INTRODUCTION

To date, no studies have been published on the relationship between avian communities and lakeshore development in central Wisconsin. The effect of urbanization on lakeshore bird populations in central Wisconsin needs to be analyzed before appropriate lakeshore management guidelines can be proposed.

The objectives of this study were: (1) to assess avian diversity and richness along 17 lakeshores of Portage County, Wisconsin, that vary in degree of urbanization; and (2) to relate avian species, diversity, richness and sites to a variety of environmental variables, including vegetative features and levels of development along lakeshores. This study is an important step towards better understanding the effects such development has on avian communities in central Wisconsin.

METHODS

The avian community was sampled during the 2003 breeding season. Point counts were conducted at 6 random locations at 17 lakes. Counts were taken 50 m inland from the water's edge, corresponding to a similar study on birds and lakeshore development done in northern Wisconsin[1]. Only one count was taken per site. Birds detected at <50m were recorded.

On-site measurements of several variables corresponding to human use and vegetation were taken. The number of buildings, birdhouses and birdfeeders were counted within a 50m radius from each point count. Development and vegetative cover were assessed within the same 50m radius by making visual estimates of the percent area covered by 5 habitat variables: open developed, wooded developed, open undeveloped, wooded undeveloped, and paved. Within the same 50 m radius, other vegetation variables were measured. The amount of canopy cover, ground level vegetation, and understory vegetation were recorded.

Several statistical analyses were conducted to examine associations within and between the 11 habitat variables measured and the birds detected, including ANOVA, PCA, CCA, and DFA. All bird species detected were analyzed and additional tests were conducted on the most frequently detected species. Species were also grouped and analyzed according to memberships in major guild associations. Memberships in food, nest type, and nest location guilds will be addressed here.

RESULTS/DISCUSSION

We recorded 55 avian species with 748 individuals detected within 50 m at a total of 102 sites. Red-winged Blackbird (*Agelaius phoeniceus*), American Goldfinch (*Carduelis tristis*), American Robin (*Turdus migratorius*), and Black-capped Chickadee (*Poecile atricapillus*) were the most abundant species, with American Goldfinch, American Robin, Red-winged Blackbird, and Song Sparrow (*Melospiza melodia*) present at the most sites.

The 17 study lakes represented a gradient of developed, moderately undeveloped, and totally undeveloped sites from which to assess avian relationships to development. Lakes separated into three distinctly different development levels as defined by their measured habitat variables. Developed and undeveloped lakes are similar in species richness and diversity, as found in northern Wisconsin[1,2]. Though slightly higher in moderately developed lakes, richness and diversity were not found to be significantly different between three development categories. However, the results suggested that the lake classification derived from analysis of the habitat variables was reflected in the bird communities.

Bird assemblages differed in relation to the development levels defined at each lake. The relationship of avian communities to development is obviously complicated, with bird populations in both urban and more natural environments responding to a complex combination of environmental factors[3]. Lakeshore development can negatively or positively affect habitat quality of birds depending on the ecological requirements of each species[1]. Development can play a important role in providing resources unavailable to certain species in a more natural environment, yet eliminate other species' needs altogether, especially at the most extreme levels of development[4,5]. Each species may use certain habitats for a variety of reasons, perhaps choosing one or more habitats for one use (e.g., food) and another for a different function (e.g., nesting).

At the species level, bird species are known to respond differently to resource changes resulting from urbanization[5]. As expected, some species in this study selected developed areas over undeveloped areas whereas other species showed little or no preference. Of the 28 most common species, Eastern Phoebe (*Sayornus phoebe*), American Goldfinch, American Robin, Morning Dove (*Zenaida macroura*), and Downy Woodpecker (*Picoides pubescens*) showed the greatest tendency to be found in developed areas. These species may be taking advantage of different resources available in the urban environment, such as birdfeeders (as in the case of the American Goldfinch and Downy Woodpecker), open foraging areas (American Robin and Mourning Dove), or nest sites (Eastern Phoebe). At undeveloped sites, Least Flycatcher (*Empidonax minimus*), Great Crested Flycatcher (*Myiarchus crinitus*), Red-eyed Vireo (*Vireo olivaceus*), Black-capped Chickadee, Blue Jay (*Cyaanocitta cristata*), Red-bellied Woodpecker (*Melanerpes carolinus*), Eastern Wood-pewee (*Contopus virens*), Indigo Bunting (*Passerina cyanea*), and Common Yellowthroat (*Geothylypis trichas*) were the most common. A majority of these species are insectivores and are likely to feed in more forested environments. A northern Wisconsin study found similar lakeshore development effects on the composition of the avian community[1].

