

# The Kings Park Avifauna: keeping birds in the city

Harry F. Recher<sup>1</sup>

School of Natural Sciences, Edith Cowan University, Joondalup, W.A. 6027, Australia

<sup>1</sup>Current address: C/- P.O., Dangar Island, N.S.W. 2083, Australia

## ABSTRACT

Kings Park is a 400 ha reserve near the centre of the City of Perth, Western Australia. Two-hundred and sixty-seven hectares of the park remain as native vegetation and the park has a rich flora and fauna. Contributing importantly to the naturalness of Kings Park is its birdlife with more than 80 species having been recorded within the park's boundaries. Despite the large amount of native vegetation, Kings Park is not pristine and has been changed in many ways by human activities since the settlement of Perth by Europeans in 1829. These changes to the park, as well as changes to the urban matrix in which the park is found, coupled with regional changes outside the urban environment, have produced a dynamic and changing avifauna. Census data are available for a transect through Kings Park from 1928 to 2002. Between 1928 and 2002, 61 species of birds, excluding waterbirds, were recorded along the transect. Of these, 20 % increased in abundance and 40 % decreased with 10 species proceeding to local extinction. Since 1928, Kings Park and the urban landscape of Perth has been increasingly dominated by large nectar-feeding and seed-eating birds. Small insectivores, particularly ground and shrub foragers, have declined in abundance or become locally extinct. Despite the array of changes in the avifauna, the birds of Kings Park are as rich and probably as abundant as they were in 1928 when censuses commenced. The avifauna is just different. Keeping birds in Kings Park and the urban environment requires no special attention. However, if small birds and insectivores are desired, changes need to be made not only to the management of the park, but to the way vegetation in the urban matrix is managed. Foremost among the changes needed is the progressive replacement of exotic trees and shrubs along roads and in parks and gardens with indigenous species and the creation of complex foliage structures. This is necessary to foster an abundant arthropod fauna for insectivores to feed upon and to provide the kinds of habitats such birds require. Whether such changes are essential or even desirable depends on the reasons why people want birds about them in the city and suburbs. It may be that it is only important to have birds and not important as to which species are represented.

**Key words:** urban birds, wildlife, introduction, fire, longterm study, wildlife responsibility

## Introduction

Located in the heart of the city of Perth, Western Australia, Kings Park is an urban icon. Without Kings Park, Perth would not be Perth and the sense of living in a clean, green city would vanish.

Kings Park has had a long and chequered history. The land for the park was set aside in 1831 by the Western Australian Government for public purposes, declared a Public Park and Recreation Ground in 1871 and made a Class A [conservation] Reserve in 1901 (Anon. 1957). As an inner city urban park, Kings Park is special not only for its size, but because a large area of native vegetation or bushland has been retained within its boundaries. Of the park's 400 ha, 267 are 'bush'. This does not mean the park is pristine. Far from it. In the 1830s, the eucalypt timber for Western Australia's parliament being built adjacent to the reserve was cut and milled in Kings Park. For generations, locals gathered tinder and fuel from the park and added to its species diversity with myriad garden escapes. Of the park's 465 wild plant species (Kings Park is also home to the botanic gardens), 175 are naturalised exotics (Anon. 1957; Bennett 1984; Radho-Toly *et al.* 2001), many of which are trenchant and damaging weeds. Logging the park and removing the canopy of *Eucalyptus* allowed *Banksia* and *Allocasuarina* to dominate and prevent the recovery of native eucalypts (Beard 1967). Only in the last few decades are there signs that a eucalypt canopy may be restored, but it is by exotic eucalypts introduced to the park as ornamental plantings and which appear adept at out competing the pervasive banksias and casuarinas.

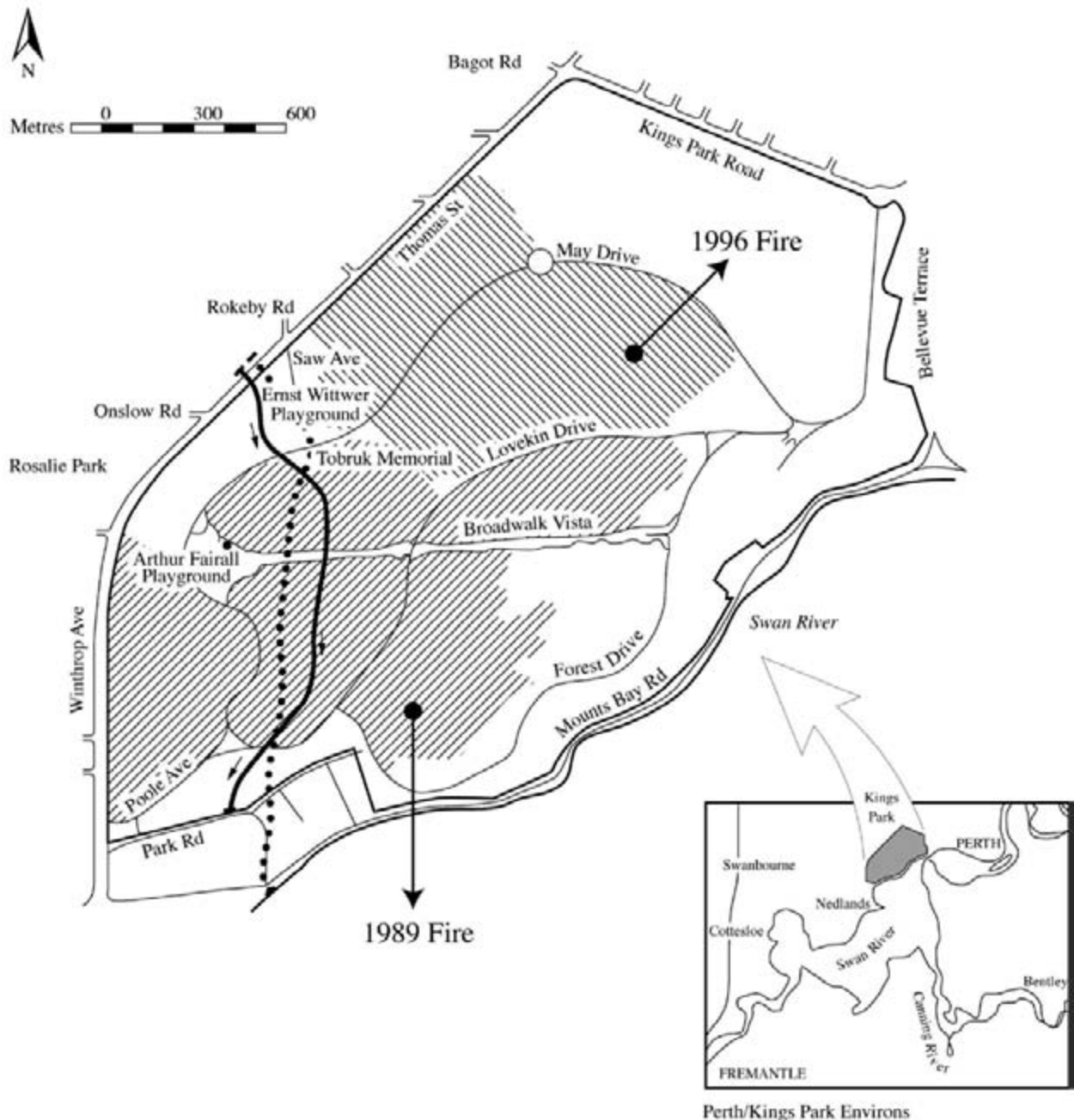
Despite 170 years of disturbance and change, Kings Park's open space and bushland are highly valued by West Australians. Both foster a feeling of naturalness which users of the park experience. Not least, the sound, movement and colour of birds are a part of the park's ambiance and do much to reinforce the sense of nature that one encounters whether walking or driving through this urban green space. It is not necessary for park visitors to be able to identify the birds around them; it is enough just to know that they are there. Ensuring that birds remain part of Kings Park is therefore as important as retaining its wildflowers and open spaces.

