Routes followed by migrant birds in the area around Stockdill and Drake-Brockman Drives, Belconnen, ACT.



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Summary

The aim of this project was to assess the movement of migrant passerine birds in the Stockdill Drive and Drake-Brockman Drive area. 81 hours of watches for bird movements were done from nine vantage points around the area within the bounds of the two roads and the adjoining William Hovell Drive. The survey period was timed to fit with the expected main autumn migration period. The main findings were:

- Eight routes were identified as used by migrants moving across the survey area.
- Birds generally moved in a north-easterly direction.
- Birds crossed Pro Hart Avenue at five locations and Drake-Brockman Drive at seven locations.
- Individual and groups of trees were used as staging posts by birds prior to crossing gaps between patches of woodland and crossing roads.
- The mean gap size between trees where birds crossed paddocks was 109m, range 72 -127m.
- The mean gap size where birds crossed roads was 62m, range 33 - 101m.
- Birds crossed gaps of 399 and 499m when they flew over vineyards.
- Migrants flew at tree canopy height (10-30m) or above when moving across the survey area.
- 11,280 migrant birds were counted crossing the area, all counts were minimal for the area and season.
- 11,006 honeyeaters were counted, 98% of all migrants.
- 90% of all migrants (93% of honeyeaters) were Yellow-faced Honeyeaters *Caligavis chrysops*.
- 16 migrant species were recorded.
- There were five sightings of Scarlet Robins *Petroica boodang* (nine birds) using remnant woodland in and near paddocks. No Scarlet Robins were observed crossing Pro Hart Avenue or Drake-Brockman Drive, three birds were observed crossing William Hovell Drive.

The author acknowledges the Ngunnawal people who are the Traditional Custodians of this land on which this study was done and pays respect to the Elders of the Ngunnawal Nation both past and present.

Introduction

The main aim of this study was to assess the movement of migrant birds around Stockdill Drive and Drake-Brockman Drive, Belconnen, Australian Capital Territory (ACT). This was to provide an indication of which species move through the area and by what routes. Knowledge of these movements might then help guide decisions on conservation management for the protection of habitats used by passerines moving through the area when on migration.

A wide study area was selected to accommodate the movement of birds adjacent to the immediate area around the two roads. This wider area was bounded by Stockdill Drive to the west, Drake-Brockman Drive to the north, William Hovell Drive to the east, and to the south, the head of the large valley leading from Drake-Brockman Drive to the Molonglo River (Fig 1). The Molonglo River Reserve, a designated part of Canberra's National Capital Open Space System, runs across the bottom of this valley (ACT Government 2019). The Molonglo River Corridor is a recognised bird migration route (Lamm & Calaby 1950; Purchase 1985; Davey 1986; Wilson 1998; Taws 1999, 2004).

Topics that were of relevance to the overall assessment were; what bird species passed through the area, what routes the birds followed, where did they cross the roads, what habitat features were used by migrant birds, at what height did they fly when crossing the area, and how did their movement in the study area compare with the movements of migrants in the wider area.

The native habitat in the area is mostly remnant Yellow Box - Red Gum Woodland. Most of the mature trees are Yellow Box *Eucalyptus Melliodora* and Blakely's Red Gum *E. blakelyi*, which grow to 10-30m (Costermans 1981). Remnant patches and single specimens of these trees are a feature of the roadsides, driveways, paddocks, and around the edges of the vineyards that are now the main features of the study area. There is also a stand of dry sclerophyll forest at Lands End in the south-east of the study area. The dominant trees there are Red Stringybark *E. macrorhyncha* and Scribbly Gum *E. rossii*. Shrubs and non-local trees have been planted along the sides of Stockdill and Drake-Brockman Drives.

All migrant bird species observed moving through the study area were monitored. As in similar studies this was only a sample. It was not feasible to count all the birds that crossed the area. The study aimed to assess what migrant birds moved across the study area and how they used the available habitat features. Previous studies of migrant passerines in the ACT have shown that the most abundant species are honeyeaters, especially the Yellow-faced Honeyeater *Caligavis chrysops* and White-naped Honeyeater *Melithreptus lunatus* (Lamm & Calaby 1950; Davey 1986; Wilson 1998; Taws 1999, 2004).

The background to this survey and the methods used were similar to those used for the survey of migrant bird movements across Strathnairn and Stockdill Drive (Rae 2025a). These are repeated here for consistency and convenience. Some birds were observed moving from the Strathnairn area into the Stockdill and Drake-Brockman Drives survey area. Any birds observed doing so were counted in both studies. Elements of the discussion are also similar between the two studies and some points in the otherer study are repeated in this study.

Background

Honeyeater migration between the Brindabella ranges and lowlands in the ACT is well known. In April 1949, flocks of four and ten thousand per hour were first described moving northwards along and eastwards across the Murrumbidgee River near Uriarra Crossing, 4km from the current study area (Lamm & Calaby 1950). Wilson (1998) described large numbers of post breeding Yellow-faced Honeyeaters building up in the Brindabella forest in March 1963 prior to migrating in April. These birds followed the Molonglo River south before turning east, flying at tree-top height.

In autumn 1985 a honeyeater migration survey in the Molonglo River Corridor recorded 669 birds moving past Stockdill Drive on 28 April (Davey 1986). The migration on that day followed a north-east direction. The first survey day that year was 16 March and the last on 24 May. The first observation of honeyeater migration was on 23 March and the migration had virtually finished moving through by 5 May. Similar migration surveys have been repeated in 1997, 2003, and 2025 (Taws 1999, 2004; Davey 2025).

Despite banding over 6,000 of Yellow-faced Honeyeaters and over 2,000 White-naped Honeyeaters in the ACT, very little was learned about their migration routes after leaving the ACT (Purchase 1985). There appears to be a general migration to forests east of the dividing range. One migration route was followed from the ACT along the escarpment on the western shore of Lake George and other movements have been reported in the coastal forests of New South Wales (Taws 1999). There is a large-scale south to north migration along the eastern coast (Griffioen & Clarke 2002) and the numbers of Yellow-faced Honeyeaters there peak in autumn and spring (Wood 2008). Current citizen science online data show the seasonal shift in abundance from south to north along the east coast and the Great Divide (eBird).