If food resources are a driving factor in these habitat selections, then analyses of food guild associations should show similar relationships of species to development levels. In support of this hypothesis, most of the aforementioned species fell into similar development categories in the food guild analysis as they did for the species analysis.

For example, seedeaters (American Goldfinch and Morning Dove) were found to be associated with buildings. Insectivores (Least Flycatcher, Great Crested Flycatcher, Black-capped Chickadee, Red-bellied Woodpecker, Eastern Wood-pewee, Indigo Bunting, and Common Yellowthroat) were associated with thicker understory and canopy cover, both undeveloped areas. Exceptions included two insectivores, Downy Woodpeckers, and American Robins, all of which are known to be quite common in developed areas. American Robins, for example, are quite tolerant of humans and may benefit from urbanization[6].

Food provided by humans may play an important factor in this analysis, as seedeaters could be drawn to more developed areas where food is readily available. The number of seedeaters can dramatically increase in the urban environment and seeds provided by the urban setting's human inhabitants may be significant[7,8]. Thus food guilds coupled with food availability may be important predictors of certain species' presence across my study sites.

An analysis of nest locations reveals reed nesters (Red-winged Blackbirds) were found in open areas. Snag and deciduous tree nesters were most common in wooded developed areas, along with bank nesters. Of the bank nesters, Belted Kingfisher (*Ceryle alcyon*) is known to use snags for perches. Ground nesters selected undeveloped areas and shrub nesters prefer areas of heavy understory. Previous studies have shown similar results, indicating that corresponding levels of development may provide more adequate nest locations for these guilds[1,7]. This study appears to provide further support for this resource-based habitat selection.

Cavity nesters, burrow nesters, and species that make pendant-shaped and saucer-shaped nests were associated with developed areas. Oven-shaped nest builders (Ovenbirds, *Seiurus aurocapilla*) were found in wooded undeveloped areas and parasite nesters (Brown-headed Cowbirds, *Molothrus ater*) were present in mostly wooded developed areas. Predicting bird presence based upon nest type may seem less intuitive than using food or nest site availability, but perhaps species requiring uncommon nesting strata or substrates may select certain locations because of limited resource availability. Like nest locations, developed areas are hypothesized to provide more opportunities for some nest types by increasing holes for cavity nests, crevices for burrows, and ledges for saucer-shaped nests[7,9]. Results from this study support for this concept, as cavity, burrow, and saucer-shaped nest builders were associated with developed areas. Cup-shaped nesters showed no preference. Arguably, cup nests can be built on man-made structures such as buildings or in more natural locations like trees and shrubs, making such nest builders less likely to select one level of development over another.

Although we found that bird communities appeared to respond strongly to the variables we measured, other variables known to affect avian assemblages could not be examined. These include predator abundance, human density, competition, and climate, among

others[6,10,11,12,13]. Of those included here, availability of food and nesting strata and substrate seem to be important parameters in avian habitat selection, with differing levels of development sometimes enhancing or degrading bird habitat, depending upon the species. For example, greater food availability associated with human presence appears to benefit a number of avian species.

This study showed there are no significant differences in species diversity and richness between the three development levels of the representative lakes, yet bird assemblages responded to differing levels of development. However, particular species and guilds (especially food and nesting) selected different levels of development, as demonstrated in previous studies[1,7,9]. This shows that avian assemblages can be related to development, particularly along the lakeshores studied, although habitat selection along the developmental gradient varies and appears to be multi-faceted.