Ensuring that there are birds in an urban landscape is not difficult and may not require any special management. All cities, even the most densely populated, have birds, often in large numbers. However, most city birds are urban commensals, species that associate with humans and find an abundance of food and nesting sites wherever people aggregate. These birds, the pigeons, parrots and ravens of the inner city and suburbs, require little encouragement. What is difficult is creating or maintaining an environment within the urban landscape which attracts and retains species which are not human commensals and for which the urban environment is alien and inhospitable. Kings Park, despite its large size and bushland, exemplifies the problems encountered in retaining particular kinds of birds in the urban landscape.

Census data are available for birds along a transect in Kings Park from 1928 to 2002 (Serventy 1938; Recher and Serventy 1991; Recher 1997, unpubl.). The data show a dynamic avifauna with more than a third of the 61 terrestrial bird species recorded along the transect between 1928 and 2002 declining in frequency of occurrence since 1928. Ten of these no longer occur in the park or now

occur so infrequently that they can be considered 'locally extinct'. A third, including new colonizers, have increased, while a third, including transients and accidentals, show little or no change. The decline of most species has been attributed to the park's increasing isolation as Perth has grown, as well as to changes to the park's vegetation, changed fire regimes, nest predation, and weeds (Recher

### Kings Park and Botanic Gardens



**Figure 1.** Kings Park is a 400 ha reserve on the north bank of the Swan River immediately adjacent to the Central Business District of Perth, Western Australia. The solid line from Thomas St to Park Rd is the transect along which H. F. Recher counted birds from 1986 to 2002. The parallel dotted line is the approximate path of the transect counted by D. L. Serventy from 1928 to 1937, and from 1952 to 1955 (adapted from Recher and Serventy 1991).

Together fires in 1989 and 1996 burnt 73 % (195 of 267 ha) of the bushland east and south of Winthrop Avenue and Thomas Street to May Drive on the north and Forest Drive on the south. The 1989 fire included all the transect bar the Ernst Wittwer Playground and the section between Lovekin Drive and Park Road.

and Serventy 1991; Recher 1997). Changes to forest and woodland habitats outside the Perth region coupled with the loss of other urban bushland remnants are also factors bringing about change in the Kings Park avifauna (Recher and Serventy 1991; Recher 1997).

In this paper, I review the changes to the Kings Park avifauna since European settlement of the Swan River Colony (Western Australia) in 1829. In doing so, I consider the question 'what is it that decides whether a species adapts to urbanization or falters and declines to local extinction?' Changes before 1928 when Dom Serventy began his censuses of Kings Park birds are necessarily speculative, but assist in understanding the response of an indigenous Australian avifauna to urbanization and the kinds of management that may be required to attract and retain native birds in urban environments and remnant bushland. I include remnant bushland, because Kings Park is a model of what is happening to birds in bush remnants across Australia and foreshadows the changes we can expect even in large conservation reserves. In reviewing the response of birds to the urbanization of Perth, I also consider the benefits or amenity values of having birds in a city and ask if it matters what species occur in the city or is it just important to have birds.

## Methods

### Census procedures

I counted birds from 1986 through 2002 along a transect across Kings Park from the intersection of Saw Avenue and Thomas Street to Park Road near the intersection with Crawley Road (Figure 1). The transect follows established paths and is 1600 m in length (1480 m in a straight line). The route is approximately the same used by Serventy during his bird counts in Kings Park from 1928 to 1937, and from 1952 to 1955 (Serventy 1938; Recher and Serventy 1991) (Figure 1). The section of the transect (390 m in length) nearest Thomas Street traverses open parkland with scattered tall trees (10 - 25 m), palms and lawn (the Ernst Wittwer Playground and Tobruk Memorial). The remainder passes through bushland dominated by *Banksia menziesii*, *B. attenuata* and *Allocasuarina fraseriana* with taller marri *Eucalyptus calophylla*, jarrah *E. marginata* and a few tuart *E. gomphocephala*. Canopy height in the bush varies from 5 to 6 m to about 17 m. Under the taller trees there is an almost continuous and floristically diverse understorey from 0.5 to 2.5 m in height. The ground vegetation is also floristically diverse with numerous weeds, and tends to be continuous and dense throughout. There is a continuous and thick litter layer, and abundant dead wood and coarse woody debris on the ground. Standing dead trees and shrubs are common. At various places the bushland is crossed by roads and there is a wide (12 m) grass promenade (the Broadwalk Vista) which divides the transect (Figure 1). The Broadwalk was inflicted on the park in 1966 and, at the same time, an area of bush around the Tobruk Memorial was cleared (P. R. Wycherley pers. comm.). The road verges are planted with eucalypts, mainly sugar gum *E. cladocalyx* and southern mahogany *E. botryoides*, but also marri, in memory of Western Australia's fallen soldiers. These are quite tall (15-25 m) and provide a continuous and thick canopy of eucalypt foliage along roads.

Serventy recorded all species of land birds along the transect as he walked from Thomas Street to Park Road. He scored only the species present and did not record the number of individuals (Serventy 1938). Neither in his publications nor his field notes, which I discussed with him, did he describe his methods in greater detail. Because of poor health, he was unable to elaborate on his procedures in discussion. Thus, it is not known whether he recorded birds seen and heard, or seen only. In 1986, I counted birds along the transect using Serventy's procedure, but for some species (particularly the smaller insectivores), I also recorded the number of individuals. On all counts from 1986 through 2002, excluding waterbirds, I recorded all bird species seen or heard regardless of distance. I did not include birds flying overhead other than martins, swallows, swifts and bee-eaters foraging above the canopy. Birds seen, but not identified, were not recorded, but there were few of these.

Serventy's counts and mine in 1986 were done in most months, but fewer counts were done in summer than at other times (see Recher and Serventy 1991 for details). Between 1928 and 1986, the majority of counts were done in morning, usually before 11 AM, but a few were done later in the day, including late afternoon (Recher and Serventy 1991). Counts were restricted to fine conditions with light wind and no rain, although it could be cloudy.

I resumed counts along the transect in 1989 (Recher 1997). From January 1989 to December 1995, I counted birds along the transect whenever I visited Perth (see Recher 1997 for dates), but the procedure was changed from 1986. After 1986, I completed two censuses each morning birds were counted. After walking the transect and counting birds, I waited 10 - 15 min and repeated the census walking in the opposite direction. I alternated the end of the transect on which the first census of the morning was begun. Censuses always began 30 - 60 min after sunrise, with earlier starts in summer when it was hot, and later in winter when mornings were cold and birds less vocal at dawn. As on previous occasions, censuses were restricted to fine conditions. I was able to complete censuses a minimum of two mornings on each visit to Perth (i.e., four counts), although I attempted to conduct censuses on four mornings (eight counts), if time and weather permitted. After 1986, I recorded the number of individuals seen or heard for all species of land birds along the transect regardless of distance from the transect.

