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Does variation in garden characteristics influence the conservation of birds in suburbia?

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ABSTRACT

Can enhancement of garden habitat for native birds have conservation benefits, or are garden bird assemblages determined by landscape and environmental characteristics? The relative roles of vegetation structure, floristics and other garden attributes, and environmental and landscape controls, on the abundance and richness of bird species in 214 back or front gardens in 10 suburbs of Hobart, Tasmania, Australia, are addressed to answer this question. Birds were counted in each garden and the resources they utilized noted. Vascular plant species and other attributes of the garden were noted, along with rainfall, altitude, distance from natural vegetation, distance from the city and garden size. Garden floristics and bird assemblages were ordinated, and garden groups characterized by particular assemblages of birds identified. General linear modelling was used to determine the combinations of independent variables that best predicted the richness of birds and the abundance of individual bird species and groups of species. The models for bird richness, bird species and groups of bird species were highly individualistic. Although native birds showed a preference for native plants, they also utilized many exotic plants. Exotic birds largely utilized exotic plants. Variation in garden characteristics does substantially affect the nature of garden bird assemblages in Hobart, with weaker environmental and landscape influences. The fact that gardens can be designed and managed to favour particular species and species assemblages gives gardeners a potentially substantial role in the conservation of urban native avifauna.

1. Introduction

There are a growing number of studies on assemblages of birds in cities. This work has indicated that: urban bird communities are characterised by less species richness and diversity than communities in adjacent natural vegetation; more biomass and density; and, the super-dominance of a few species, which are usually exotics (Jones, 1981; Beissinger and Osborne, 1982; Green, 1986; Catterall et al., 1989; Clergeau et al., 1998). These tendencies vary within urban areas along the gradient from natural vegetation to heavily urbanised areas (Green, 1986; Jokiamaki and Suhonen, 1993; Germaine et al., 1998; Fernandez-Juricic, 2000; Chamberlain et al., 2004; however, see Catterall et al., 1989 for an exception). Bird species richness in gardens is affected by tree species composition, with deciduous rather than coniferous trees promoting the highest bird species richness in Europe (Thompson et al., 1993). Garden area has a positive influence on garden bird species richness (Thompson et al., 1993; Chamberlain et al., 2004). Clumped trees result in more birds per unit area than dispersed trees (Day, 1995).

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In recent years, many Australian books have recommended native plants, which are believed to attract native birds, for gardens (Dengate, 2000; Pizzey, 2000; Grant, 2003; Burke, 2004). However, very little quantitative data has been gathered in Australia, or elsewhere, to determine whether native plants, or indeed any type of plant, do, in fact, increase the number and richness of native birds utilising a garden. Day (1995) found that, although native plants were more attractive to a wider range of bird species than introduced plants in Hamilton, New Zealand, they did not necessarily attract a greater abundance of birds, and noted that a number of introduced bird species seemed to be able to meet their habitat requirements equally well from native or introduced plants. In Australia, Catterall et al. (1989) found that neither silvereyes (*Zosterops lateralis*) nor exotic species displayed any clear foraging preferences for groups of plant species defined by origin or physiognomy. On the other hand, there were stronger associations of bird use with plant species and genera. French et al. (2005) found that the Australian native plant genera *Banksia* and *Grevillea* were significantly more attractive than the exotic genera *Hibiscus* and *Camellia* to both categories of all birds and Australian native species.

Very little work has been done to quantify the effects of non-vegetation garden components, such as pets, bird baths, and supplementary feeding, on garden bird assemblages. Lepczyk et al. (2004) investigated the number of people taking part in behaviours that could affect bird abundances, but did not quantify the effects of any of these behaviours. Gillies and Clout (2003) found that domestic house cats *Felis catus* regularly prey upon birds in Auckland, New Zealand, but there has been no attempt to quantify the effects of cat presence on garden bird abundance. Thompson et al. (1993) found that feeding frequency had no major effect on the number of bird species recorded in a garden, whereas Chamberlain et al. (2004) found that the probability of occurrence of many species increased in the presence of supplementary feeding.

Clergeau et al. (2001), on examination of urban bird data from France, Finland and Canada, found that, in winter at least, the composition of urban bird communities differed from that of surrounding 'periurban' landscapes; implying that local features were more important than landscapes. However, Chamberlain et al. (2004) found few associations between birds and garden habitat, suggesting that surrounding habitat is one of the main determinants of occurrence in gardens for most bird species, although the surrounding habitat analysed by Chamberlain et al. (2004) was within 100 m of the gardens and thus could still be considered local vegetation, rather than landscape. Thus, there is still uncertainty on whether enhancement of garden habitat is worthwhile, or if urban bird assemblages are simply determined by landscape and environmental features.

The main aim of the present paper is to determine if garden variation does affect garden bird composition, abundance and richness. If garden birds are primarily influenced by surrounding landscapes, it is unlikely that garden level habitat enhancement can significantly increase urban bird diversity. Conversely, if urban birds are primarily influenced by garden features and are, to some extent, independent of the surrounding landscape, domestic gardens could become very important in the conservation of urban avifauna. If variation in gardens accounts for at least some of the variation in garden birds, it is important to understand the nature of this relationship. Therefore, this paper relates attributes of garden birds to attributes of gardens to determine which garden attributes best explain bird species richness, bird assemblage abundances, bird group abundances and individual species abundances. Particular focus is given to the hypothesis of a strong positive relationship between local native plants in gardens and the occurrence of native bird species.

2. Methods

2.1. Study area and garden selection

Ten suburbs of Hobart, Tasmania, Australia, were selected for sampling (Fig. 1). These represented a range of environments (annual precipitation and altitude) and locations (distance to Hobart and distance to bush). The suburbs range between: 5 and 370 m above sea level; 1 km and 16 km (as the bird flies) from the Hobart General Post Office; <5 m to greater than 3 km from natural vegetation; and receive between 500 and 1000 mm of mean annual precipitation. Hobart is a linear city of 190,000 people, situated on both banks of a large estuary (Fig. 1), and is contained to a large degree by forested hills and mountains. Most people live in self-contained houses, with both front and back gardens. These gardens vary markedly in their structural characteristics and floristic composition, both within and between suburbs (Daniels and Kirkpatrick, in press; Kirkpatrick et al., in press).

Within the suburbs, the number and location of gardens used in the study depended on the willingness of owners to allow observation. Almost all owners (>90%) were happy to have the survey done on their properties. Within suburbs, gardens were selected subjectively without preconceived bias (Mueller-Dombois and Ellenberg, 1974). The total number of properties from which data were collected was 107. With the front and back gardens being treated as independent locations, the total number of sites was 214. Treating the front and back gardens of a property as independent data points means that it is likely that the same individual birds were often recorded in both gardens. However, multiple recordings of individuals birds were not considered a problem because, no matter how close survey points were located, it was hypothesised that birds would only visit a garden (and thus be recorded at that data point) if there was suitable habitat present. This was further ensured by only recording species that stopped and utilised the garden in some manner (see below). The gardens range between 50 and 1600 m^2 in area.

2.2. Data collection

Stationary point counts have special value in studies of bird–habitat associations, when habitat variables are measured at the counting points (Bibby et al., 2000), and there is insufficient space for transects, as in the present study. Twenty minute stationary point counts were undertaken between sunrise and 1100 hours, 1100 hours and 1400 hours, or 1400 hours and sunset. A few pilot surveys identified 20 min as a sufficiently long period to capture all individuals utilizing a garden on any one occasion. Nonetheless, it is unlikely that sampling