When on migration, Yellow-faced Honeyeaters have been recorded collecting in a tall tree prior to crossing a gap in tree cover, until one led the way and then the whole flock flew to the tallest tree on the far side of the gap, 60m away (Horey 1979). The use of those trees was an example of connectivity conservation, where the gap between trees was small enough to allow birds to move across an area. Managing habitats to fit such a requirement is a recognised method of spatial planning of habitats that can help local bird movement, bird dispersal, nomadism, and migration. By maintaining patches of vegetation, including trees, close enough to one another, near continuous stands of vegetation can allow birds to move freely across the landscape. Connectivity tree watches have revealed that gap distance is the most important parameter for birds moving across partially cleared landscapes such as paddocks (Doerr *et al*. 2014).

The Scarlet Robin *Petroica boodang* was declared a vulnerable species in the ACT in 2015 (ACT Government 2016). It was expected to be observed on migration through the study area, because it has been reported moving across the adjacent properties of Ginninderry and Wagtail Park (Trevaskis Family) (Rae 2025b). The main habitats used by Scarlet Robins in the area are grassy woodland, Callitris forest, and paddock edge, all in open or no shrub cover and high proportions of bark/leaf litter ground cover. Scarlet Robins were observed moving across Stockdill Drive from the Ginninderry area to Wagtail Park in autumn in a north-easterly direction.

Methods

All passerine species observed moving across the study area were counted. As previous surveys of migrant passerines in the ACT area have concentrated on honeyeaters, especially the Yellow-faced Honeyeater (Lamm & Calaby 1950; Wilson 1998; Davey 1986, 2025; Taws 1999, 2004), this report has also focused on this species. The only species recorded in the survey that is listed as of vulnerable conservation status was the Scarlet Robin, therefore that is given separate consideration. All other recorded species are listed in the results and given general consideration.

The methods used were based on experience of other bird migration counts in the ACT (Davey 1986; Taws 1999, 2004). The autumn migration was used for the study because the birds are then in higher numbers and in larger flocks than in spring, and their movements are more obvious (Compston *et al*. 2001). The first survey watch was on 26 March 2025 and the last was on 08 May 2025. The watch periods were for one to four hours per session and they were done between 0700 and 1600 hrs. There were at total of 81 hours of watches, ranging 4-18 hours per vantage point (Table 1). Most watches 91% (74 hrs) were between 08-1300 hrs, which has been described as the period of most activity and the period covered by other surveys (Davey 1986; Taws 2004), with peak movement between 1040-1100 hrs (Taws 2004).

Birds observed moving through the survey area were counted as accurately as possible.
Flocks of up to approximately 20 birds were counted, flocks of 20-100 birds were estimated to the nearest 10, and the numbers of birds in larger flocks were estimated to the nearest 50. Birds were identified to species except where there were flying flocks of mixed honeyeaters and the exact count of each species was not possible. Estimates were then made of the numbers of each species. The routes followed by migrant birds moving over the study area were mapped, the numbers of each species following each route were counted, the height they were flying was estimated relative to local tree height, and the times and dates recorded. When birds were near to roads it was noted whether they flew along or crossed them, and how they used nearby trees or shrubs. The points were mapped where birds crossed Stockdill and Drake-Brockman Drives and other crossings nearby on William Hovel Drive

Some birds that were observed in the study area were not seen to move other than within small patches of woodland, shrubbery or grassland. These birds were considered to be local residents and were not included in the counts of migrants.

Watches were made from a set of nine vantage points (VPs) (Figs. 2 -11). Figure 2 illustrates a circle with a 500m radius around each vantage point and figures 3 -11 show these zones for each individual vantage point together with the viewshed of each as generated in Google Earth. The true visibility from each vantage point was farther or closer than 500m in some directions and less than the illustrated viewshed, because the topography varied and trees obscured parts of the views.

Migrant birds were seldom observed flying along a whole route and the numbers of birds observed crossing roads, paddocks and vineyards was less than the total number of birds on any route. Where the birds were observed crossing these features and the trees they used was mapped on Google Earth. Then the distances of gaps between trees used by crossing birds were measured (Doerr *et al*. 2014).

The survey was done by one observer, the author. Only one vantage point was used at a time, and all birds passing the vantage point could not be counted if more than one flock of birds was moving at a time. Therefore, counts of birds from different vantage points cannot be truly compared with one

another. The numbers presented here are only indications of minimum numbers of birds that used each route.

Observations were done on sunny calm days after cool nights as most honeyeaters migrate through the ACT area under such conditions (Taws 1999, 2004). The weather was noted per hour with reference to data recorded at the same time by the Bureau of Metrology at Canberra Airport, 18 km from the study area.

Results

Routes followed by migrant birds

Migrants that moved across the study area flew along lines of trees, or they followed a general direction, moving from one paddock tree or group of trees to the next. This repetitive behaviour led to the birds staying within recognisable routes. They were observed to follow eight identifiable routes. The numbers of migrant birds observed following each route are given in Table 2. Most birds were observed on Routes 1 and 4. Route 1 led across the main valley eastwards towards Lands End, Route 4 led along Stockdill Drive north-eastwards towards Holt. Birds that followed Routes 2 and 3 were observed to enter a zone, a central node, which was dominated by a dense woodland, where they mostly were lost to view as they moved through the trees. The approximate area of that node is marked by a yellow circle in Figure 12. Routes 2 and 3 led into the node. Routes 5, 6, and 7 led out from that general area and were probably the exit routes of birds entering the survey area via routes 1, 2, and 3. But this was not proved as no birds were followed along any such continuous line.