In 1996, I commenced a regime of counting birds four mornings each month, with two counts each morning as from 1989 to 1995. Censuses were conducted during the last fortnight of the month in fine weather with all individuals seen or heard recorded regardless of their distance from the transect. In practice, few birds, and then only the loudest species (e.g., Grey Butcherbird, Australian Magpie), were more than 50 m from the transect. This procedure was followed from February 1996 to October 1999, missing February 1999. Subsequently, a monthly census using the same procedures was completed in December 2000, January, August, September and December 2001, and from February 2002 to January 2003. Not all of these data are presented in this paper.

## Data analysis

For comparisons between my censuses and those of Serventy, frequency of occurrence data are used (see Serventy 1938; Recher and Serventy 1991; Recher 1997). That is, the abundance of a species was estimated by the frequency or percent of counts on which it was recorded. As a convention, I adopted a difference of 15 % in frequency of occurrence between Serventy's counts and mine as indicating a significant change in abundance. I retain this convention in this paper when making comparisons with Serventy's data or between my 1986 data and those collected from 1989 onwards. For the purposes of this paper, a species is judged to be extinct in Kings Park if at some time from 1928 to 1999 it was recorded on 5% or more of counts, but has either not been recorded since 1999 or could not be found in 2001 and 2002 despite intensive searching.

Decisions on changes in abundance are based on comparisons of censuses during the same season or month of the year. This is necessary as the number of individuals recorded during a count is a function of both numbers and detectability. It is now well-established that, even within a single vegetation type, detectability changes with weather conditions, time of day and time of year (Ralph and Scott 1981; Recher 1988).

For migrants, such as the Rainbow Bee-eater and Horsfield Bronze Cuckoo, frequency of occurrence was calculated for the number of months during the year the species was expected to occur in the Perth Region (see Recher and Serventy 1991). Scientific names of birds are given in Appendix A, which lists all species recorded on the transect from 1928 to November 2002. Species were assigned to foraging guilds using data on their foraging behaviour in Western Australia from Recher and Davis (1998, 2002, unpublished).

Other than using the 15 % criterion for frequency of occurrence, I make no effort to impart a statistical significance to any of the data and instead rely on trends and my familiarity with Western Australia's avifauna to decide which species have increased, decreased or remained unchanged in abundance.

## Results

### Bird species

Including waterbirds, more than 80 species of birds have been recorded in Kings Park (Serventy 1938; Anon. 1957; Recher and Serventy 1991; Recher 1997; McLean pers. comm.). From 1928 to November 2002, 61 species of land birds were recorded along the transect (Table 1; Appendix

**Table 1.** Frequency of occurrence of bird species along a transect in Kings Park, Perth, W.A. All species recorded during counts from 1928 to 2002 are listed, but frequency data for censuses after 1999 are not shown. The status of each species is shown as increasing (I), decreasing (D), unchanged (U) or locally extinct (E). Status is current for 2002 and is based on trends in abundance along the transect from 1928 to 2002.

Years of Census	1928-37*	1952-55*	1986	1996-99	Status
Australian Magpie	100	100	100	97	U
Western Spinebill	93	100	77	64	D
Red Wattlebird	90	100	100	99	U
Western Warbler	85	100	97	82	D***
Pallid Cuckoo	82	20	25	0	E
Grey Butcherbird	80	65	63	68	U
Laughing Kookaburra**	72	65	57	64	U
Weebill	70	100	83	98	I
Silvereye	65	87	91	91	I
Golden Bronze-cuckoo	58	30	15	5	D
Scarlet Robin	57	4	0	0	E
Yellow-rumped Thornbill	55	61	77	43	D***
Indian Turtle-dove**	53	57	0	33	D
Striated Pardalote	50	61	86	77	I
Grey Fantail	43	71	89	77	D***
Rainbow Bee-eater	41	0	40	10	U
Australian Raven	37	0	100	89	I
Western Yellow Robin	36	0	0	0	E
Senegal Dove**	30	9	3	25	U
Carnaby's Black Cockatoo	29	6	10	9	D
Golden Whistler	28	22	0	1	E

Years of Census	1928-37*	1952-55*	1986	1996-99	Status
Sacred Kingfisher	28	18	0	7	D
Tree Martin	27	9	0	5	D
Singing Honeyeater	20	0	74	96	I
Black-capped Sittella	18	4	29	4	D
Purple-crowned Lorikeet	18	0	0	0	E
Rufous Whistler	18	57	91	98	I
Whistling Kite	18	0	0	0	E
Broad-tailed Thornbill	17	26	11	2	E
Western Thornbill	12	70	20	0	E
Willie Wagtail	12	0	0	2	D
Brown Honeyeater	10	26	100	94	I
Port Lincoln Parrot	8	26	97	99	I
Dusky Woodswallow	5	0	0	0	E
Horsfield Bronze-cuckoo	5	0	0	5	U
Spotted Pardalote	5	17	0	10	U
Black-faced Cuckoo-shrike	3	13	14	19	I
Australian Goshawk	2	9	14	8	U
Boobook Owl	2	0	0	0	U
Black-shouldered Kite	0	0	0	0	U
Cockatiel	0	0	0	3	U
Collared Sparrow Hawk	0	0	0	3	U
Common Bronzewing Pigeon	0	0	0	17	I
European Goldfinch**	0	9	0	0	E
Fan-tailed Cuckoo	0	0	3	1	U
Fork-tailed Swift	0	0	0	1	U
Galah	0	0	0	59	I
Little Corella**	0	0	0	0	U
Little Eagle	0	0	0	0	U
Little Falcon	0	0	0	1	U
Little Wattlebird	0	0	0	5	U
Mistletoebird	0	4	0	0	U
Nankeen Kestrel	0	0	0	1	U
Magpie-lark	0	0	0	2	U
Rainbow Lorikeet**	0	0	37	99	I
Tawny Frogmouth	0	0	1	0	U
Welcome Swallow	0	0	43	15	D
White-cheeked Honeyeater	0	0	0	51	I
White-naped Honeyeater	0	0	0	0	U
Rock Dove**	0	0	0	0	U
White-winged Triller	0	0	0	0	U
<b>Number of species</b>	<b>39</b>	<b>31</b>	<b>30</b>	<b>44</b>	<b>61</b>
<b>Number of counts</b>	<b>48</b>	<b>23</b>	<b>36</b>	<b>288</b>	

\* tabulated from Dom Serventy's field books by H. F. Recher.

\*\* introduction to Perth

\*\*\* steep decline in numbers since 1999

A). Forty-one species were recorded by Serventy between 1928 and 1955, while I recorded 54 species from 1986 to 2002. Of these, 34 were reported by Serventy. That is, Serventy reported seven species which I have not recorded, and I have recorded 20 species not reported by Serventy. Forty-four species were recorded from February 1996 to January 1999 (Table 1). An additional seven species were recorded after March 1999; Black-shouldered Kite, Little Corella, Mistletoebird, Purple-crowned Lorikeet, Rock Dove, White-naped Honeyeater and White-winged Triller. None of these species was recorded between 1986 and 1995 and, apart from the Little Corella, was recorded on fewer than five counts since 1999. The Little Corella is a species increasing in abundance throughout Perth (pers obs). Only one species, the Pallid Cuckoo, was recorded in 1986, but not from 1996 to 1999. It was recorded again in 2002, but only on one count and I consider it locally extinct. Of the species I recorded for the first time after January 1999, the Purple-crowned Lorikeet and Mistletoebird were also recorded by Serventy (Table 1).