Although this study did not demonstrate higher lake-level avian diversity at intermediate levels of development, this relationship was found in a different study of birds along an urban to rural gradient[5]. Our results indicate avian diversity and richness tend to be similar despite the level of development, at least across the range of development and the size of the study lakes. Perhaps the difference in these results is a matter of scale. At a regional scale it is possible that habitat variation among lakes would tend to yield overall a more diverse avian community than would habitat variation within lakes. This research seems to support such management, at least on smaller lakes where there may not be enough lakeshore to support large enough sections of varied habitats. However, research on large-scale habitat measures being better predictors of bird species presence than local-level habitat measures is also inconclusive[14]. More study is necessary to further test whether intermediate levels of development support higher bird diversity in general.

It is clear in this study that avian communities were dramatically altered as a result of urban development. However, further long-term studies addressing how bird species respond to the urban to rural gradient are necessary for managers to design and implement effective mitigation strategies.

Table 1. Mean richness (S) and diversity (H') scores per lake. Lakes are separated according to the 3 distinctly different average habitat scores (derived from PCA).

Lake Category and lake	$\bar{X}$ S	$\bar{X}$ H'
Developed		
Springville	11	2.2
Helen	16	2.6
Rhinehart	23	2.3
Jacqueline	18	2.7
Group Average	**17.0**	**2.5**
Moderately Developed		
South Twin	11	2.1
Emily	21	2.6
Sunset	18	2.8
Adams	23	2.7
Jordan	21	2.9
Rosholt	20	2.8
Bear	14	1.8
Thomas	17	2.6
Group Average	**18.1**	**2.5**
Undeveloped		
Joanis	12	2.1
Wolf	16	2.6
Severson	13	2.4
Skunk	18	2.7
Fountain	14	2.5
Group Average	**14.6**	**2.5**

Table 2. Means of habitat variables for each of the three development groups as defined by an analysis of habitat scores.

	Developmental Group			
Habitat Variables	**Developed**	**Moderately Developed**	**Undeveloped**	**Total**
canopy cover (%)	45.2	49.6	67.1	54.0
buildings (#)	5.0	0.9	0.1	2.0
birdfeeders (#)	3.9	0.5	0.0	1.5
birdhouses (#)	1.4	0.4	0.0	0.6
open developed (%)	61.5	37.0	10.8	36.4
wooded developed (%)	12.3	20.6	6.3	13.1
open undeveloped (%)	1.7	6.1	20.3	9.4
wooded undeveloped (%)	7.5	27.3	60.2	31.7
paved (%)	16.5	9.1	2.3	9.3
cover pole-ground (%)	43.3	53.8	64.3	53.8
cover pole-upper (%)	28.8	31.1	35.5	31.8

Table 3. Means per lake of the most abundant species for each of the three development groups as defined by an analysis of habitat scores.

	Developmental Group			
Species	**Developed**	**Moderately Developed**	**Undeveloped**	**Total Detected**
RWBL	9.3	9.0	2.2	120
AMGO	4.0	3.8	2.8	60
AMRO	4.5	2.9	2.0	51
BLCH	0.8	2.5	4.8	47
COGR	5.8	2.3	0.0	41
SOSP	1.8	2.6	2.6	41
CHSP	2.8	2.5	0.8	35
BLJA	1.8	1.4	2.6	31
CATB	0.8	1.6	1.4	23
HOWR	2.5	0.9	1.0	22
REVI	1.0	0.8	2.4	22
AMCR	0.3	2.3	0.0	19
COYE	0.8	1.0	1.4	18
HOFI	1.8	0.8	0.0	13
MODO	1.8	0.6	0.2	13
NOOR	0.8	1.1	0.2	13
WBNU	0.5	1.0	0.6	13
EAPE	0.0	0.6	1.4	12
COWB	0.0	1.1	0.4	11
LEFL	0.5	0.0	1.8	11
NOCA	1.0	0.8	0.2	11
RBGR	0.5	0.3	1.4	11
OVEN	0.0	0.4	1.4	10

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Appendix 1. Scientific names of species detected and abbreviations used in corresponding tables and figures. Scientific names follow the American Ornithogist's Union checklist of North American birds, seventh edition and corresponding supplements (American Ornithologists' Union 1998, 2000, Banks, et al. 2002, 2003, and 2004).