The migration routes were not precise and the figures are only a guide. There were variations to these lines. Route 1 divided into two lines over Lands End. One subdivision went around the southern edge of the woodland and the other around the northern edge. Route 2 followed route one down the slope into the valley then turned up the valley. Route 4 was contained by roadside trees along Stockdill Drive, then birds took five different lines across Pro Hart Avenue. The migrants that followed route 5 went through or over a wide line of paddocks and open woodland. Birds on that route crossed Pro Hart Avenue at two places and Drake-Brockman Drive at one place. Route 6 was over a broad area of paddocks with many trees and wooded edges. The migrants there followed lines of trees or paddock trees and crossed Drake-Brockman Drive at three places. Route 7 led to the junction of Drake-Brockman and William Hovell Drives, and birds that followed that line crossed at one place on each road. Route 8 was likely a continuation of the northern subdivision of route 1. Although the line is not recorded as continuous because part of the route was not visible from any vantage point. Birds on route 8 took two lines when leaving the Lands End wood, and birds crossed William Hovell Drive at two places.

Yellow-faced Honeyeaters, the most numerous migrant, were observed flying at tree-top height c 15-30m when moving across paddocks or tree lines. Approximately 20% of the birds that followed Route 1 were observed flying high, above the power transmission cable (*approx. 55m high*). They were observed until lost to sight on the south-western slopes of Lands End, flying at a lower height just above paddock trees. Other birds that flew eastwards in that line into the valley at tree-top height and were last observed on the eastern side of the creek line moving through and above the paddock trees, leading towards the Lands End woodland.

Migrant birds were observed entering the survey area from the south-west. They approached along Stockdill Drive or crossed that road from Ginninderry. Birds that entered the survey area via the Stockdill Drive route moved through or over trees and shrubbery on both sides of the road. Some continued along Route 4 as far as the Stockdill and Drake-Brockman Drives junction. Others moved into the survey area at Vantage Point 1. Birds that entered from Ginninderry followed dense woodland and sparse paddock trees, then crossed Stockdill Drive from west to east at either Vantage Point 1or 2. No birds were observed entering the survey area from the creek line leading from the Molonglo River up to the node area. The lower part of that valley was not visible from any vantage point. No birds were observed entering the survey area from the east or north.

The roadside trees and shrubs along Stockdill Drive were mostly lower than 10m and some birds used them for brief perches as they moved along the roadside. Some of the birds that crossed from Ginninderry also used these trees to perch on prior to crossing the road from west to east, others flew across without halting. The exact numbers of birds that used perches prior to crossing the road could not be accurately counted because of the rolling movement of the birds in flocks.

Crossing points

Migrant birds were observed crossing roads, gaps between trees in paddocks, and flying over vineyards. One flock of Yellow-faced Honeyeaters flew along Stockdill Drive and crossed Pro Hart Avenue obliquely at crossing 1. All other crossings were direct from one side of a road to the other (Fig. 13). Birds were only observed landing in trees on the far side of a road at crossings 1, 2 and 3 on Pro Hart Avenue. Most birds did not land in trees or other vegetation immediately after crossing a road. They generally continued in their flight over roadside trees, shrubs, adjacent suburban gardens, a golf course (Burns Golf Club) or The Pinnacle Nature Reserve. Most observations of moving birds near the roads were along route 1 where they crossed Pro Hart Avenue at five locations (Figs. 14-18). They crossed Drake-Brockman Drive at seven locations (Figs. 19-25) and William Hovell Drive at four locations (Figs. 26-29). Birds were observed perching in particular trees prior to crossing these roads (Fig. 30). The birds would typically stop flying when approaching the roads and land in treetops. Once they had gathered into groups, they flew across the roads. When migrating birds flew across gaps between paddock trees, they would sometimes leave one tree and land in another. Other birds continued flying. The trees that birds were observed using when making these crossings over paddocks are indicated in figures 30-39.

The widths of the gaps between trees and other roadside vegetation or suburban edge where the birds flew across roads were significantly shorter than the width of the gaps where birds flew between paddock trees (ANOVA: $F = 21.9$, $P < 0.001$, $n = 15, 6$). The mean distance where migrants crossed roads was 62m, range 33-101m, and the mean distance between paddock trees where they crossed was 109m, range 72-127m (Table 3). Migrants flew across gaps of 399 and 499m between trees when they flew over vineyards, and 1300m when they crossed high over the valley from vantage point 1 to Lands End.

Most birds observed flying over roads did so at tree canopy height and above utility cables alongside the roads, approximately between 10 and 30m. Some birds in two flocks of Yellow-faced Honeyeaters were observed flying lower than canopy height where they left a tree downhill from the road (crossing 6): nine from a flock of 160, and four from a flock of 70. These birds still flew higher than the tallest vehicles on the road. No birds were observed flying at the height where they would be vulnerable to road traffic.

Numbers of birds counted

The first migrants were observed on 26 March 2025 and the highest count of all migrants in a day was 2461birds on the same day. The second highest count was on 10 April 2025. The most abundant species was Yellow-faced Honeyeater and 2400 were counted that day. The last migrants were observed on 08 May (App.).

The total number of all birds observed moving across the survey area was 11280 (Table 4), of which 11006 were honeyeaters (97.6%). Yellow-faced Honeyeaters were the most frequent migrant, 10197, 90.4% of all birds, and 92.7% of all honeyeaters. Other honeyeaters were Red Wattlebird *Anthochaera carunculata*, 586 (5.3%), White-eared Honeyeater *Nesoptilotis leucotis*, 123 (1.1%), White-naped Honeyeater *Melithreptus lunatus,* 91 (0.8%), Brown-headed Honeyeater *Melithreptus brevirostris,* 8 (0.1%), and one Eastern Spinebill *Acanthorhynchus tenuirostris*.

Scarlet Robin

There were five sightings of Scarlet Robins in the survey. The birds were all in or on the edge of remnant woodland or paddocks with scattered remnant trees of the native woodland, where they were foraging on the ground on open areas with few or no shrubs.

One sighting was of a male and female foraging in a paddock east of Pegasus on 25 April. Another male and female were observed foraging on the edge of the Lands End woodland adjacent to the cemetery on 8 May. No Scarlet Robins were subsequently seen at these sites and it is likely that they moved, although it is not known what route they might have taken.