### **Frequency and abundance of the modern avifauna in Kings Park**

Seasonal and year-to-year species richness and total bird abundance along the transect changed little between 1996 and 1999 (Recher unpubl. data). Of the 44 species recorded from February 1996 to January 1999, 18 occurred on more than 50 % of counts, while another 18 were recorded on fewer than 10 % of counts (Table 1). Twenty-seven species were present on 9 % or more of counts. These were also the species with the greatest number of individuals along the transect (Recher unpubl. data).

A few species (e.g., Brown Honeyeater, Silvereye, Striated Pardalote) had seasonal patterns of abundance as individuals moved into and out of the park. The numbers of some species (e.g., Spotted Pardalote, Western Spinebill) differed between years, possibly in response to changes in regional patterns of abundance and/or rainfall. The movement of White-naped Honeyeater to Kings Park and the Swan Coastal Plain during 2002 was almost certainly a result of drought conditions inland from Perth. Other species, such as White-cheeked Honeyeater and Common Bronzewing Pigeon, which differed in abundance between years may have responded to long-term changes in the vegetation following the 1989 and 1996 wildfires.

### **Change in species status 1928 - 2002**

Between 1928 and 1986, 14 species (32 %) increased in frequency of occurrence by 15 % or more (increasers), 16 (36 %) decreased (decreasers), while 14 (32 %) showed no change or were recorded too infrequently to assess their status (Recher 1997). Of the 16 species which decreased, 10 were judged locally extinct. These numbers differ slightly from the analysis in Recher and Serventy (1991), with the differences based upon data obtained between 1989 and 1995.

Using information on their ecology and numerical abundance along the transect obtained since 1995, of the 61 species recorded between 1928 and 2002, I consider 13 species (21 %) to have increased in

frequency, while 22 (36 %) decreased or are locally extinct (Table 1). Twenty-six species showed no change or were recorded too infrequently to judge their status. Thus, some species which were increasers from 1928 to 1986, are now judged to be in decline and vice versa, but this does not affect conclusions.

Of the 54 species recorded between 1986 and November 2002, 7 (13 %) increased and 13 (24 %) decreased. Ten of the 61 species (16 %) recorded along the transect between 1928 and 2002 meet the criteria set out above of being locally extinct. Based on assessments of status in How and Dell (1993) and my own experience with the birds, another 17 species of land birds probably occurred along the transect prior to European settlement, but have not been recorded since censuses commenced in 1928. Two of these, Painted Button Quail *Turnix varia* and Variegated Wren *Malurus lamberti*, breed in the park, but are uncommon (Ian McLean pers. comm.). On the premise that both of these species could frequent the transect from time to time, at least 25 species have decreased to extinction along the transect since 1829. This is about one-third of the expected pre-European terrestrial avifauna (> 74 species) of the park with another 13 species in decline (Table 1). Of the 59 terrestrial bird species listed for Kings Park in Anon. (1957), 18 (31 %) no longer occur in the park or are species which I have observed on fewer than five occasions since 1986 and probably meet the criteria of local extinction.

### **Impact of fire on an isolated avifauna**

In January 1989, a wildfire burnt 120 ha of bushland and all of the transect bar the section within the Ernst Wittwer playground and the length of bushland between Lovekin Drive and Park Road (Fig. 1). In 1996, a fire burnt 75 ha adjoining the 1989 burn to the east (Fig. 1). Together, the fires burnt 73 % of the park's 267 ha of bushland (Hopper 1996). As a result of the 1989 fire, the Western Thornbill went to extinction in the park and several other species, including Broad-tailed and Yellow-rumped Thornbills and Black-capped Sittella, decreased in frequency of occurrence (Table 1); the Broad-tailed Thornbill has declined to extinction, while Yellow-rumped Thornbill and Black-capped Sittella continued to decline through 2002. Following the fires, White-cheeked Honeyeater and Common Bronzewing Pigeon colonized the transect (Table 1). Forty species were recorded along the transect from 1986 to December 1995. Of these, seven decreased in frequency of occurrence from 1986 to 1995, seven increased, and 26 were unchanged (Recher 1997).

### **Guild structure**

Using the information in Recher and Davis (1998, 2002) and foraging data from Kings Park (Recher unpubl.), the 27 most frequently recorded and abundant species along the transect from 1996 to 1999 are assigned to foraging guilds in Table 2. Thirteen are seed-eaters or nectarivores, three species forage primarily on lerp, the sugary protective cover of psyllid insects, and 11 forage mainly on insects and spiders, although small vertebrates and carrion may also be taken. Ten species, five seed-eaters and five

**Table 2.** The 27 most frequently recorded birds along a transect in Kings Park, Perth from 1996 to 1999 are grouped by foraging guilds. Exotic refers to birds colonizing or introduced to Perth. Birds marked with an asteric (\*) are seen regularly in the suburbs around Kings Park and throughout the Perth Metropolitan area in recreation parks.

### Seed-eaters/Herbivores

#### Canopy Foragers

Carnaby's Black Cockatoo\*

#### Canopy & Ground Foragers

Port Lincoln Parrot\*

Galah\* (Exotic)

#### Ground Foragers

Common Bronzewing Pigeon

Senegal Dove\* (Exotic)

Indian Turtle-dove\* (Exotic)

#### Nectar-feeders

Red Wattlebird\*

Rainbow Lorikeet\* (Exotic)

Western Spinebill

Brown Honeyeater\*

White-cheeked Honeyeater\*

Singing Honeyeater\*

Silvereye\*

#### Lerp-feeders

Weebill

Spotted Pardalote

Striated Pardalote\*

### Insectivores/Omnivores

#### Canopy Foragers

Rufous Whistler

Western Warbler

Black-faced Cuckoo-shrike\*

#### Ground Foragers

##### Large (>100 gms)

Australian Magpie\*

Australian Raven\*

Grey Butcherbird\*

Laughing Kookaburra\* (Exotic)

##### Small (<15 gms)

Yellow-rumped Thornbill

#### Aerial Sweepers

Welcome Swallow\*

#### Aerial Hawk

Grey Fantail

Rainbow Bee-eater

insectivores, forage mainly on the ground (Table 2). The nectar-feeders, which also take some fruit and insects, forage from the shrub layer through the canopy.

In Kings Park, the lerp-feeders and three of the insectivores, Rufous Whistler, Western Warbler and Black-faced Cuckoo-shrike, foraged mostly in the canopy. The lerp-feeders foraged primarily in eucalypts, with the Weebill commonly foraging in the rows of eucalypts along roads and in the Ernst Wittwer Playground. Three species foraged on flying insects, the Welcome Swallow above the canopy, the Rainbow Bee-

eater above and within the canopy, and the Grey Fantail from ground level to within the canopy. Of the five ground-foraging insectivores, four are large (>200g), while the Yellow-rumped Thornbill is small (<20g) and also foraged on branches in the lower canopy. In addition to the four large ground-foraging insectivores, the five ground-foraging seed-eaters are large.

