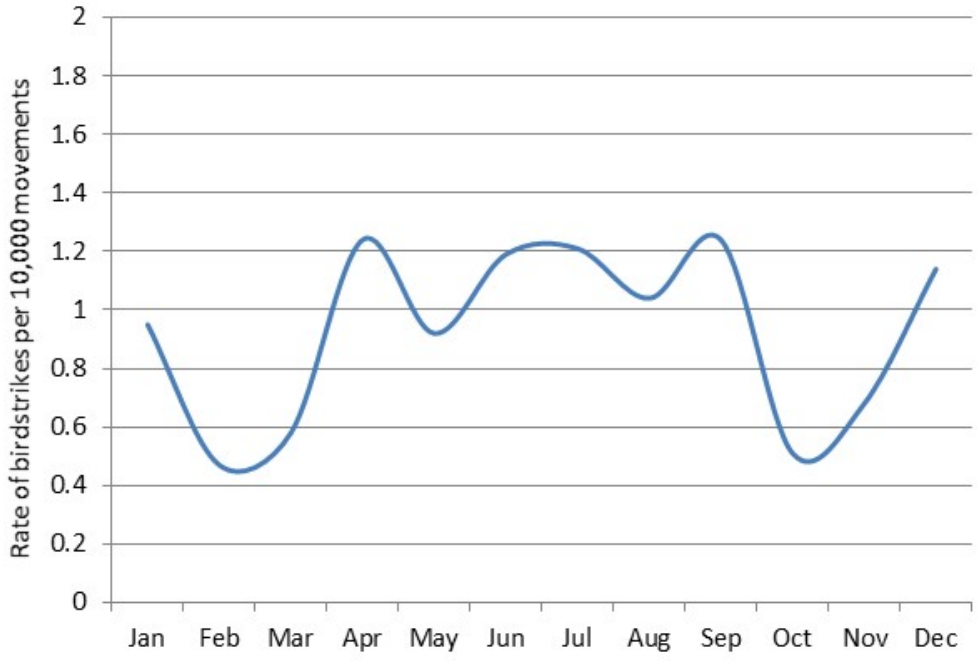


Figure 87: Monthly birdstrike rates for Parafield aerodrome, 2006 - 2015



Appendix D – Additional birdstrike data

Table 32: Number of birdstrikes at major aerodromes by location, aggregated for all operation types, 2006 to 2015

Airport	Aerodrome proximity	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Adelaide	Aerodrome confines	54	49	45	72	51	72	55	40	57	69	564
	5 to 15 km	7	1	0	3	0	2	2	0	2	2	19
	>15 km	1	0	0	0	0	0	0	0	0	0	1
	Unknown	0	0	0	0	0	0	0	0	0	1	1
Brisbane	Aerodrome confines	67	73	112	102	109	125	107	118	114	111	1038
	5 to 15 km	14	4	2	1	2	1	3	3	2	5	37
	>15 km	1	0	0	0	0	1	0	1	1	1	5
	Unknown	0	0	0	0	0	0	0	1	6	2	9
Cairns	Aerodrome confines	46	87	80	69	79	68	61	82	99	118	789
	5 to 15 km	11	5	3	2	3	1	5	5	0	3	38
	>15 km	3	0	2	0	2	0	1	0	0	0	8
	Unknown	1	0	0	0	0	0	0	1	0	0	2
Canberra	Aerodrome confines	44	37	30	21	34	43	21	31	51	61	373
	5 to 15 km	3	1	0	2	0	2	0	1	4	0	13
	>15 km	1	0	1	0	0	1	0	0	0	0	3
	Unknown	0	0	0	0	0	0	0	1	0	1	2
Darwin	Aerodrome confines	66	73	77	111	92	73	89	155	87	158	981
	5 to 15 km	2	1	0	1	0	3	3	1	3	1	15
	>15 km	1	0	1	4	0	1	1	0	1	0	9
	Unknown	0	0	0	0	0	0	2	1	1	1	5
Gold Coast	Aerodrome confines	27	31	30	32	50	47	42	46	81	94	480
	5 to 15 km	9	0	0	0	1	2	1	2	4	2	21
	>15 km	0	0	0	0	0	0	0	0	0	1	1
	Unknown	0	0	0	0	0	1	0	0	0	0	1
Hobart	Aerodrome confines	28	34	22	21	19	13	10	11	23	13	194
	5 to 15 km	2	1	1	0	0	0	0	0	0	0	4
Melbourne	Aerodrome confines	70	36	76	62	95	57	44	51	65	71	627
	5 to 15 km	11	6	3	2	1	2	9	3	7	6	50
	>15 km	0	0	1	0	0	0	0	0	0	0	1
	Unknown	0	0	0	1	1	1	0	1	1	3	8
Perth	Aerodrome confines	42	37	46	40	54	67	73	49	68	41	517
	5 to 15 km	9	1	2	2	2	0	3	0	1	3	23
	>15 km	1	0	1	0	0	1	0	1	0	0	4
	Unknown	0	0	1	0	0	1	0	0	2	1	5
Sydney	Aerodrome confines	73	87	84	110	111	133	81	91	186	175	1131
	5 to 15 km	9	5	0	1	1	0	8	5	7	2	38
	>15 km	3	0	0	0	0	0	1	1	0	1	6
	Unknown	0	0	0	0	0	6	0	4	2	2	14

Table 33: Number of birdstrikes at towered regional class D aerodromes by location, aggregated for all operation types, 2006 to 2015

Airport	Aerodrome proximity	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Albury	Aerodrome confines	9	15	9	17	12	12	15	17	11	16	**133**
	5 to 15 km	1	0	0	0	1	1	0	0	1	0	**4**
	Unknown	0	0	0	0	0	0	0	1	0	1	**2**
Alice Springs	Aerodrome confines	14	14	5	12	55	38	10	9	11	10	**178**
	5 to 15 km	0	1	0	0	0	0	1	0	0	0	**2**
Avalon	Aerodrome confines	5	7	8	19	20	14	20	5	11	15	**124**
	5 to 15 km	0	1	0	0	0	1	0	0	0	0	**2**
Coffs Harbour	Aerodrome confines	10	14	9	10	10	9	10	10	21	9	**112**
	5 to 15 km	0	0	0	0	0	1	1	0	0	0	**2**
	>15 km	0	0	0	0	1	0	0	0	0	0	**1**
Essendon	Aerodrome confines	12	6	8	11	5	5	5	6	6	1	**65**
	5 to 15 km	1	0	1	0	0	0	0	2	0	0	**4**
Hamilton Island	Aerodrome confines	10	11	6	5	5	6	2	5	1	5	**56**
Launceston	Aerodrome confines	4	8	19	10	11	7	17	13	16	8	**113**
	5 to 15 km	1	0	0	0	0	0	0	0	0	0	**1**
Mackay	Aerodrome confines	16	10	12	23	25	20	24	20	37	25	**212**
	5 to 15 km	1	0	0	0	0	0	1	0	1	0	**3**
	>15 km	0	0	0	0	0	0	0	0	1	0	**1**
	Unknown	0	0	0	0	0	0	1	0	0	0	**1**
Rockhampton	Aerodrome confines	37	21	37	41	50	35	38	50	37	55	**401**
	5 to 15 km	1	0	1	0	1	4	2	2	3	1	**15**
	>15 km	1	0	0	1	0	0	0	1	1	0	**4**
	Unknown	0	0	0	0	0	1	1	0	0	0	**2**
Sunshine Coast	Aerodrome confines	9	17	7	9	11	6	5	7	8	1	**80**
	5 to 15 km	1	1	0	0	1	0	1	1	1	0	**6**
Tamworth	Aerodrome confines	17	17	23	12	12	11	20	20	13	10	**155**
	5 to 15 km	2	1	0	0	0	0	0	0	1	0	**4**
	>15 km	0	0	0	0	0	0	0	0	1	1	**2**
Townsville	Aerodrome confines	26	44	44	52	67	62	73	68	42	44	**522**
	5 to 15 km	6	2	0	2	2	0	4	6	2	6	**30**
	>15 km	1	1	0	1	2	0	0	0	1	1	**7**
	Unknown	0	1	0	0	0	0	1	2	1	0	**5**