There were three observations of Scarlet Robins moving through the study area. Two males were observed crossing William Hovell Drive from the cemetery on 13 April. They crossed in the proximity of the routes 15 and 16 followed by other migrants. A single male was observed crossing the road by a similar route on 8 May, and a male and female were observed moving north along the edge of paddocks adjacent to the Lands End cemetery on 8 May. The distances that the Scarlet Robins flew when they crossed William Hovell Drive were 63 and 52m.

Discussion

Migrant passerines were confirmed to cross Pro Hart Avenue, Drake-Brockman Drive and William Hovell Drive after moving through the area south of and within the bounds of these roads. The main land use in the area is paddock or vineyard, and the birds moved between small patches of woodland, paddock trees, and tree lines when they crossed the area. The distribution of these habitat features led the migrant birds along distinct routes across the area. The migrants entered the study area from the southwest, along Stockdill Drive or from the remnant woodland and paddocks on the adjacent Ginninderry land. The overall direction of movement was north-east. When the migrants left the survey area, they crossed all three roads at points where the birds could perch on trees prior to moving across the roads.

In previous studies of migrating honeyeaters crossing the Molonglo River Corridor, the birds generally moved in an easterly direction, varying from north-east to south-east (Davey 1986; Taws 1999, 2004). The nearest of those survey points to the current study area is at Uriarra Crossing,

southwest of the current study area, where honeyeaters have been recorded moving north past Uriarra Crossing then east (Taylor 1987; Wilson 1998; Taws 1999). This would be a likely route by which migrating birds approach the current study area. It is likely that the birds involved breed in the Brindabella Range to the west (Wilson 1998) or farther afield (Taws 2004).

The two routes that most migrants followed, along Stockdill Drive and across Lands End, aligned with records of honeyeaters that crossed Stockdill and William Hovell Drives in 1985 (Davey 1986). These historical records of migrants moving over these places support the current findings migrants follow these routes.

Few honeyeaters were observed passing through the northern suburbs of Belconnen in 1985 (Davey 1986). In the current study, honeyeaters were observed to cross Stockdill and Drake-Brockman Drives and continue to fly over these suburbs. It might be that the gardens and trees in those suburbs are now mature and the honeyeaters are more attracted to cross over these suburbs. In 1985, migrant honeyeaters moved along the southern edge of the nearby Belconnen suburbs in an easterly direction, following the ridge towards Black Mountain (Davey 1986). The migrants observed exiting the current study area by crossing William Hovel Drive would fit this route. It is not known where migrant birds went after leaving the study area nor the honeyeaters that pass through the wider Molonglo River Corridor (Purchase 1985). Small numbers remain over winter in nearby suburbs and woodland (Taylor & Canberra Ornithologists Group 1992) It is likely that most Yellow-faced Honeyeaters continued in north-easterly direction, possibly as far as north-west New South Wales where they are known to be in high numbers during winter (Shi 2024; eBird).

The general direction followed by migrants moving through the Stockdill and Drake-Brockman Drive area was north-east. Most of the migrants were Yellow-faced Honeyeaters and they use the earth's magnetic field to aid their direction finding during migration movements (Munro & Munro 1998) with possible supplementary reference to the sun's position (Munro & Wiltschko 1993). The migrant birds in the current study were likely obligated to follow this direction and in doing so they likely followed the safest routes. As they are woodland birds, that would have likely followed the most continuous tree cover.

Individual and groups of trees were used as perches by migrants birds prior to crossing roads and gaps between patches of woodland. The widest road crossing was 62m and birds flew farther than the width of the roads as they typically continued flying after crossing the roads. When birds crossed paddocks, the widest gap they crossed between paddock trees was 127m. Some migrants flew as far as almost 500m when crossing vineyards, and 1300m when they flew over the valley. Therefore migrants could potentially cross roads with wider gaps between trees than they were observed to do when moving across roads.

Most migrants observed in this study were Yellow-faced Honeyeaters, and these have been previously described using the tops of trees to perch and gather prior to crossing gaps as in the current study (Horey 1979). Honeyeaters are nomadic foragers and nomadic foragers have been found to mostly move across gaps <400m (Doerr *et al*. 2014). Other migrant species that are woodland generalists mostly move across gaps <150m between connectivity trees, (Doerr *et al*. 2014). Therefore, for conservation of habitat use by woodland generalists, Doerr *et al.* (2014) recommended a maximum gap distance <150m between individual trees within gaps between patches of woodland, and distances of 1.3km between patches of woodland. If parameters on spacing of gaps between trees were to be set for woodland generalists, the needs of honeyeaters and similar migrant passerines would also be accommodated.

The numbers of birds that moved through the survey area varied between days. Daily and annual variations in numbers have been recorded for migrant honeyeaters moving through the Molonglo River Corridor in other surveys where they have been done on the same or similar dates in different years: 6, 12, 13, 19, 20 and 26, 27 April (Taws 1999, 2004, Davey 2025). The first and last dates when migrant birds were observed in the current study were similar to those on 23 March and 5 May 1985 (Davey 1986) and the highest daily counts were on 26 March and 10 April. Therefore it is likely that the main migration period of birds through the study area was covered by the current survey. However, the main movement in 2025 was likely earlier than the survey dates in the wider Molonglo River Corridor survey in 2025 when fewer birds were counted than in previous years (Davey 2025). It might be that migrant honeyeater movements are partially determined by local weather conditions (Taws 2004).

The Scarlet Robin was the only conservation listed species (Vulnerable) observed to move through the survey area. Scarlet Robins were observed foraging in woodland, under paddock trees, and along fence lines and tree-lined edges of paddocks. Although they foraged in a paddock adjacent to Drake-Brockman Drive none were observed crossing that road. The birds that were observed crossing out of the survey area did so over William Hovell Drive. Similar to all the other migrants observed, the robins followed a general north-easterly direction. Scarlet Robins are known to migrate between their breeding areas in the wooded hills of the Namadgi and Brindabella areas, and their wintering areas in lower parts of the ACT (Taylor & Canberra Ornithologists Group 1992; Bounds *et al*. 2010). The habitats used in the current study area are considered as corridors or stepping stones for Scarlet Robins when moving between larger stands of woodland when these birds are on migration.