No species along the transect foraged primarily in the shrub layer, although the Broad-tailed Thornbill used this vegetation layer in addition to the canopy before becoming extinct. The Western Thornbill also used the shrub layer and lower canopy, but foraged mainly on the ground. The Black-capped Sittella is a bark forager using branches and tree trunks from near the ground to the canopy. All three are insectivorous.

### Attributes of increasers and decreaseers

In Table 3, I assign attributes to the birds along the transect which I judge to be increasers or decreaseers, as well as those whose abundances appear unchanged over time (see Table 1). The listings are based on both the long-term trends in the census data from 1928 through 2002 and on changes in abundance evident since 1986.

The species most likely to be increasers are large birds which feed on seeds, or are birds feeding on nectar or lerp (Table 3). Included in the last category are six of the seven small birds which increased in frequency from 1928 to 1999; Brown Honeyeater, Silvereye, Singing Honeyeater, Striated Pardalote, White-cheeked Honeyeater, and Weebill. By contrast, those that are most likely to be decreaseers are small insectivores. Where an insectivore forages does not seem to make much difference to its

**Table 3.** Attributes of birds along a transect in Kings Park, Perth which increased in abundance (increasers), decreased (decreaseers) and those which did not change in abundance (same) from 1928 to 2001, as shown in Table 1. Birds which were recorded infrequently (< 10 % of counts) on all censuses are not included. As each species may have multiple attributes, the number of species does not necessarily conform with the number of species recorded. Percentages are for the category.

Attribute	Number of species (%)		
	Increasers	Decreaseers	Same
Large (> 200 g)	3 (33)	2 (22)	4 (45)
>20 < 200 grams	3 (23)	7 (54)	3 (23)
Small (< 20 g)	7 (33)	13 (62)	1 (5)
Nectarivore	5 (63)	2 (25)	1 (12)
Lerp-eater	2 (67)	0	1 (33)
Insectivore	3 (15)	15 (75)	2 (10)
Ground-forager	1 (9)	7 (64)	3 (27)
Shrub-forager	0	1 (100)	0
Canopy-forager	2 (33)	4 (67)	0
Aerial	0	3 (75)	1 (25)
Bird of prey	0	1 (50)	1 (50)
Seed-eater	3 (50)	2 (33)	1 (17)
Uses suburbs & recreation parks	9 (47)	4 (21)	6 (32)
Exotic	2 (40)	1 (20)	2 (40)

status, with ground, shrub, canopy and aerial insectivores having a high proportion of species in decline. However, six of the ten species listed in Table 1 as locally extinct are ground foragers. Of 12 species recorded by Serventy on more than 10 % of his counts between 1928 and 1937 and which are now locally extinct or were recorded on 5 % or fewer of counts between 1996 and 1999 (Table 1), five are ground-foragers (Pallid Cuckoo, Scarlet Robin, Western Thornbill, Western Yellow Robin, Willie Wagtail), one forages mainly in the shrub layer (Broad-tailed Thornbill), three in the canopy (Golden Bronze-cuckoo, Golden Whistler, Purple-crowned Lorikeet), one above the canopy (Tree Martin), one on bark (Black-capped Sittella), and one is a raptor (Whistling Kite). Other than the Purple-crowned Lorikeet, a nectar/pollen-feeder, and the kite (a predator/scavenger) all are insectivorous.

Only one small ground foraging insectivore, the Yellow-rumped Thornbill, remains along the transect, but Variegated Wrens, ground and shrub foragers, persist elsewhere in the park. In practice, there are virtually no ground-foraging birds in the bushland sections of the transect. Those ground-foragers which do occur are most abundant in the grassy parks and along roads and tracks (e.g., Australian Magpie). Within the bushland, only the Yellow-rumped Thornbill is encountered foraging on the ground away from edges and open areas, although the Common Bronzewing Pigeon probably also forages on the ground within the bushland.

Eighteen of the 27 most abundant species in Kings Park are also frequently encountered in Perth's suburban residential areas and recreation parks (landscaped, open grassed parks with little or no native vegetation) (Recher pers. obs.) (Table 2). Included in the 18 are five species not indigenous to Perth or its environs (Table 2). Six of the 18 are nectar-feeders, five are seed-eaters or herbivores, and four are large ground foragers (Table 2). Perth's suburbs and recreation parks have no insectivores apart from Black-faced Cuckoo-shrike (a canopy foliage snatcher) and Welcome Swallow (an aerial sweeper) which forage above ground level (Table 2). There is also one canopy foraging lerp-feeder, the Striated Pardalote, but a wider range of species occurs in remnant urban bushlands. Although insectivores are largely absent from the suburbs, honeyeaters (Meliphagidae) do take insects and both the Singing Honeyeater and Red Wattlebird, ubiquitous and abundant suburban residents, forage for insects throughout the year (Recher pers. obs.).

Only 11 of the remaining 34 species recorded along the transect frequent Perth's suburbs (pers. obs.). Of the 11, four are raptors (Little Falcon, Collared Sparrowhawk, Australian Goshawk, Little Eagle), one is an owl (Boobook Owl), while only three are insectivores (Magpie-lark, Willie Wagtail, Pallid Cuckoo). Of the last, the Magpie-lark and Willie Wagtail are common in suburban parks, while the Pallid Cuckoo is an uncommon but regular migrant to the suburbs (Recher pers. obs.). All are ground foragers. The raptors and owl are frequently encountered in the suburbs and both accipters could be considered abundant.

Nearly 80 % of birds whose abundances increased or remained unchanged between 1928 and 2002 are birds which use suburban gardens and recreation parks (Table 3).

## Discussion

The census data from Kings Park reveal a dynamic avifauna with two-thirds of species showing an increase or decrease of 15% or more in frequency of occurrence over time. One species in six has proceeded to local extinction, while Galah, Little Corella and Rainbow Lorikeet have established resident breeding populations. As a result, the avifauna of Kings Park in 2002 is very different from that found by Dom Serventy in 1928.

Only four of Serventy's ten most frequently recorded species remain among the top 10 in 2002, although all are among the 20 most frequently recorded birds along the transect (Table 1). Since 1928, Kings Park has become increasingly dominated by large birds and nectar-feeders, while insectivores and small birds have decreased. Compared with three species (Indian Turtle Dove, Laughing Kookaburra, Senegal Dove) in 1928, five of the 20 most frequently recorded birds in Kings Park in 2002 are introductions (e.g., Rainbow Lorikeet) or colonizing species (e.g., Galah) exotic to Perth and a sixth, the Little Corella, is increasing in abundance<sup>1</sup>.

Despite this recent history of rapid change and the decline and extinction of many species, the avifauna of Kings Park is as rich in species in 2002 as it was when Serventy initiated his counts. However, it is a poorer avifauna than occurred at the time of European settlement in 1829 (see Serventy 1948; How and Dell 1993). Many birds appear to have disappeared from Kings Park before Serventy commenced his counts in 1928. The Emu *Dromaius novaehollandiae* is probably among these early losses. However, the most notable losses are among the insectivores (e.g., Grey Shrike-thrush *Colluricincla harmonica*, Spotted Scrubwren *Sericornis maculatus*), eucalypt canopy foragers (e.g., Brown-headed Honeyeater *Melithreptus brevirostris*, White-naped Honeyeater *M. lunatus*) and birds dependent on tree hollows for nesting (e.g., Western Rosella *Platycercus icterotis*, Red-capped Parrot *Purpureicephalus spurius*).