Table 34: Number of birdstrikes at metropolitan class D aerodromes by location, aggregated for all operation types, 2006 to 2015

Airport	Aerodrome Proximity	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Archerfield	Aerodrome confines	4	6	7	18	9	7	3	11	9	5	**79**
	5 to 15 km	3	1	0	0	0	0	0	0	2	2	**8**
	>15 km	1	0	0	0	0	0	0	0	0	0	**1**
Bankstown	Aerodrome confines	5	8	13	13	7	5	7	13	4	10	**85**
	5 to 15 km	2	1	1	1	1	1	1	1	1	0	**10**
	>15 km	1	0	0	0	0	0	0	1	0	0	**2**
Camden	Aerodrome confines	1	1	1	0	1	0	0	1	1	0	**6**
Jandakot	Aerodrome confines	28	21	4	8	19	14	17	8	12	13	**144**
	5 to 15 km	1	0	1	0	0	0	0	0	0	0	**2**
	>15 km	0	0	1	1	0	0	0	0	0	1	**3**
	Unknown	0	0	0	0	0	0	0	0	0	1	**1**
Moorabbin	Aerodrome confines	5	9	11	14	12	8	11	10	8	13	**101**
	5 to 15 km	2	1	0	2	0	0	0	1	3	2	**11**
	>15 km	0	0	0	1	0	0	0	0	0	0	**1**
	Unknown	0	0	0	0	0	0	0	1	0	0	**1**
Parafield	Aerodrome confines	15	27	32	32	38	37	22	12	20	16	**251**
	5 to 15 km	1	0	0	0	0	0	0	0	0	0	**1**
	>15 km	1	0	0	0	0	0	0	0	0	0	**1**

Table 35: Number of birdstrikes at other regional aerodromes by location, aggregated for all operation types, 2006 to 2015

Airport	Aerodrome proximity	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Amberley	Aerodrome confines	0	1	0	4	19	5	8	9	7	7	**60**
	5 to 15 km	0	0	0	0	0	0	1	2	1	1	**5**
	>15 km	1	0	0	0	0	0	1	1	1	0	**4**
	Unknown	0	0	0	0	0	1	1	1	0	1	**4**
Ballina / Byron Gateway	Aerodrome confines	3	10	8	6	8	10	8	7	6	15	**81**
	5 to 15 km	3	1	0	0	0	0	0	0	1	0	**5**
	Unknown	0	0	0	0	0	0	0	0	0	1	**1**
Barrow Island	Aerodrome confines	1	0	0	1	3	7	8	2	9	3	**34**
	5 to 15 km	1	0	0	0	0	0	0	1	0	0	**2**
Broken Hill	Aerodrome confines	3	0	0	0	2	6	3	1	3	9	**27**
Broome	Aerodrome confines	10	26	20	11	15	16	17	28	16	8	**167**
	5 to 15 km	0	0	0	0	0	1	1	0	0	0	**2**
	>15 km	1	0	0	0	0	0	0	0	1	0	**2**
Christmas Island	Aerodrome confines	2	1	5	3	5	4	6	2	4	6	**38**
	5 to 15 km	0	0	0	0	0	1	1	0	0	0	**2**
	Unknown	0	0	0	0	0	1	0	0	1	0	**2**
Dubbo	Aerodrome confines	10	17	26	7	14	12	16	19	17	15	**153**
	5 to 15 km	1	0	0	0	1	0	0	0	0	0	**2**
	Unknown	0	0	0	0	0	0	1	0	0	0	**1**
Emerald	Aerodrome confines	6	12	8	2	11	6	7	10	12	8	**82**
	5 to 15 km	0	1	0	0	0	0	0	0	1	0	**2**
	>15 km	0	0	0	1	0	0	0	0	0	1	**2**
Gladstone	Aerodrome confines	5	2	0	4	8	5	8	11	16	25	**84**
	5 to 15 km	0	0	2	0	0	0	2	0	0	1	**5**
	>15 km	0	0	1	0	0	0	1	0	0	1	**3**
	Unknown	0	0	0	0	0	0	0	0	1	0	**1**
Grafton	Aerodrome confines	0	2	5	3	4	4	3	4	2	9	**36**
Griffith	Aerodrome confines	4	4	1	3	3	11	6	6	11	12	**61**
	5 to 15 km	0	0	0	0	0	0	2	1	0	0	**3**
	>15 km	0	0	0	0	0	0	1	1	0	0	**2**

Continued

Airport	Aerodrome proximity	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Karratha	Aerodrome confines	11	6	5	22	11	23	17	12	15	10	**132**
	5 to 15 km	1	0	0	0	0	0	0	1	0	0	**2**
	Unknown	0	0	0	0	0	2	0	0	0	0	**2**
Kununurra	Aerodrome confines	3	3	7	5	7	4	12	4	11	13	**69**
	Unknown	0	0	0	0	0	0	0	0	0	1	**1**
Lismore	Aerodrome confines	5	9	3	7	4	9	7	10	6	8	**68**
	5 to 15 km	0	1	0	0	1	0	0	0	0	1	**3**
Lord Howe Island	Aerodrome confines	3	7	6	4	7	0	5	6	3	7	**48**
	5 to 15 km	0	0	0	0	0	0	1	0	0	0	**1**
Mount Isa	Aerodrome confines	11	15	9	18	15	24	12	5	13	12	**134**
	5 to 15 km	1	0	0	0	0	0	1	0	0	0	**2**
	>15 km	0	0	0	0	0	1	0	0	0	0	**1**
Newman	Aerodrome confines	2	1	2	6	1	9	8	11	8	5	**53**
	5 to 15 km	0	0	0	0	0	0	0	0	1	0	**1**
Port Hedland	Aerodrome confines	9	2	2	13	4	12	20	13	24	10	**109**
	5 to 15 km	0	0	0	0	0	0	0	1	0	0	**1**
Port Lincoln	Aerodrome confines	5	1	8	6	1	2	2	10	8	5	**48**
Port Macquarie	Aerodrome confines	5	0	4	3	14	10	10	14	10	7	**77**
	5 to 15 km	1	0	0	0	0	0	0	0	0	0	**1**
Proserpine / Whitsunday Coast	Aerodrome confines	6	6	9	7	7	4	5	6	8	3	**61**
	5 to 15 km	1	1	0	0	0	0	0	0	0	1	**3**
	>15 km	0	1	0	0	0	0	0	0	0	0	**1**
Richmond	Aerodrome confines	0	1	0	0	3	6	3	5	4	9	**31**
	5 to 15 km	0	1	0	1	0	1	0	1	0	0	**4**
	Unknown	0	0	0	0	0	0	0	1	0	0	**1**
Roma	Aerodrome confines	0	4	11	3	9	7	2	11	16	11	**74**
	5 to 15 km	0	0	0	1	0	0	0	0	0	1	**2**
	>15 km	0	0	1	0	0	0	0	0	0	0	**1**
Toowoomba	Aerodrome confines	0	1	3	6	4	3	5	13	7	7	**49**
	5 to 15 km	0	0	0	0	0	0	0	0	1	0	**1**
	>15 km	0	0	1	0	0	0	0	0	0	0	**1**
Wagga Wagga	Aerodrome confines	11	14	13	20	16	28	9	20	19	17	**167**
	5 to 15 km	0	0	0	0	1	1	0	0	1	0	**3**
	>15 km	0	0	0	1	0	0	0	1	1	0	**3**