Overall, conservation or enhancement of tree cover along the routes described in this study would likely benefit Yellow-faced Honeyeater migration across the Stockdill and Drake-Brockman Drives area and in consequence help to conserve them and the other migrant species that follow similar routes.

Limitations of the survey.

The results presented here are limited as they only present data from one migration season, autumn 2025. Surveys were not done on all days during the potential migration period and all routes were not surveyed on the same days. The total numbers of birds moving through the study area were not counted in this survey. Previous surveys of migrant birds in the Molonglo River Corridor have also been limited. As in the current study, the numbers of migrants recorded at other survey points have only been samples and they have varied between days and years (Davey 1986, 2025; Taws 1999, 2004). Therefore, comparative counts between surveys are of limited accuracy and have not been done in this study.

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Tables

Table 1. Numbers and times of watches per vantage point.

VP	The hours of watches									Total Hours
	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	
1		1	2	3	2					8
2	1	1	1	1	1	1				6
3		5	5	5	2	1				18
4		1	1	2	1	1				6
5					1	1		1	1	4
6		2	2	2	2	1	1			10
7		1	1	1		0.50	0.10			4
8		2	2	3	1.30	0.30				9
9		2	2	2	4	3	2	1		16
Total Hours	1	15	16	19	14.30	9.20	3.10	2	1	81

Table 2. The numbers of birds observed on each flight route migrant birds followed across the study area.

Route	Total number of birds per route	Total number of honeyeaters per route
1	3214	2811
2	1439	1399
3	1748	1680
4	2550	2427
5	1109	924
6	328	324
7	285	201
8	603	431

Table 3. Migrant crossings over roads, paddocks, vineyards and valley. The trees used are numbered T01-T26 and they are shown in the accompanying figures.

Crossing	Distance (m)	Trees used (number)	Figure	Notes
Pro Hart Avenue				
01	249	03 – 05	14	Birds flew along and across the road
02	41	04 – 05	15	Some birds landed in T05, others continued in same direction
03	41	06 – 07	16	Some birds landed in T05, others continued in same direction
04	101	08	17	Birds crossed road and continued over golf course
05	91	09	18	Birds crossed road and continued over golf course
Drake-Brockman Dr				
06	61	10	19	Birds crossed road and continued over suburbs
07	75	11	20	Birds crossed road and continued over suburbs
08	33	12	21	Birds crossed road and continued over suburbs
09	64	13	22	Birds crossed road and continued over suburbs
10	72	14	23	Birds crossed road and continued over suburbs
11	46	15	24	Birds crossed road and continued over suburbs
12	51	16	25	Birds crossed road and continued over suburbs
William Hovel Dr				
13	37	17	26	Birds crossed road and continued over suburbs
14	66	18	27	Birds crossed road and continued over suburbs
15	69	19	28	Birds crossed road and continued over suburbs
16	80	20	29	Birds crossed road and continued over suburbs
Paddocks				
17	124	06 – 08	31	Birds landed in T08 then continued on crossing 04
18	122	21 – 22	32	Birds landed in T22 then moved to T08 or T09 and crossed the road
19	118	23 – 12	33	Birds continued across road from T12

20	91	24 – 13	34	Birds continued across road from T13
21	127	25 – 14	35	Birds continued across road from T14
22	72	26 – 15	36	Birds continued across road from T15
Vineyard				
23	499	01	37	Birds flew to trees and landed
24	399	02	38	Birds flew to trees and landed
Across Valley				
25	1300	01	39	Birds flew high, above transmission cables, last seen still flying at point marked

Table 4. Bird species observed moving across the study area, listed by their common names in scientific order, the total number of each species recorded for all routes and their conservation status: LC = Least Concern, V = Vulnerable.

Species common name	Scientific name	Total Recorded	Conservation Status
Australian King-Parrot	*Alisterus scapularis*	10	LC
White-naped Honeyeater	*Melithreptus lunatus*	91	LC
Brown-headed Honeyeater	*Melithreptus brevirostris*	8	LC
White-eared Honeyeater	*Nesoptilotis leucotis*	123	LC
Eastern Spinebill	*Acanthorhynchus tenuirostris*	1	LC
Red Wattlebird	*Anthochaera carunculata*	586	LC
Yellow-faced Honeyeater	*Caligavis chrysops*	10197	LC
Spotted pardalote	*Pardalotus punctatus*	20	LC
Striated Pardalote	*Pardalotus striatus*	37	LC
Weebill	*Smicrornis brevirostris*	70	LC
Rufous Whistler	*Pachycephala rufiventris*	1	LC
Golden Whistler	*Pachycephala pectoralis*	1	LC
Pied Currawong	*Strepera graculina*	40	LC
Grey Fantail	*Rhipidura albiscapa*	10	LC
Scarlet Robin	*Petroica boodang*	5	V
Silvereye	*Zosterops lateralis*	80	LC