## Reasons for long-term change

Recher and Serventy (1991) suggested that changes to the vegetation of Kings Park through logging, changed fire regimes and invasion by weeds, the expansion of suburbia, and the extensive clearing of vegetation throughout southwestern Western Australia had a greater effect on the avifauna of Kings Park than the park's size or its isolation in an urban landscape. The proliferation of weedy vegetation and the increased density of ground plants were suggested as having had a particularly significant impact on ground foraging birds, while the loss of a eucalypt canopy had an early effect on canopy and bark foragers, and on species requiring tree hollows for nesting. Nest predation by the Australian Raven, which has greatly increased in abundance since 1928 in Perth, was seen by Recher and

<sup>1</sup>Two Australian species, the Galah and the Little Corella, have self-colonized Perth and two others, the Laughing Kookaburra and the Rainbow Lorikeet, were introduced from eastern Australia. The remaining exotics, the European Goldfinch, the Indian Turtle-dove and the Senegal Dove, are introductions from outside the Australian continent. The European Goldfinch was abundant in Kings Park during the early 1950s, but decreased to extinction by the mid-1960s (Recher and Serventy 1991). During the 1990s, a new population of goldfinch established itself in Perth, but has so far not been recorded in the park.



Serventy (1991) as a contributing factor in the decline of some species. Conversely, the abundance of fruit, seeds, nectar and water in suburban gardens, parks and road verges advantaged some species, which increased in abundance. Large expanses of playing fields and well-watered lawns assured an abundance of food for ground foraging insectivores, such as Australian Magpie and Willie Wagtail, willing to forage away from cover.

After studying the effect of wildfire on the avifauna of Kings Park (Recher 1997), I concluded that the small size of the park and its small resident bird populations increased the likelihood of local extinction from extensive fires, such as those of 1989 and 1996 (Fig. 1). Moreover, the park's increasing isolation in an urban matrix decreased the chance of recolonization by all but the most mobile species. I also hypothesized that, because Kings Park is located on nutrient poor calcareous and quartz sands (Anon. 1957), populations of arthropods, even on lush post-fire vegetation, were likely to be relatively low (Recher 1997). Unlike the rapid recovery of vegetation, arthropods and birds observed after fire on richer soils elsewhere in Australia (see Woinarski and Recher 1997), I saw the low nutrient status of Kings Park as preventing the rapid recovery of insectivorous birds following fire. In such circumstances, the adverse effects of small area and isolation would be intensified (Recher 1997).

Data obtained since 1995 reinforce some of the suggestions of Recher and Serventy (1991) and Recher (1997), but disprove others. McLean and colleagues (pers. comm.) conducted studies of nest predation in Kings Park in 1999 and found predation of natural nests of a range of species was relatively low (~ 37 %). Using artificial nests with plasticine eggs, they found most egg predators were other birds and that the Grey Butcherbird was the most important individual predator. Ravens attacked less than 4 % of nests suggesting that they spent little time searching for eggs or nestlings, an observation confirmed by Suzanne Cumming in her study of raven behaviour in Perth (S. Cumming, pers. comm.). It appears that nest predation, particularly by ravens, may not be a significant factor in the decline of birds in Kings Park. However, even low nest predation rates can have a significant impact on the survival of small populations. The two species to become extinct in the park within the last decade, Western and Broad-tailed Thornbills, had populations in 1986 of fewer than 20 individuals, while all Yellow-rumped Thornbill nests (n = 6) found along the transect from 1989 to 2002 were parasitized by cuckoos or predated (Recher unpubl.).

Radho-Toly *et al.* (2001) used Kings Park to investigate the impact of fire on leaf nutrients and arthropods. Although not specifically addressing my hypothesis of low arthropod abundances affecting avian survival, arthropod abundances (excluding ants) on eucalypt saplings reported by Radho-Toly *et al.* (2001) appear low compared to the numbers collected from eucalypts growing east of Perth on richer soils (see Recher *et al.* 1996; Majer *et al.* 2000). As foliage nutrient levels were in the same range as found for eucalypts on richer soils, the relationship between foliar nutrients, arthropod abundances and avian survival in Kings Park is unclear and merits more attention. Certainly,

insectivorous birds have fared worst over time in the park. Populations of all resident small insectivores are low and all but the Rufous Whistler are in decline or have become recently extinct. This suggests an environment incapable of sustaining large numbers of insectivorous birds and means that the long-term survival of insect-eating birds in the park requires immigration from other populations.

The loss of insectivorous birds may have significant implications for the long-term health and conservation of the flora of Kings Park. Everleigh *et al.* (2001) showed that when birds were excluded from the canopies of marri trees, arthropod abundances increased, as did insect damage to the foliage. Although there have not been any obvious insect outbreaks in Kings Park since 1986 (pers obs), the loss and decline of insect-eating birds is turning the park into a grand natural experiment.

### Decreasers and increasers

Whatever its original bird life, Kings Park is now home to a distinctively Australian urban avifauna. It is an avifauna dominated by large birds and species which feed on nectar, fruit and seeds. As with urban centres elsewhere in Australia, most of the species common in the pre-European landscape are absent or uncommon (see Green *et al.* 1989; Sewell and Catterall 1998).

Many of the birds dominating Kings Park can be described as bold, assertive and clever. Parrots, honeyeaters, and corvids or corvid-like birds (magpies, butcherbirds) are the dominant species. All are capable of moving large distances quickly and make extensive use of the urban landscape where they find an abundance of food, water and nest sites. Small birds and insectivores are conspicuously absent or in decline, although individuals may cling tenaciously to life in large bushland remnants (see Catterall 2004).

The key to success of these birds in Kings Park is their ability to use the resources of the suburbs outside the park. The park's most abundant bird, the Brown Honeyeater, leaves the park in late summer and takes up residence in suburban gardens and parks where nectar is available from a wide variety of exotic Australian and overseas plants. It returns to breed when the bushland begins to flower in late winter. Notably, the Brown Honeyeater is one of the few small birds to increase in abundance since 1928 as Perth grew and lush suburban gardens proliferated.

Not all the birds which do well in Kings Park leave the park or use the suburb's resources. For example, magpies and kookaburras are sedentary, but there are numerous other individuals living in the urban matrix. In other words, the individuals in Kings Park are part of a larger population with individuals no doubt dispersing from place to place.

Of the smaller insectivores which remain in the park, it is likely that Western Warblers, Black-capped Sittellas, Rufous Whistlers, the pardalotes, and Grey Fantails are also part of larger regional populations with dispersal of individuals between different locations. Other than the sittella, all are species in which at least part of the population is migratory or nomadic outside the breeding

season (Serventy 1948; Serventy and Whittell 1962; pers obs) and even the sittellas may move between isolated bush remnants and Kings Park. The decline of most of these birds in Kings Park arises from the decline of regional populations as Perth expands and urban environments become increasingly alien to native wildlife thereby restricting or preventing the dispersal of individuals. Degradation of forests and woodlands outside the urban context is probably also a factor, as in the case of Western Yellow and Scarlet Robins (Recher and Serventy 1991).