Continued

Airport	Aerodrome proximity	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Whyalla	Aerodrome confines	3	2	0	5	3	8	4	4	4	6	**39**
	5 to 15 km	1	0	0	0	0	0	0	0	0	0	**1**
Williamtown	Aerodrome confines	15	20	17	24	14	14	22	20	17	7	**170**
	5 to 15 km	5	0	1	1	1	1	1	2	1	2	**15**
	>15 km	0	1	0	0	0	0	3	1	0	0	**5**
	Unknown	0	0	0	0	1	0	0	1	1	1	**4**
Wynyard	Aerodrome confines	4	6	7	5	11	4	8	14	8	7	**74**

Table 36: Number of damaging (serious and minor) birdstrikes at aerodromes, departing and on approach (including those further than 15 kilometres from an aerodrome) by operation type, 2006 to 2015

Airport	Operation Type	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Adelaide	High capacity air transport	1	1	1	4	1	1	2	0	1	0
	Low capacity air transport	1	0	0	2	0	1	0	0	0	0
Albury	Low capacity air transport	1	2	1	1	0	0	0	0	0	1
Alice Springs	High capacity air transport	0	0	0	0	0	0	1	0	0	0
	Low capacity air transport	1	0	0	0	1	0	0	0	0	0
	General Aviation	0	1	0	0	0	1	0	0	0	1
Amberley	High capacity air transport	0	0	0	0	0	0	0	1	0	0
	Military	0	0	0	1	2	4	1	0	0	0
Archerfield	Low capacity air transport	1	0	0	0	0	0	0	0	0	0
	General Aviation	2	1	1	5	0	3	0	1	2	1
Avalon	High capacity air transport	0	0	0	2	0	1	0	0	0	0
	General Aviation	1	0	0	0	0	0	0	0	0	0
Ballina / Byron Gateway	High capacity air transport	0	0	1	0	0	0	0	0	0	0
	Low capacity air transport	0	0	1	0	1	0	0	0	1	1
Bankstown	Low capacity air transport	1	0	0	0	0	1	1	1	0	0
	General Aviation	0	0	1	2	1	3	1	1	0	1
	Military	0	0	1	0	0	0	0	0	0	0
Brisbane	High capacity air transport	2	4	3	4	4	8	4	7	5	4
	Low capacity air transport	0	0	1	0	0	0	0	0	2	0
	General Aviation	0	0	0	0	0	1	0	1	0	0
	Military	0	1	0	0	0	0	0	0	0	0
Broome	High capacity air transport	0	0	1	0	0	0	3	2	2	0
	Low capacity air transport	1	0	0	1	0	1	0	1	1	0

Continued

Airport	Operation Type	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Cairns	High capacity air transport	1	6	2	3	1	1	1	4	4	6
	Low capacity air transport	0	0	0	1	2	0	1	0	1	2
	General Aviation	1	0	1	0	0	2	0	2	0	1
Camden	General Aviation	0	0	1	0	0	0	0	0	0	0
Canberra	High capacity air transport	4	2	3	3	0	2	2	0	0	0
	Low capacity air transport	1	0	0	0	0	0	0	0	0	0
	General Aviation	2	0	0	0	0	0	0	0	1	0
	Unknown	0	0	0	0	1	0	0	0	0	0
Ceduna	Low capacity air transport	0	0	0	1	0	0	0	0	0	0
Coffs Harbour	High capacity air transport	0	0	0	0	0	0	1	0	1	0
	Low capacity air transport	0	0	0	0	1	0	0	0	0	0
Darwin	High capacity air transport	1	0	3	4	1	0	3	4	4	0
	Low capacity air transport	1	1	2	2	1	1	3	5	4	1
	General Aviation	0	0	0	1	0	1	0	1	1	1
	Military	1	1	0	0	0	1	0	0	0	0
	Unknown	0	0	0	0	2	0	0	0	0	0
Dubbo	High capacity air transport	0	0	1	0	0	0	0	0	0	0
	Low capacity air transport	3	1	2	0	0	1	0	1	0	0
	General Aviation	0	0	1	0	1	0	0	0	0	0
Emerald	High capacity air transport	1	1	0	0	1	1	1	0	0	0
	General Aviation	0	0	0	0	0	1	0	0	0	0
Essendon	Low capacity air transport	3	0	0	1	0	0	0	0	1	0
	General Aviation	0	0	2	0	0	0	0	2	1	0
Gold Coast	High capacity air transport	0	2	2	0	2	1	1	3	2	1
	General Aviation	1	0	0	0	0	0	0	1	0	1
Hamilton Island	High capacity air transport	0	0	0	1	0	1	0	0	0	0
Hobart	High capacity air transport	0	2	0	1	0	0	0	0	1	0