Figures

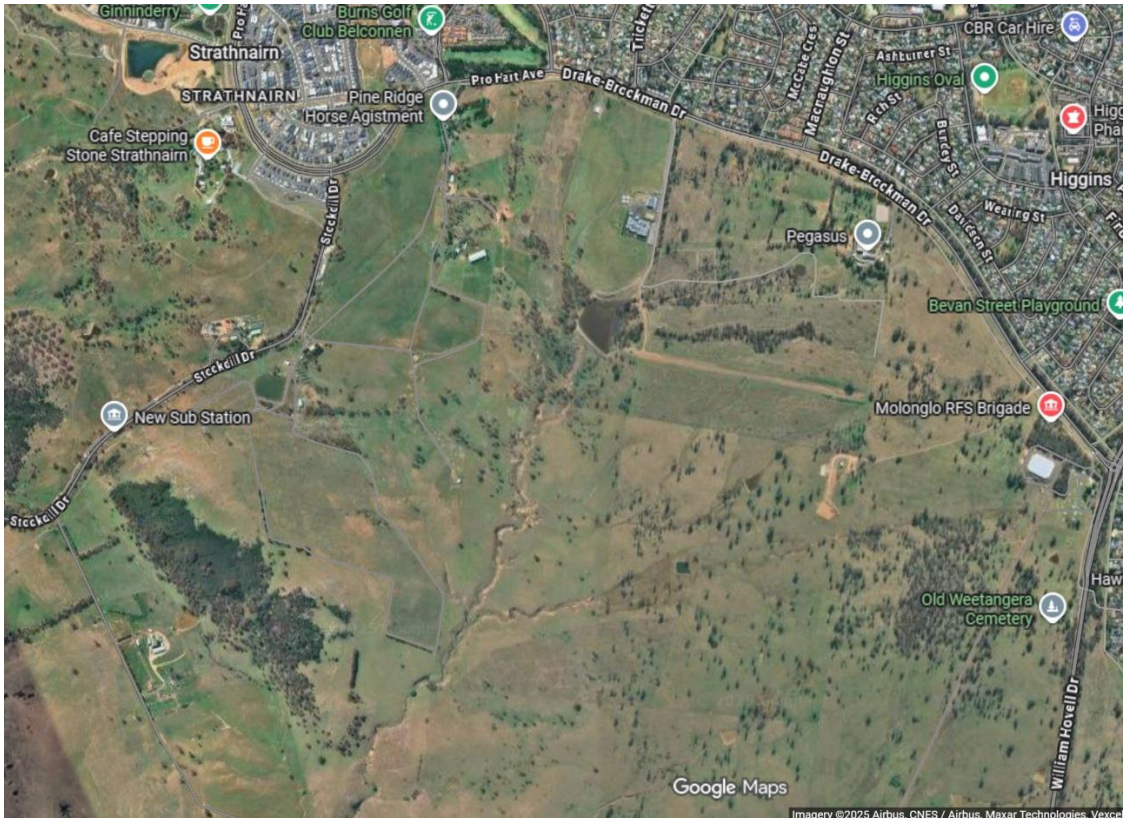


Figure 1. The study area. Stockdill Drive forms the western boundary, Drake-Brockman Drive the northern one and Willaim Hovell Drive the eastern one.



Figure 2. The locations of all the vantage points and circles with a 500m radius around each one.



Figure 3. The location of vantage point 1 showing a circle with a 500m radius and a viewshed from the point as generated in Google Earth.



Figure 4. The location of vantage point 2 showing a circle with a 500m radius and a viewshed from the point as generated in Google Earth.



Figure 5. The location of vantage point 3 showing a circle with a 500m radius and a viewshed from the point as generated in Google Earth.



Figure 6. The location of vantage point 4 showing a circle with a 500m radius and a viewshed from the point as generated in Google Earth.



Figure 7. The location of vantage point 5 showing a circle with a 500m radius and a viewshed from the point as generated in Google Earth.



Figure 8. The location of vantage point 6 showing a circle with a 500m radius and a viewshed from the point as generated in Google Earth.



Figure 9. The location of vantage point 7 showing a circle with a 500m radius and a viewshed from the point as generated in Google Earth.



Figure 10. The location of vantage point 8 showing a circle with a 500m radius and a viewshed from the point as generated in Google Earth.



Figure 11. The location of vantage point 9 showing a circle with a 500m radius and a viewshed from the point as generated in Google Earth.

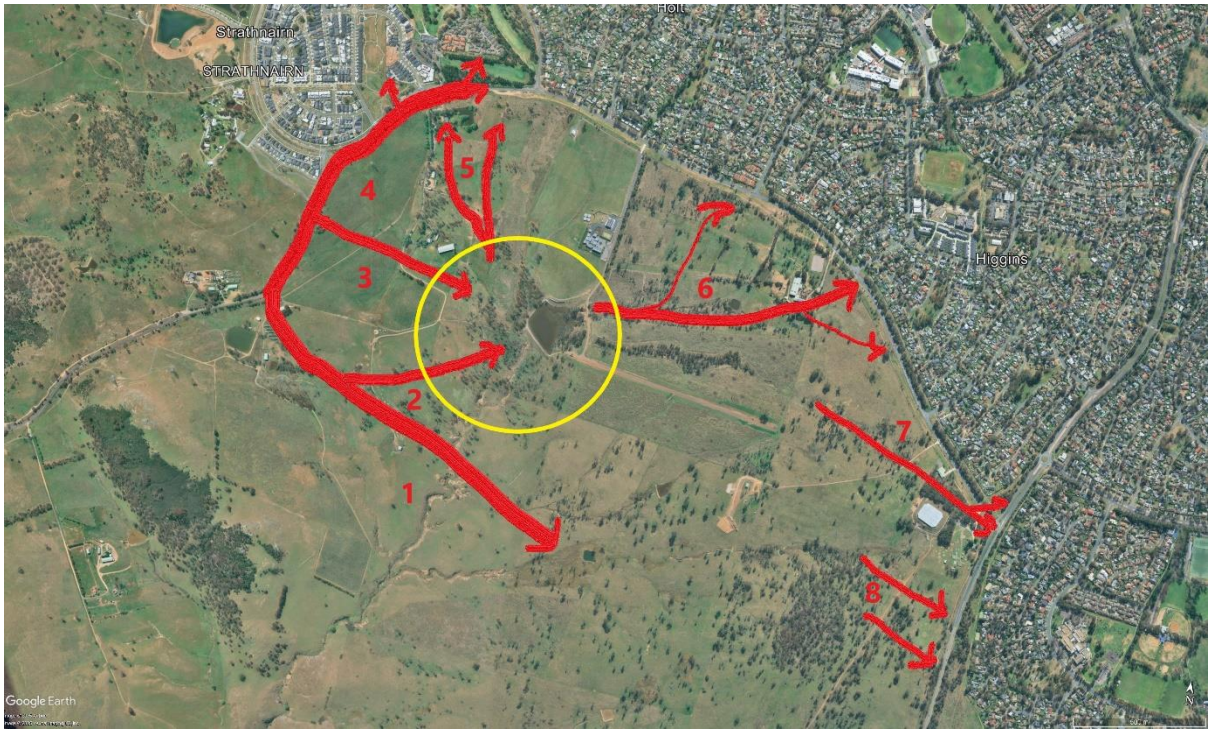


Figure 12. The routes (8) that migrant birds were observed to follow across the study area.