Among the insectivores, only the Weebill appears to be self-contained within the Park, but it has the advantage of being able to exploit the extensive canopy of eucalypts along park roads. Probably pardalotes are able to do this as well, but the Spotted Pardalote is a winter migrant or nomad along the transect<sup>2</sup> and a scarcity of tree hollows in the park limits nesting opportunities for Striated Pardalotes.

This leaves unanswered the question as to why insectivores, and small birds in particular, fare so badly in Kings Park and its urban environs. It is not simply that small insectivores are incompatible with people. Serventy (1948) described the Yellow-rumped Thornbill as 'invading' Perth's suburban streets after nesting. Yellow-rumps do well in suburban Armidale on the Northern Tablelands of New South Wales (pers obs) and so are able to cope with cats, dogs and foxes. Yet, since the 1950s they have decreased around Perth with populations persisting only along the urban fringe and in large bushland parks. As ground foragers and willing users of mowed grasslands, food should not be the reason for decline.

I think three factors account for the loss of small insectivores from the urban landscape. The first is that too much urban vegetation is exotic or cultivars of Australian plants which lack herbivorous arthropods. Green *et al.* (1989) showed that arthropods were more abundant on native than exotic plants in both Brisbane and Melbourne. Similarly, Bhullar and Majer (2000) showed that trees indigenous to Perth supported significantly greater numbers of arthropods than eucalypts from eastern Australia and still greater numbers than trees from outside the continent. Majer *et al.* (2001) found the greatest eucalypt arthropod abundances occurred on locally indigenous species and the least on eucalypt species sourced from further away.

The second factor is the fragmentation of the urban landscape by roads, paths, fences and large open areas without vegetation or only grass. Movement of small birds, especially those that naturally frequent the shrub layer or lower canopy, is impeded by these conditions. Large canopy species, such as Black-faced Cuckoo-shrike, which naturally move across the canopy and travel long distances in the open do well in the urban environment and occur regularly even on Perth's inner city streets with few trees (pers. obs.).

<sup>2</sup>McLean (pers. comm.) has found Spotted Pardalotes nesting along the limestone escarpment on the park's northeast boundary.

The third factor is linked inextricably with fragmentation; the automobile. Even if small birds were able and willing to cross streets, the mortality by road death for small, low-flying birds would be huge. I am certain that it is the car more than anything else that extirpated the Yellow-rumped Thornbill from Perth's suburbs. In Kings Park, the small surviving population of Yellow-rumped Thornbill is rarely, if ever, encountered along roads and the reason it is in decline in the park is for other, as yet unknown, reasons. However, it is possible that Yellow-rumped Thornbills and other small birds in Perth are adversely affected by the large numbers of falcons and accipters in the suburbs, city and bush remnants. The populations of these raptors are sustained by the abundance of doves, but no doubt predation occurs on other birds. Those species, such as Yellow-rumped Thornbills, already affected by other changes to the urban environment may not be able to survive even small increases in predation.

### The reality

It will be difficult to maintain populations of bird species within urban parks, even those as large as Kings Park, unless the species in question is part of a larger population capable of exchanging individuals between locations. In the absence of populations in the urban matrix, the populations in urban reserves will be small and subject to all the vagaries of nature which make the persistence of small populations difficult: chance events, predation, inbreeding, and absence of social facilitation are only a few of the problems confronted in conserving small populations. In Kings Park, I have seen the Western Thornbill brought to local extinction by a chance wildfire of human origin. Inbreeding and/or the absence of social facilitation may have contributed to the recent loss of the Broad-tailed Thornbill and may be factors in the decline of Yellow-rumped Thornbills. In contrast to Broad-tailed Thornbills in the large expanses of forest east of Perth, the birds in Kings Park rarely called. It may be the population was so small (< 20 individuals in 1986) that, even with this territorial species, there was insufficient social stimulation to foster breeding. It is also possible that young birds dispersed out of the park constantly draining the population, which in the absence of any individuals dispersing into the park, inevitably led to extinction. Such issues challenge the conservation and management of birds in the urban landscape.

### Management options

Kings Park and Perth have an abundant and rich avifauna. It is not the same as occupied the land of Perth City in 1829, but restoring the original avifauna is not an option. Nonetheless, there are things that could be done to enrich the birdlife of Kings Park and Perth and prevent or slow the loss of more species. In doing so, our own lives would be enriched.

Recher and Serventy (1991) made a series of recommendations for the management of Kings Park which they felt would improve the park as habitat for a range of declining species. These included changes to fire management, restoration of a eucalypt canopy, weed

eradication, and retention of dead wood and dying trees, many of which are routinely removed to provide wood for the park's BBQ facilities. The primary objectives of these recommendations were to open the ground vegetation and litter layer to encourage small, insectivorous ground foraging birds, such as Western Thornbill and the robins, to retain foraging habitat for Black-capped Sittella and other bark foragers, and to increase the number of tree hollows for hole nesters, such as Striated Pardalote.

Recher (1997) repeated these recommendations in more detail and particularly stressed the need to prevent unplanned fires burning large areas of the park. In making these recommendations, Recher and Serventy (1991) and Recher (1997) were reiterating advice on the park's management given by Anon. (1957), Beard (1967) and Baird (1977) among others and not unknown to park management. Implementation of some recommendations is difficult, with the use of controlled burns to reduce the risk of large wildfires contributing to weediness. The retention of dead and dying trees is seen as a public hazard. Since 1997, considerable progress has been made in Kings Park with weed control and eradication, but none of this has created habitat for ground foragers. Does something different or more need to be done?

### Some things different

One of the most important programs to initiate in the urban environment for the conservation of urban wildlife is the progressive replacement of exotic trees and shrubs along streets and in gardens and parks with indigenous species. Above anything else, this will foster a more biodiverse landscape and improve the urban landscape as habitat for native wildlife. However, simply planting natives may not enable insectivorous and other birds to colonize the urban environment. Sewell and Catterall (1998) found that retaining original mature trees and planting nectar-rich native shrubs and trees encouraged a distinctive and rich assemblage of native birds, but did not benefit the majority of species, mainly small insectivores, found in the original forest where they worked in southeast Queensland. The latter were restricted to remnant forest and Sewell and Catterall (1998) suggested these birds required a complexly structured vegetation "over large areas of three-dimensional space". In other words, planting natives in an otherwise suburban or park landscape appeared insufficient to recover insectivorous birds regardless of any benefits to other native animals. As the findings of Sewell and Catterall (1998) probably have application outside southeastern Queensland, it means that retaining many native bird species in the city depends largely on the retention and management of remnant native bushland within the urban landscape.

Apart from managing Kings Park bushland to provide better habitat for insectivorous birds, what can be done to enhance the avifauna of the park? One suggestion is to reintroduce bird species no longer found in the park. I personally favour the reintroduction of Western and Broad-tailed Thornbills. Both are recently extinct in the park and habitats have recovered from the 1989 and 1996

fires to a stage where they look similar to those occupied by both species in 1986. Populations of both occur on the coast just north and south of Perth ensuring genetically suitable stock for reintroductions. Almost certainly the reintroductions would succeed and could be achieved at little cost, although I also recommend regular additions of new birds to compensate for the lack of young birds immigrating into the park. The latter may also be needed to prevent the extinction of the park's Yellow-rumped Thornbills.