Continued

Airport	Operation Type	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Jandakot	General Aviation	0	0	2	1	0	1	0	0	0	0
Karratha	High capacity air transport	0	0	0	0	0	0	1	0	0	0
King Island	Low capacity air transport	0	0	0	1	0	1	1	0	0	0
Kowanyama	Low capacity air transport	2	1	2	2	0	1	0	1	0	0
Kununurra	High capacity air transport	0	0	1	0	1	0	1	0	0	0
	Low capacity air transport	0	1	1	0	0	0	1	0	1	0
	Unknown	0	0	0	0	1	0	0	0	0	0
Launceston	High capacity air transport	0	1	2	0	0	1	0	0	0	0
	General Aviation	0	0	1	0	0	0	0	0	0	0
Lismore	High capacity air transport	0	1	0	0	0	0	0	0	0	0
	Low capacity air transport	0	2	1	1	0	0	0	0	0	1
	General Aviation	0	0	1	0	0	0	0	1	0	0
Mackay	High capacity air transport	1	0	1	1	1	0	0	1	1	1
	Low capacity air transport	0	0	0	0	0	0	0	1	0	1
	General Aviation	0	0	1	0	0	0	0	0	1	0
Melbourne	High capacity air transport	4	1	3	2	5	3	1	2	2	2
	Low capacity air transport	0	0	0	1	1	0	0	0	0	0
Mildura	General Aviation	0	0	0	0	0	0	1	0	0	0
Moorabbin	Low capacity air transport	2	0	0	0	1	0	0	1	0	1
	General Aviation	0	2	0	4	1	0	1	1	1	4
Mount Isa	Low capacity air transport	2	0	0	0	0	0	0	0	1	0
	General Aviation	1	0	0	0	0	1	1	1	0	0
Other aerodromes	High capacity air transport	2	9	11	7	16	11	16	10	9	17
	Low capacity air transport	16	12	18	13	11	26	15	13	18	24
	General Aviation	9	15	13	23	21	24	21	28	19	25
	Military	0	1	1	4	5	3	4	7	7	3
	Unknown	0	0	0	0	2	2	2	1	0	2

Continued

Airport	Operation Type	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Parafield	General Aviation	2	2	4	1	4	4	2	0	0	2
Perth	High capacity air transport	3	2	0	1	3	4	2	1	2	0
	Low capacity air transport	0	0	0	0	0	0	1	0	0	0
	Unknown	0	0	0	0	0	1	0	0	0	0
Port Hedland	High capacity air transport	0	0	0	0	0	0	1	0	1	0
	Low capacity air transport	0	0	0	0	0	1	0	0	0	0
	General Aviation	0	0	0	1	0	0	0	0	0	0
Port Macquarie	High capacity air transport	0	0	0	0	1	0	0	0	2	0
	Low capacity air transport	1	0	0	0	0	0	0	0	0	0
	General Aviation	3	0	0	0	0	1	3	1	0	0
	Unknown	0	0	0	0	0	0	0	1	0	0
Proserpine / Whitsunday Coast	High capacity air transport	0	0	0	0	1	0	0	0	0	0
	General Aviation	0	0	0	1	0	0	0	0	0	0
Rockhampton	High capacity air transport	2	1	0	2	1	3	1	0	0	1
	Low capacity air transport	0	0	0	1	0	0	1	0	0	0
	General Aviation	0	0	0	2	1	0	1	2	1	2
	Military	0	0	0	0	0	0	1	1	0	0
	Unknown	0	0	0	0	2	0	0	0	0	0
Sunshine Coast	High capacity air transport	0	0	0	1	1	0	0	0	0	0
	General Aviation	2	0	0	0	0	0	0	0	3	0
Sydney	High capacity air transport	6	5	2	3	3	6	6	3	4	5
	Low capacity air transport	0	1	0	1	0	2	1	1	0	0
	General Aviation	0	0	0	0	0	0	1	0	1	0
Tamworth	High capacity air transport	1	0	0	0	0	1	0	0	0	1
	General Aviation	0	0	1	1	0	0	0	1	0	0

Continued

Airport	Operation Type	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Tindal	Low capacity air transport	0	0	0	1	0	0	0	0	0	0
	Military	0	1	0	1	1	0	1	0	0	1
	Unknown	0	0	0	0	0	0	1	0	0	0
Townsville	High capacity air transport	4	2	2	1	4	3	3	4	0	3
	Low capacity air transport	0	0	0	0	0	2	0	0	0	1
	General Aviation	0	1	0	1	1	1	1	2	0	0
	Military	0	0	0	0	0	1	1	0	1	0
Wagga Wagga	High capacity air transport	0	0	0	0	0	0	1	0	0	1
	Low capacity air transport	0	0	0	0	1	0	0	1	0	0
	General Aviation	0	0	0	0	1	0	0	0	0	2
Williamtown	High capacity air transport	1	1	1	1	2	0	0	0	0	0
	Low capacity air transport	0	1	1	0	1	1	1	1	0	0
	General Aviation	0	1	1	0	1	0	0	0	1	0
	Military	0	1	0	1	1	1	2	0	1	0
Wynyard	Low capacity air transport	0	1	0	1	1	0	1	3	0	0
	General Aviation	2	0	0	0	0	0	0	1	0	0

Table 37: Number of damaging (serious and minor damage) birdstrikes by bird type, operation type, and location (including those greater than 15 kilometres from an aerodrome), 2006 to 2015

Airport	Bird type	High capacity air transport	Low capacity air transport	General Aviation	Military	Unknown
Adelaide	Duck	0	1	0	0	0
	Galah	5	1	0	0	0
	Magpie	1	1	0	0	0
	Magpie-lark	1	0	0	0	0
	Silver Gull	0	1	1	0	0
Albury	Dove	0	1	0	0	0
	Duck	1	0	0	0	0
	Galah	0	1	0	0	0
	Hawk	0	1	0	0	0
	Lapwing/Plover	0	1	0	0	0
	Magpie-lark	0	1	0	0	0
Alice Springs	Falcon	0	1	0	0	0
	Kite	1	1	0	0	0
	Nankeen Kestrel	1	0	0	0	0
Archerfield	Bat/Flying Fox	0	1	3	0	0
	Crow/Raven	0	0	1	0	0
	Duck	0	0	1	0	0
	Ibis	0	0	1	0	0
	Magpie	0	0	1	0	0
	Magpie-lark	0	0	1	0	0
	Thrush	0	0	1	0	0
Avalon	Lapwing/Plover	1	0	0	0	0
	Magpie	1	0	0	0	0
Ballina / Byron Gateway	Bat/Flying Fox	1	0	0	0	0
	Duck	0	1	0	0	0
	Ibis	0	1	0	0	0
Bankstown	Bat/Flying Fox	0	1	3	0	0
	Dove	0	0	1	0	0
	Duck	0	0	0	1	0
	Ibis	0	0	1	0	0
	Magpie	0	0	2	0	0
	Owl	0	1	0	0	0
	Pelican	0	0	1	0	0

Continued

Airport	Bird type	High capacity air transport	Low capacity air transport	General Aviation	Military	Unknown
Brisbane	Bat/Flying Fox	5	0	0	0	0
	Hawk	1	0	0	0	0
	Heron/Egret	2	1	0	0	0
	House Sparrow	1	0	0	0	0
	Ibis	6	0	0	0	0
	Kite	0	0	1	0	0
	Lapwing/Plover	1	0	0	0	0
	Pelican	0	0	0	1	0
Broome	Eagle	0	1	0	0	0
	Kite	1	1	0	0	0
	Lapwing/Plover	1	0	0	0	0
	Pipit	2	0	0	0	0
	Silver Gull	0	1	0	0	0
Cairns	Bat/Flying Fox	5	3	2	0	0
	Duck	0	0	1	0	0
	Eagle	0	1	0	0	0
	Kite	3	0	0	0	0
	Nankeen Kestrel	1	0	0	0	0
	Parrot	1	0	0	0	0
	Swallow/Martin	1	0	0	0	0
Canberra	Bat/Flying Fox	1	0	0	0	0
	Crow/Raven	1	0	0	0	0
	Duck	4	0	0	0	0
	Galah	4	0	0	0	0
	Magpie	1	0	0	0	0
	Nankeen Kestrel	1	0	0	0	0
Ceduna	Cockatoo	0	1	0	0	0
Coffs Harbour	Bat/Flying Fox	1	0	0	0	0
	Duck	0	1	0	0	0