Figure 13. The crossing points (16) where migrant birds were observed to cross the boundary roads when moving out of the study area.



Figure 14. Crossing 1 flight line followed by migrant birds when moving across Pro Hart Avenue.



Figure 15. Crossing 2 flight line followed by migrant birds when moving across Pro-Hart Avenue.



Figure 16. Crossing 3 flight line followed by migrant birds when moving across Pro Hart Avenue.



Figure 17. Crossing 4 flight line followed by migrant birds when moving across Pro Hart Avenue.



Figure 18. Crossing 5 flight line followed by migrant birds when moving across Pro Hart Avenue.



Figure 19. Crossing 6 flight line followed by migrant birds when moving across Drake-Brockman Drive.



Figure 20. Crossing 7 flight line followed by migrant birds when moving across Drake-Brockman Drive.



Figure 21. Crossing 8 flight line followed by migrant birds when moving across Drake-Brockman Drive.



Figure 22. Crossing 9 flight line followed by migrant birds when moving across Drake-Brockman Drive.



Figure 23. Crossing 10 flight line followed by migrant birds when moving across Drake-Brockman Drive.



Figure 24. Crossing 11 flight line followed by migrant birds when moving across Drake-Brockman Drive.



Figure 25. Crossing 12 flight line followed by migrant birds when moving across Drake-Brockman Drive.



Figure 26. Crossing 13 flight line followed by migrant birds when moving across William Hovell Drive.



Figure 27. Crossing 14 flight line followed by migrant birds when moving across William Hovell Drive.



Figure 28. Crossing 15 flight line followed by migrant birds when moving across William Hovell Drive.



Figure 29. Crossing 16 flight line followed by migrant birds when moving across William Hovell Drive.



Figure 30. Tree used by migrant birds crossing the Stockdill and Drake-Brockman Drives area.

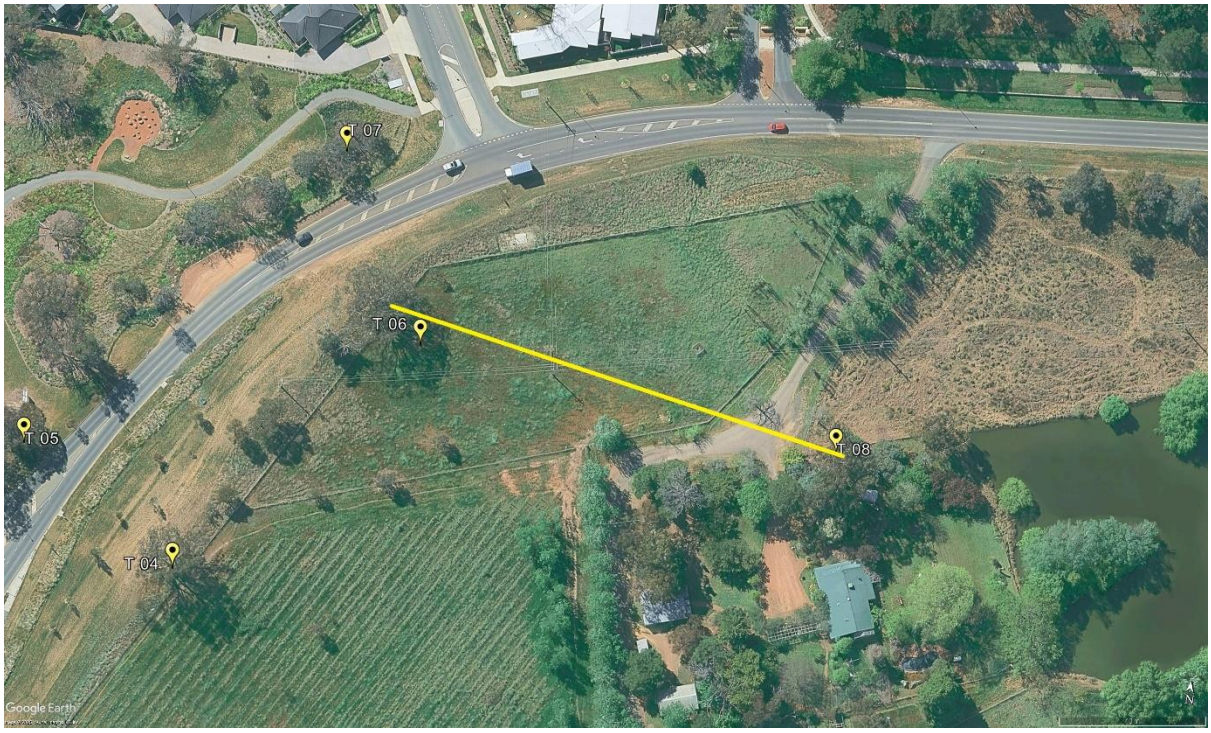


Figure 31. Route followed by migrant birds crossing a paddock between trees numbered T06 and T08.



Figure 32. Route followed by migrant birds crossing a paddock between trees numbered T21 and T22.



Figure 33. Route followed by migrant birds crossing a paddock between trees numbered T23 and T12.