This presumes there is some benefit or purpose of reintroducing species to the park. One obvious benefit is the enrichment of the avifauna for the enjoyment of people using the park and who appreciate the presence of birds. There may also be some ecological benefit in returning top end insectivores to the system, as birds do reduce arthropod numbers and may dampen the amplitude of insect outbreaks. Surprisingly, the suggestion of reintroducing the thornbills has not attracted a great deal of interest, although the idea of reintroductions was warmly received. Instead of the two small, rather drab and vocally insignificant thornbills, others have proposed to introduce the Splendid Wren *Malurus splendens* and the Scarlet Robin. Both are also insectivores and small, but both are colourful and rather more interesting vocally than the thornbills. It is easy to see why they were favoured over the thornbills, but this response raises some interesting questions in regard to the management of urban wildlife.

There is no reason why the four species could not be introduced to Kings Park. However, introductions should have some reasonable prospect of success and neither the wren nor the robin is likely to succeed in Kings Park. I am not aware of any evidence of Splendid Wrens ever occurring in the area now occupied by the park and, in my experience with the bird, the park's vegetation in 2002 is totally unsuited to this species. The Splendid Wren is also a bird which responds poorly to environments disturbed by humans and rarely associates with human settlements even on the urban fringe. The Scarlet Robin was frequent in Kings Park and occurred on more than half Serventy's counts between 1928 and 1937, but decreased to below 5 % of counts from 1952-55 (Serventy 1938; Recher and Serventy 1991). I recorded it in the park in 1973, but know of no record since then. The Scarlet Robin is a ground forager which hunts by pouncing and requires a substrate with a fine scale mosaic of litter, ground vegetation and bare ground (Recher *et al.* 2002). However, even if fire and weed control in Kings Park could be applied successfully to create the required conditions, the Scarlet Robin has decreased throughout the southwest as a result of habitat loss and change. Scarlet Robins are a partial migrant or nomad and the Kings Park population that Serventy counted probably ranged over a much larger area. As most of this area now appears alien to the needs of Scarlet Robins, it would be futile to attempt to establish a Kings Park population in the 21st Century. It is likely that Kings Park is too small to sustain a viable population of this species.

## Keeping birds in the city

Is it necessary to have a city with birds? The answer to this question depends entirely on what you value in life and whether or not you feel responsible for the welfare of other organisms. A person concerned for the welfare of other organisms might answer the question by saying we have a moral responsibility to share the world's resources with other species. No other reason or justification is required. By creating cities in which other species can live, albeit at lesser numbers and in reduced variety from a natural landscape, we can be seen to care for other organisms. Putting feelings of morality aside, an ecologist or an economist might answer by saying there are no pressing or obvious ecological or economic reasons for retaining urban wildlife. In all likelihood, the city will function and its people prosper economically without birds or other urban wildlife. However, many people prefer not to live

by ecology or economics alone. The people who live, play and toil in the city may not think much about the birds in their daily routine, but if pressed might say that birds add colour, sound, variety and enjoyment to life and that there should always be birds in the city.

Like the people I encounter during my bird counts in Kings Park, knowing the names of the birds is not important; knowing that the birds are there is important. People consciously or unconsciously like birds and, despite grumbles about noise and occasional bouts of damage to property from some species, most of us like to have them in our environment.

Thus, two good reasons for keeping birds in the city are because we have a responsibility towards other species and because we like them. Does it matter then what the birds are? For most people, it probably doesn't.

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**Appendix A.** Birds recorded along a transect through Kings Park, Perth, Western Australia by D. L. Serventy and H. F. Recher from 1928 to 2002

# APPENDIX

- Australian Goshawk *Accipiter fasciatus*  
 Australian Magpie *Gymnorhina tibicen*  
 Australian Raven *Corvus coronoides*  
 Black-capped Sittella *Daphoenositta pileata*  
 Black-faced Cuckoo-shrike *Coracina novaehollandiae*  
 Black-shouldered Kite *Elanus axillaris*  
 Boobook Owl *Ninox boobook*  
 Broad-tailed Thornbill *Acanthiza apicalis*  
 Brown Honeyeater *Lichmera indistincta*  
 Carnaby's Black Cockatoo *Calyptorhynchus latirostris*  
 Cockatiel *Nymphicus hollandicus*  
 Collared Sparrowhawk *Accipiter cirrocephalus*  
 Common Bronzewing Pigeon *Phaps chalcoptera*  
 Dusky Woodswallow *Artamus cyanopterus*  
 European Goldfinch *Carduelis carduelis*  
 Fan-tailed Cuckoo *Cacomantis flabelliformis*  
 Fork-tailed Swift *Apus pacificus*  
 Galah *Eolophus roseicapillus*  
 Golden Bronze-cuckoo *Chalcites lucidus*  
 Golden Whistler *Pachycephala pectoralis*  
 Grey Butcherbird *Craticus torquatus*  
 Grey Fantail *Rhipidura fuliginosa*  
 Horsfield Bronze-cuckoo *Chalcites basalis*  
 Indian Turtle-dove *Streptopelia chinensis*  
 Laughing Kookaburra *Dacelo novaeguinae*  
 Little Corella *Cacatua sanguinea*  
 Little Eagle *Hieraetus morphnoides*  
 Little Falcon *Falco longipennis*  
 Little Wattlebird *Anthochaera chrysoptera*  
 Magpie Lark *Grallina cyanoleuca*  
 Mistletoebird *Dacaeum hirundinaceum*  
 Nankeen Kestrel *Falco cenchroides*  
 Pallid Cuckoo *Cuculus pallidus*  
 Port Lincoln Parrot *Barnardius zonarius*  
 Purple-crowned Lorikeet *Glossopsitta porphyrocephala*  
 Rainbow Bee-eater *Merops ornatus*  
 Rainbow Lorikeet *Trichoglossus haematodus*  
 Red Wattlebird *Anthochaera carunculata*  
 Rock Dove *Columba livia*  
 Rufous Whistler *Pachycephala rufiventris*  
 Sacred Kingfisher *Todiramphus sanctus*  
 Scarlet Robin *Petroica multicolor*  
 Senegal Dove *Streptopelia senegalensis*  
 Silvereye *Zosterops lateralis*  
 Singing Honeyeater *Lichenostomus virescens*  
 Spotted Pardalote *Pardalotus punctatus*  
 Striated Pardalote *Pardalotus striatus*  
 Tawny Frogmouth *Podadrgus stgrigoides*  
 Tree Martin *Hirundo nigricans*  
 Weebill *Smicromnis brevirostris*  
 Welcome Swallow *Hirundo neoxena*  
 Western Spinebill *Acanthorhynchus superciliosus*  
 Western Thornbill *Acanthiza inornata*  
 Western Warbler *Gerygone fusca*  
 Western Yellow Robin *Eopsaltria griseogularis*  
 Whistling Kite *Haliastur sphenurus*  
 White-cheeked Honeyeater *Phylidonyris nigra*  
 White-naped Honeyeater *Melithreptus lunatus*  
 White-winged Triller *Lalage sueurii*  
 Willie Wagtail *Rhipidura leucophrys*  
 Yellow-rumped Thornbill *Acanthiza chrysorrhoa*