Continued

Airport	Bird type	High capacity air transport	Low capacity air transport	General Aviation	Military	Unknown
Darwin	Bat/Flying Fox	1	0	0	0	0
	Curlew/Sandpiper	3	2	0	0	0
	Duck	1	1	0	0	0
	Eagle	0	0	0	0	1
	Hawk	1	0	0	0	0
	Kite	6	8	1	1	0
	Owl	0	1	0	0	0
	Parrot	0	1	0	0	0
	Pratincole	1	0	1	1	0
Dubbo	Cockatoo	1	0	0	0	0
	Galah	0	2	2	0	0
	Kite	0	3	0	0	0
	Lapwing/Plover	0	1	0	0	0
	Magpie	0	1	0	0	0
Emerald	Bustard	0	0	1	0	0
	Hawk	1	0	0	0	0
	House Sparrow	1	0	0	0	0
	Kite	2	0	0	0	0
Essendon	Dove	0	1	0	0	0
	Duck	0	2	0	0	0
	Silver Gull	0	1	1	0	0
Gold Coast	Bat/Flying Fox	3	0	1	0	0
	Duck	3	0	0	0	0
	Eagle	0	0	1	0	0
Hamilton Island	Crow/Raven	1	0	0	0	0
	Curlew/Sandpiper	1	0	0	0	0
Hobart	Lapwing/Plover	1	0	0	0	0
	Pacific Gull	0	1	0	0	0
Jandakot	Eagle	0	0	4	0	0
	Pelican	0	0	1	0	0
Karratha	Eagle	1	0	0	0	0
King Island	Lapwing/Plover	0	3	0	0	0

Continued

Airport	Bird type	High capacity air transport	Low capacity air transport	General Aviation	Military	Unknown
Kowanyama	Galah	0	3	0	0	0
	Heron/Egret	0	1	0	0	0
	Kite	0	3	0	0	0
Kununurra	Eagle	0	1	0	0	0
	Hawk	1	0	0	0	0
	Kite	0	1	0	0	1
	Pratincole	1	0	0	0	0
Launceston	Duck	0	0	1	0	0
	Lapwing/Plover	1	0	0	0	0
	Nankeen Kestrel	1	0	0	0	0
	Swan	1	0	0	0	0
Lismore	Bat/Flying Fox	0	2	1	0	0
	Crow/Raven	0	1	0	0	0
	Duck	1	0	0	0	0
	Kite	0	0	1	0	0
	Lapwing/Plover	0	1	0	0	0
Mackay	Bat/Flying Fox	1	0	0	0	0
	Curlew/Sandpiper	1	0	0	0	0
	Hawk	1	0	0	0	0
	House Sparrow	1	0	0	0	0
	Parrot	0	1	0	0	0
Melbourne	Bat/Flying Fox	4	0	0	0	0
	Crow/Raven	1	0	0	0	0
	Falcon	1	0	0	0	0
	Ibis	0	1	0	0	0
	Magpie	4	1	0	0	0
	Owl	3	0	0	0	0
	Parrot	1	0	0	0	0
	Thrush	1	0	0	0	0
Mildura	Hawk	1	0	0	0	0
	House Sparrow	0	0	1	0	0
Moorabbin	Crow/Raven	0	0	1	0	0
	Duck	0	0	1	0	0
	Ibis	0	1	1	0	0
	Silver Gull	0	2	5	0	0

Continued

Airport	Bird type	High capacity air transport	Low capacity air transport	General Aviation	Military	Unknown
Mount Isa	Bat/Flying Fox	0	0	1	0	0
	Dove	0	1	0	0	0
	Hawk	0	0	1	0	0
	Kite	0	1	1	0	0
Parafield	Dove	0	0	2	0	0
	Galah	0	0	4	0	0
	Magpie	0	0	5	0	0
	Magpie-lark	0	0	2	0	0
	Pelican	0	0	3	0	0
Perth	Duck	1	0	0	0	0
	Falcon	0	0	0	0	1
	Galah	6	0	0	0	0
	Nankeen Kestrel	1	1	0	0	0
Port Hedland	Bat/Flying Fox	0	0	1	0	0
	Kite	1	1	0	0	0
Port Macquarie	Bat/Flying Fox	1	0	3	0	0
	Hawk	0	0	1	0	0
	Ibis	0	0	1	0	0
	Lapwing/Plover	0	0	1	0	0
	Swift	0	0	1	0	0
Proserpine / Whitsunday Coast	Curlew/Sandpiper	1	0	0	0	0
	Lapwing/Plover	0	0	1	0	0
Rockhampton	Bat/Flying Fox	1	1	1	0	0
	Hawk	1	0	0	0	0
	Kite	0	0	1	0	1
	Lapwing/Plover	1	0	0	0	0
	Magpie	0	0	1	0	0
	Owl	1	0	0	0	0
	Parrot	1	0	0	0	0
	Pelican	0	1	0	0	0
	Wedge-tailed Eagle	0	0	1	0	0
Sunshine Coast	Bat/Flying Fox	1	0	0	0	0
	Duck	0	0	1	0	0

Continued

Airport	Bird type	High capacity air transport	Low capacity air transport	General Aviation	Military	Unknown
Sydney	Bat/Flying Fox	8	1	0	0	0
	Cockatoo	1	0	0	0	0
	Cormorant	0	1	0	0	0
	Eagle	0	1	0	0	0
	Hawk	1	0	0	0	0
	Ibis	1	0	0	0	0
	Pelican	1	1	1	0	0
	Silver Gull	7	0	0	0	0
Tamworth	Galah	0	0	1	0	0
	House Sparrow	1	0	0	0	0
	Ibis	0	1	1	0	0
	Kite	0	0	1	0	0
	Magpie	0	0	1	0	0
	Magpie-lark	1	0	1	0	0
Tindal	Bat/Flying Fox	0	1	0	0	0
	Eagle	0	0	0	1	0
Townsville	Bat/Flying Fox	4	0	0	1	0
	Bustard	1	0	1	0	0
	Curlew/Sandpiper	3	1	0	0	0
	Dove	1	0	0	0	0
	Duck	2	0	1	0	0
	Heron/Egret	3	0	0	0	0
	Ibis	0	0	0	1	0
	Kite	2	0	1	0	0
	Lapwing/Plover	1	0	0	0	0
	Magpie	1	0	0	0	0
	Magpie Goose	1	1	1	0	0
Wagga Wagga	Galah	1	3	1	0	0
Williamtown	Bat/Flying Fox	2	0	1	0	0
	Duck	0	1	0	0	0
Wynyard	Duck	0	0	1	0	0
	Lapwing/Plover	0	5	1	0	0
	Silver Gull	0	2	0	0	0