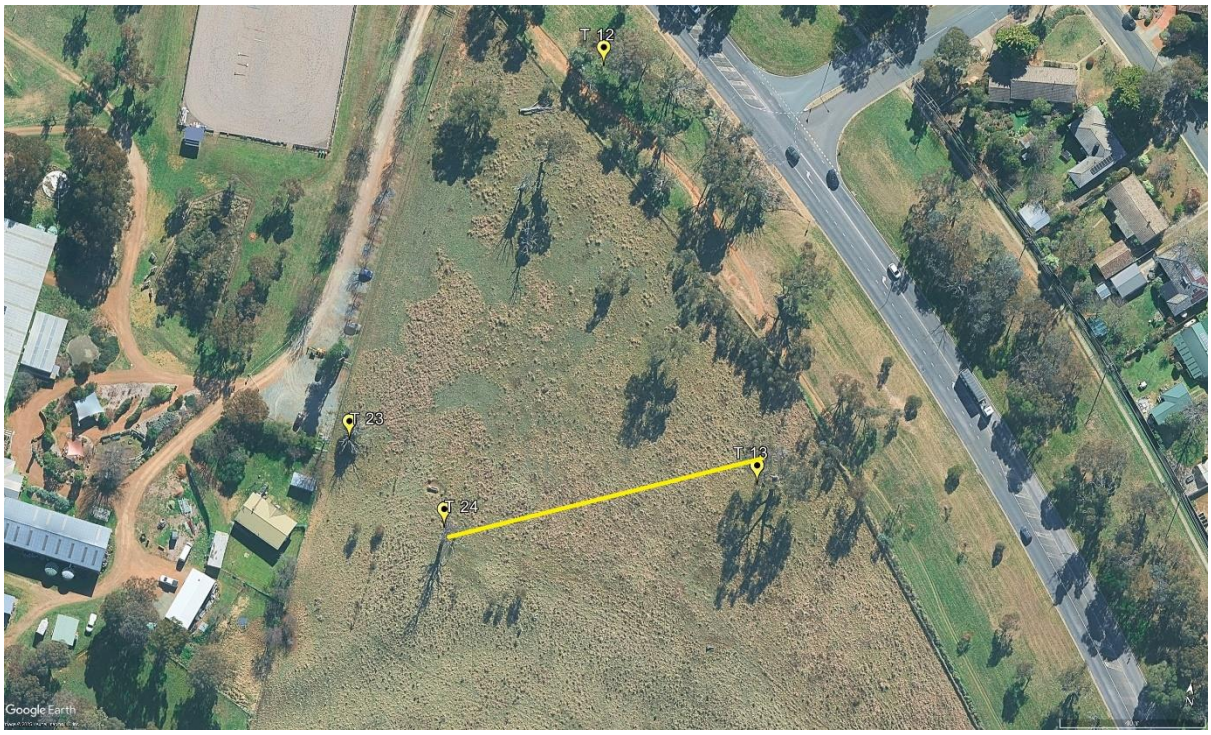


Figure 34. Route followed by migrant birds crossing a paddock between trees numbered T24 and T13.



Figure 35. Route followed by migrant birds crossing a paddock between trees numbered T25 and T14.



Figure 36. Route followed by migrant birds crossing a paddock between trees numbered T26 and T15.

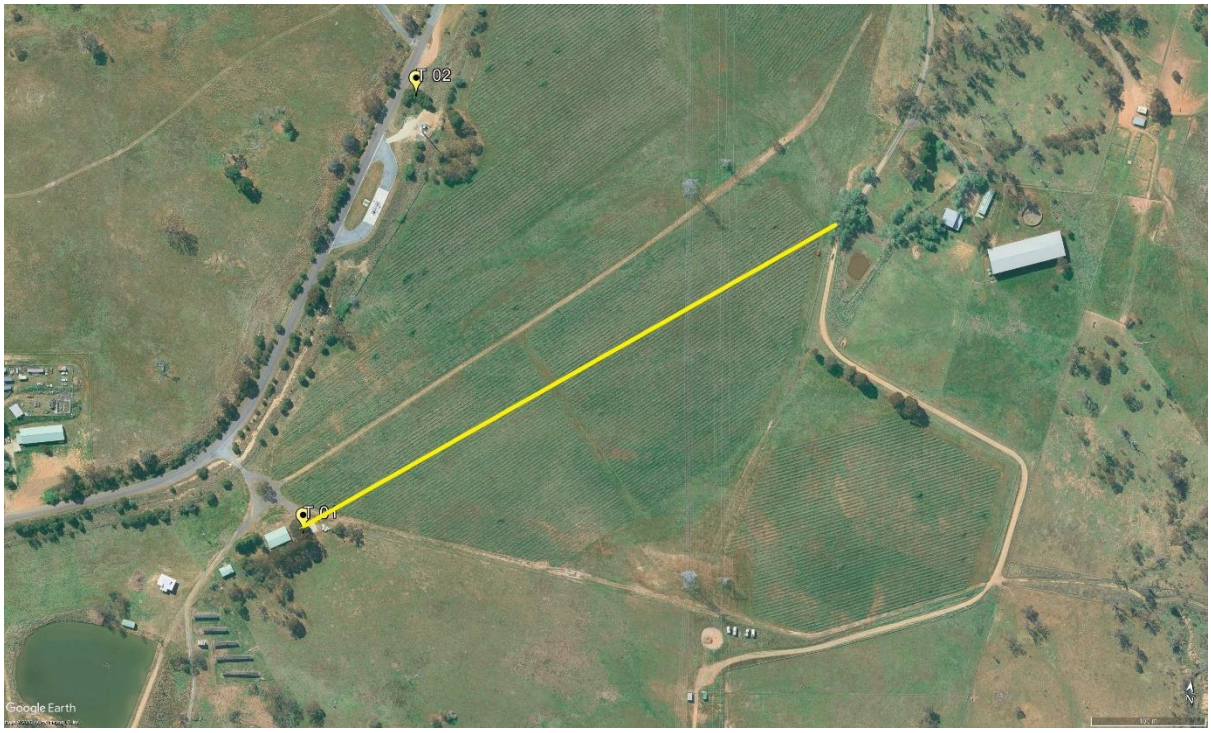


Figure 37. Route followed by migrant birds crossing a vineyard from tree number T01.



Figure 38. Route followed by migrant birds crossing a vineyard from tree number T01.



Figure 39. Route followed by migrant birds crossing the main valley from tree number T01.