Table 38: Number of reported birdstrikes by bird type by state, 2006 to 2015

Bird type	ACT	NSW	NT	QLD	SA	TAS	VIC	WA	Other	Total
Bat/Flying Fox	5	322	71	537	8	0	39	34	0	**1016**
Kite	0	81	277	426	9	0	29	108	0	**930**
Lapwing/Plover	14	174	107	176	58	142	45	149	0	**865**
Galah	110	308	27	132	130	2	44	73	0	**826**
Swallow/Martin	11	120	40	328	38	18	25	68	2	**650**
Nankeen Kestrel	15	105	32	219	54	1	11	126	18	**581**
Magpie	32	135	3	87	113	4	110	29	0	**513**
Magpie-lark	1	50	25	121	129	3	10	30	0	**369**
Hawk	7	76	16	108	21	10	13	65	1	**317**
Pipit	12	79	11	43	0	25	58	43	0	**271**
Silver Gull	1	66	1	13	42	29	58	42	4	**256**
Curlew/Sandpiper	0	3	95	122	1	1	0	11	3	**236**
Duck	22	44	4	82	2	6	13	54	3	**230**
Dove	0	39	15	60	64	1	25	20	3	**227**
Pratincole	0	0	143	24	0	0	0	20	0	**187**
House Sparrow	2	30	5	72	11	14	30	16	0	**180**
Heron/Egret	0	25	6	115	2	0	5	8	10	**171**
Owl	0	25	10	39	7	0	16	44	1	**142**
Ibis	2	32	4	78	4	0	12	5	0	**137**
Parrot	0	9	21	35	11	0	1	26	0	**103**
Crow/Raven	6	12	7	37	10	7	14	8	0	**101**
Finch	0	5	19	18	1	22	4	22	2	**93**
Eagle	0	13	8	32	1	3	6	24	0	**87**
Swift	0	15	0	61	0	0	0	3	1	**80**
Falcon	0	11	17	14	2	1	12	19	0	**76**
Starling	1	15	1	9	12	17	14	3	1	**73**
Cockatoo	3	20	10	8	3	0	2	20	0	**66**
Tern	0	15	3	16	0	0	2	28	0	**64**
Skylark	0	1	0	2	8	27	17	0	0	**55**
Australian Brush-turkey	0	0	5	12	0	0	0	17	0	**34**

Continued

Bird type	ACT	NSW	NT	QLD	SA	TAS	VIC	WA	Other	Total
Bustard	0	0	5	15	0	0	0	10	0	**30**
Cormorant	0	13	0	6	3	1	2	0	0	**25**
Wedge-tailed Eagle	0	9	1	6	2	0	1	6	0	**25**
Pacific Gull	0	2	0	0	0	10	11	0	0	**23**
Pelican	0	8	0	9	3	0	2	0	0	**22**
Hen	0	2	0	9	1	9	0	0	0	**21**
Magpie Goose	0	0	4	13	2	0	0	1	0	**20**
Wagtail	0	4	4	5	3	0	0	3	0	**19**
Kingfisher/Kookaburra	0	7	2	4	0	0	0	1	0	**14**
Wader	0	1	1	6	0	0	0	5	0	**13**
Myna	0	2	0	3	0	0	2	5	0	**12**
Frigate	0	0	1	5	0	0	0	0	4	**10**
Swan	2	2	0	0	0	2	2	0	0	**8**
Robin	0	0	0	0	0	1	0	5	0	**6**
Thrush	0	0	1	2	0	0	1	1	0	**5**
Oystercatcher	0	1	0	0	0	2	0	0	2	**5**
Honeyeater/Chat	0	1	0	0	1	0	1	2	0	**5**
Darter	0	5	0	0	0	0	0	0	0	**5**
Wren	0	0	0	3	0	0	2	0	0	**5**
Chicken	0	0	0	0	0	0	0	2	2	**4**
n/a	0	1	1	0	0	0	0	1	1	**4**
Rail	0	0	0	1	0	0	1	1	0	**3**
Cuckoo	0	0	0	1	1	1	0	0	0	**3**
Bee-eater	0	1	0	1	0	0	0	1	0	**3**
Sanderling	0	0	2	0	0	0	0	0	0	**2**
Ruddy Turnstone	0	1	0	0	0	0	0	0	0	**1**
Spangled drongo	0	0	0	1	0	0	0	0	0	**1**
Spinifex bird	0	0	0	0	0	0	0	1	0	**1**
Spinifexbird	0	0	0	0	0	0	0	1	0	**1**
Unknown	0	0	0	0	0	0	0	0	1	**1**

Continued

Bird type	ACT	NSW	NT	QLD	SA	TAS	VIC	WA	Other	Total
Stork	0	0	0	1	0	0	0	0	0	**1**
Stubble Quail	0	0	0	0	1	0	0	0	0	**1**
Nil	0	0	0	0	0	0	0	1	0	**1**
Noddy	0	0	0	1	0	0	0	0	0	**1**
none	0	1	0	0	0	0	0	0	0	**1**
Quail	0	0	0	0	1	0	0	0	0	**1**
Bittern, brown	0	0	0	1	0	0	0	0	0	**1**
Black-necked stork	0	0	0	1	0	0	0	0	0	**1**
Booby	0	0	0	0	0	0	0	0	1	**1**
Australian Grebe	0	0	1	0	0	0	0	0	0	**1**
Australasian Fig Bird	0	0	0	1	0	0	0	0	0	**1**
Australasian Grebe	0	0	0	1	0	0	0	0	0	**1**
Coot	0	0	0	0	0	0	0	1	0	**1**
Leaf warbler	0	0	0	1	0	0	0	0	0	**1**
Eurasian Coot	0	1	0	0	0	0	0	0	0	**1**
Grey bunting	0	0	0	0	0	0	0	0	0	**0**

Table 39: Number of birdstrikes by bird type, ordered by average difference between 2006 to 2010 and 2011 to 2015

Bird type	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Bat/Flying Fox	57	74	73	115	134	109	110	117	124	154	**1067**
Swallow/Martin	40	52	38	54	66	77	76	58	93	99	**653**
Kite	79	72	62	81	99	96	102	155	99	89	**934**
Nankeen Kestrel	59	32	61	43	61	77	83	53	52	63	**584**
Swift	6	6	1	0	8	6	9	16	14	18	**84**
Duck	15	17	24	16	24	20	13	49	35	18	**231**
Magpie-lark	22	32	41	30	43	56	38	24	39	48	**373**
Pratincole	16	21	15	15	14	15	17	20	21	36	**190**
Other	0	0	0	1	1	1	4	4	13	7	**31**
Parrot	4	5	3	10	19	6	13	15	10	20	**105**
Ibis	11	11	9	13	13	18	18	17	14	13	**137**
Heron/Egret	9	17	17	20	12	23	22	18	21	13	**172**
Falcon	2	2	5	2	17	16	8	12	9	4	**77**
House Sparrow	12	10	29	13	17	17	19	19	21	25	**182**
Finch	10	8	4	11	6	10	17	9	12	7	**94**
Bustard	2	1	1	1	2	7	4	3	7	2	**30**
Pipit	19	23	36	17	34	31	18	35	38	22	**273**
Kingfisher/Kookaburra	2	0	0	0	0	7	1	0	1	4	**15**
Wagtail	1	1	1	1	1	3	2	0	7	3	**20**
Lapwing/Plover	89	74	84	107	77	100	91	93	71	85	**871**
Cockatoo	6	8	5	6	4	8	7	4	10	8	**66**
Cormorant	2	0	2	2	3	2	3	5	1	5	**25**
Owl	13	11	14	13	17	16	25	17	4	12	**142**
Pelican	1	3	1	1	2	2	4	2	2	4	**22**
Silver Gull	28	31	17	30	20	30	20	38	20	23	**257**
Tern	1	10	5	7	7	5	11	6	4	9	**65**
Oystercatcher	0	1	0	0	0	0	0	0	1	3	**5**
Honeyeater/Chat	0	0	0	0	1	3	0	0	0	1	**5**

Continued

Bird type	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Eagle	5	8	10	7	12	8	10	14	4	9	**87**
Frigate	1	0	1	1	1	2	1	1	0	2	**10**
Myna	1	1	2	0	1	1	0	3	2	1	**12**
Skylark	4	3	6	4	10	8	3	5	4	9	**56**
Bee-eater	1	0	0	0	0	0	0	2	0	0	**3**
Thrush	2	0	0	0	0	1	0	1	1	0	**5**
Wren	0	1	0	0	1	2	1	0	0	0	**5**
Pacific Gull	1	0	4	4	2	1	5	0	4	2	**23**
Swan	1	2	0	1	0	1	1	1	1	0	**8**
Darter	0	0	2	1	0	1	0	0	0	1	**5**
Cuckoo	1	1	0	0	0	0	0	1	0	0	**3**
Rail	0	1	1	0	0	0	0	0	0	1	**3**
Wedge-tailed Eagle	2	1	3	2	5	4	2	3	0	3	**25**
Wader	0	3	1	1	3	3	0	1	0	2	**14**
Robin	2	3	0	0	0	0	0	1	0	0	**6**
Starling	10	6	9	6	8	3	8	6	7	10	**73**
Dove	21	24	24	23	26	30	21	25	15	22	**231**
Hen	2	6	0	2	3	2	0	2	1	3	**21**
Magpie Goose	0	3	0	5	5	5	0	0	1	1	**20**
Crow/Raven	13	11	7	18	6	5	9	9	11	12	**101**
Australian Brush-turkey	6	8	2	3	3	5	3	2	2	0	**34**
Curlew/Sandpiper	29	29	18	21	29	21	19	22	33	18	**239**
Magpie	45	40	46	57	75	62	46	41	33	68	**513**
Hawk	39	35	23	32	37	23	42	33	25	29	**318**
Galah	84	90	88	67	98	104	64	80	87	67	**829**

Table 40: Number of birdstrikes by bird size and state, 2006 to 2015

State	Bird size	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
ACT	Large	0	0	1	0	0	0	0	0	0	0
	Medium	10	24	32	30	19	18	17	31	9	9
	Small	4	3	6	3	5	1	6	3	4	16
	Unknown	5	6	9	4	6	5	11	12	8	8
NSW	Large	11	8	2	10	11	7	15	17	10	20
	Medium	95	87	115	140	153	146	118	161	118	128
	Small	43	46	44	60	49	56	68	71	77	99
	Unknown	58	74	61	46	47	88	91	83	93	109
NT	Large	1	5	2	4	1	6	26	15	19	10
	Medium	41	51	60	44	44	70	65	64	38	108
	Small	55	69	38	58	49	53	54	55	50	61
	Unknown	22	31	12	9	18	33	38	32	38	33
QLD	Large	17	21	21	24	22	27	30	47	26	31
	Medium	137	159	175	179	181	172	236	204	180	180
	Small	117	121	113	122	146	123	180	176	176	214
	Unknown	97	145	87	87	105	149	144	134	134	188
SA	Large	1	2	2	1	0	1	3	2	2	1
	Medium	71	66	61	59	59	74	61	66	49	34
	Small	21	13	16	15	20	22	34	51	30	20
	Unknown	14	38	19	17	15	39	26	43	29	35
TAS	Large	1	1	0	1	2	1	2	0	0	3
	Medium	13	29	12	31	26	30	28	21	21	22
	Small	9	12	18	22	17	16	17	10	16	16
	Unknown	4	12	11	8	11	4	8	5	6	8

Continued

State	Bird size	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
VIC	very large	1	3	0	0	2	2	1	1	1	1
	large	4	1	0	2	1	1	2	2	1	0
	medium	65	32	35	52	61	37	44	31	42	40
	small	19	4	26	17	35	14	16	14	15	15
	unknown	37	41	56	63	57	53	55	60	73	79
WA	very large	3	2	4	4	4	3	6	4	7	1
	large	2	3	3	3	4	2	4	1	2	1
	medium	78	74	57	79	72	102	130	104	103	69
	small	15	16	18	16	16	19	35	21	33	36
	other	0	0	0	0	0	1	1	0	3	2
	unknown	61	43	42	54	56	83	80	68	101	79
Other	large	0	0	1	0	0	2	1	0	0	0
	medium	1	3	5	7	6	1	5	2	3	9
	small	0	1	0	1	0	1	1	2	0	3
	other	0	0	0	0	0	0	2	1	2	0
	unknown	2	0	3	1	3	3	3	4	13	13

Table 41: Number of birdstrikes by bird type and hour of day (where time is known), 2006 to 2015

Hour of day	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Bat/Flying Fox	38	9	4	6	22	42	33	29	19	22	15	8	10	6	5	3	0	22	171	222	159	79	41	41
Kite	17	2	1	0	2	7	48	133	132	133	92	69	50	36	38	42	37	32	10	6	2	3	2	1
Lapwing/Plover	30	11	12	5	12	15	35	43	65	65	54	32	36	33	23	43	44	22	34	53	73	50	22	21
Galah	12	4	3	2	0	1	49	86	125	93	62	21	25	16	25	40	67	72	40	36	24	3	2	0
Swallow/Martin	13	10	1	0	0	3	23	68	81	70	101	55	47	32	33	24	34	19	9	4	4	2	5	2
Nankeen Kestrel	13	3	3	1	1	4	21	37	77	58	64	36	35	34	37	36	33	31	25	6	5	1	0	1
Magpie	12	3	1	1	0	2	22	44	55	53	53	34	30	26	25	32	22	42	9	14	9	5	3	1
Magpie-lark	7	3	1	1	1	2	12	41	66	45	32	16	26	15	10	15	26	23	9	0	5	3	2	1
Hawk	1	1	0	0	1	1	20	26	43	39	26	28	16	10	17	15	17	18	15	7	1	1	2	1
Pipit	8	2	0	0	2	4	11	16	30	31	24	25	24	20	13	9	13	3	8	5	2	1	3	2
Silver Gull	4	2	2	0	2	1	11	31	33	20	20	16	11	12	11	19	11	14	4	10	6	3	3	2
Curlew/Sandpiper	15	6	5	5	10	14	6	7	6	9	4	6	5	3	3	2	6	3	13	32	28	21	10	8
Dove	9	0	1	2	2	0	2	11	32	28	19	10	13	14	12	18	9	18	8	6	1	2	0	2
Duck	12	4	3	0	4	2	9	17	14	6	5	5	5	1	5	10	7	6	25	17	37	16	10	4
Pratincole	11	3	3	2	1	4	9	10	18	14	16	13	8	6	8	10	11	7	6	11	10	1	0	0
House Sparrow	3	2	0	0	1	1	8	19	24	25	14	9	9	11	10	9	15	8	1	2	0	2	2	0
Heron/Egret	3	0	1	2	0	1	8	6	14	18	20	11	8	10	10	8	14	6	6	6	14	3	2	0
Owl	13	9	1	1	0	3	0	4	4	2	1	1	0	0	1	0	0	3	5	32	23	14	7	7
Ibis	2	0	1	0	2	1	7	9	12	12	20	15	12	7	4	2	6	8	8	1	2	3	1	0
Parrot	6	1	0	0	0	1	7	10	9	10	7	3	3	1	4	3	11	11	12	1	0	1	0	0
Crow/Raven	1	0	0	0	0	0	11	8	10	11	10	6	5	3	9	8	9	5	0	3	1	0	0	0
Finch	2	1	1	1	0	0	2	10	8	15	6	5	6	4	3	6	4	2	3	0	1	3	4	3
Eagle	1	1	0	0	0	0	2	2	11	5	14	4	7	7	8	7	6	3	2	1	0	0	0	1
Swift	1	0	0	0	0	1	15	18	24	5	6	1	0	2	3	3	1	2	1	1	0	0	0	0
Falcon	2	0	1	0	0	2	3	6	13	13	3	4	6	2	0	4	8	6	0	2	1	0	0	1
Starling	1	1	0	0	1	3	2	5	9	5	11	3	8	3	4	0	4	5	2	0	2	0	1	0
Cockatoo	1	0	0	0	0	0	2	7	8	7	2	1	1	3	1	4	8	3	6	5	1	3	0	1
Tern	3	0	0	0	0	0	2	6	5	4	5	4	2	7	6	6	5	5	2	0	1	1	0	1
Skylark	1	0	0	1	0	0	1	2	5	12	9	5	6	3	3	0	2	1	2	1	0	0	0	0
Australian Brush-turkey	2	1	0	0	0	0	2	3	6	4	1	3	0	0	2	0	2	4	2	0	0	0	1	0
Other	0	2	1	0	1	1	1	3	5	1	2	0	3	0	3	1	2	0	0	1	1	2	1	0
Bustard	0	1	0	0	0	0	4	7	2	2	0	0	0	0	1	4	1	1	4	1	2	0	0	0
Cormorant	0	0	0	0	0	1	3	2	4	2	0	1	2	1	1	3	1	0	1	0	1	0	1	0
Wedge-tailed Eagle	0	0	0	0	0	0	0	0	2	3	3	2	3	3	1	2	5	0	0	1	0	0	0	0
Pacific Gull	1	0	0	0	0	0	1	1	5	0	3	2	1	0	1	2	1	3	0	0	0	0	0	1
Pelican	0	0	0	0	0	0	0	1	0	2	3	3	1	2	2	1	0	0	4	2	0	1	0	0

Continued

Hour of day	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Hen	0	0	0	0	0	0	5	0	1	2	1	0	0	0	2	0	0	1	2	2	0	1	0	0
Magpie Goose	1	0	1	0	1	0	2	0	3	1	3	0	0	0	1	0	1	2	2	0	1	0	0	0
Wagtail	1	1	0	0	0	0	0	1	3	2	1	0	2	2	0	1	2	0	0	0	1	0	0	0
Kingfisher/Kookaburra	0	1	0	0	0	0	2	1	2	0	1	1	1	0	1	0	1	1	2	1	0	0	0	0
Wader	1	0	0	0	0	1	2	0	0	0	1	2	0	0	0	1	0	0	4	0	1	0	1	0
Myna	1	0	0	0	0	0	0	1	2	1	0	2	0	2	0	1	2	0	0	0	0	0	0	0
Frigate	0	0	0	0	0	0	1	0	0	1	0	1	1	0	1	0	1	1	1	1	0	0	0	1
Swan	0	0	1	0	0	0	1	1	1	0	0	0	1	1	0	0	0	1	0	0	1	0	0	0
Robin	1	0	0	0	0	0	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
Thrush	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0
Wren	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0
Darter	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	2	0	1	0	0	0	0
Oystercatcher	0	0	0	0	0	0	0	0	0	1	1	0	0	2	0	0	0	0	0	0	0	0	0	0
Honeyeater/Chat	0	0	0	0	0	0	0	0	2	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0
Cuckoo	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0
Bee-eater	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0
Rail	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0

Australian Transport Safety Bureau

The Australian Transport Safety Bureau (ATSB) is an independent Commonwealth Government statutory agency. The ATSB is governed by a Commission and is entirely separate from transport regulators, policy makers and service providers. The ATSB's function is to improve safety and public confidence in the aviation, marine and rail modes of transport through excellence in: independent investigation of transport accidents and other safety occurrences; safety data recording, analysis and research; fostering safety awareness, knowledge and action.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia that fall within Commonwealth jurisdiction, as well as participating in overseas investigations involving Australian registered aircraft and ships. A primary concern is the safety of commercial transport, with particular regard to operations involving the travelling public.

The ATSB performs its functions in accordance with the provisions of the *Transport Safety Investigation Act 2003* and Regulations and, where applicable, relevant international agreements.

Purpose of safety investigations

The object of a safety investigation is to identify and reduce safety-related risk. ATSB investigations determine and communicate the factors related to the transport safety matter being investigated.

It is not a function of the ATSB to apportion blame or determine liability. At the same time, an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner.

Developing safety action

Central to the ATSB's investigation of transport safety matters is the early identification of safety issues in the transport environment. The ATSB prefers to encourage the relevant organisation(s) to initiate proactive safety action that addresses safety issues. Nevertheless, the ATSB may use its power to make a formal safety recommendation either during or at the end of an investigation, depending on the level of risk associated with a safety issue and the extent of corrective action undertaken by the relevant organisation.

When safety recommendations are issued, they focus on clearly describing the safety issue of concern, rather than providing instructions or opinions on a preferred method of corrective action. As with equivalent overseas organisations, the ATSB has no power to enforce the implementation of its recommendations. It is a matter for the body to which an ATSB recommendation is directed to assess the costs and benefits of any particular means of addressing a safety issue.

When the ATSB issues a safety recommendation to a person, organisation or agency, they must provide a written response within 90 days. That response must indicate whether they accept the recommendation, any reasons for not accepting part or all of the recommendation, and details of any proposed safety action to give effect to the recommendation.

The ATSB can also issue safety advisory notices suggesting that an organisation or an industry sector consider a safety issue and take action where it believes it appropriate. There is no requirement for a formal response to an advisory notice, although the ATSB will publish any response it receives.

Australian Transport Safety Bureau

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Investigation

ATSB Transport Safety Report
Aviation Research Statistics

Australian Aviation wildlife strike statistics: 2006 to 2015

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