Species	Common Name	Scientific name
AMCR	American Crow	*Corvus brachyrhynchos*
AMGO	American Goldfinch	*Carduelis tristis*
AMRO	American Robin	*Turdus migratorius*
BAEA	Bald Eagle	*Haliaeetus leucocephalus*
BASW	Barn Swallow	*Hirundo rustica*
BEKI	Belted Kingfisher	*Ceryle alcyon*
BLCH	Black-capped Chickadee	*Poecile atricapillus*
BWHW	Black-and-white Warbler	*Mniotilta varia*
BLJA	Blue Jay	*Cyanocitta cristata*
BWWA	Blue-winged Warbler	*Vermivora pinus*
BRTH	Brown Thrasher	*Toxostoma rufum*
CATB	Catbird	*Dumetella carolinensis*
CEWA	Cedar Waxwing	*Bombycilla cedroroum*
CHSP	Chipping Sparrow	*Spizella passerina*
COGR	Common Grackle	*Quiscalus quiscula*
COYE	Common Yellowthroat	*Geothylypis trichas*
COHA	Cooper's Hawk	*Accipiter cooperii*
COWB	Brown-headed Cowbird	*Molothrus ater*
DOWO	Downy Woodpecker	*Picoides pubescens*
EABL	Eastern Bluebird	*Sialia sialis*
EAKI	Eastern Kingbird	*Tyrannus tyrannus*
EAPE	Eastern Wood-Pewee	*Contopus virens*
FISP	Field Sparrow	*Spizella pusilla*
GRCF	Great Crested Flycatcher	*Myiarchus crinitus*
GRHE	Green Heron	*Butorides virescens*
HAWO	Hairy Woodpecker	*Picoides villosus*
HOFI	House Finch	*Carpodacus mexicanus*
HOWR	House Wren	*Troglodytes aedon*
HOSP	House Sparrow	*Passer domesticus*
INBU	Indigo Bunting	*Passerina cyanea*
LEFL	Least Flycatcher	*Empidonax minimus*
MODO	Mourning Dove	*Zenaida macroura*
NOCA	Northern Cardinal	*Cardinalis cardinalis*

Species	Common Name	Scientific name
NOMO	Northern Mockingbird	*Mimus polyglottos*
NOOR	Baltimore Oriole	*Icterus galbula*
OVEN	Ovenbird	*Seiurus aurocapilla*
PHOE	Eastern Phoebe	*Sayornus phoebe*
PUFI	Purple finch	*Carpodacus purpureus*
PIWO	Pileated Woodpecker	*Dryocopus pileatus*
RENU	Red-breasted Nuthatch	*Sitta canadensis*
RBWO	Red-bellied Woodpecker	*Melanerpes carolinus*
PUMA	Purple Martin	*Progne subis*
REVI	Red-eyed Vireo	*Vireo olivaceus*
RWBL	Red-winged Blackbird	*Agelaius phoeniceus*
RBGR	Rose-breased Grosbeak	*Pheucticus ludovicianus*
RWSW	Northern Rough-winged Swallow	*Stelgidopteryx serripennis*
RTHU	Ruby-throated Hummingbird	*Archilochus colubris*
SCTA	Scarlet Tanager	*Piranga olivacea*
SOSP	Song Sparrow	*Melospiza melodia*
STAR	European Starling	*Sturnus vulgaris*
TRSW	Tree Swallow	*Tachycineta bicolor*
WAVI	Warbling Vireo	*Vireo gilvus*
WBNU	White-breasted Nuthatch	*Sitta carolinensis*
YTVI	Yellow-throated Vireo	*Vireo flavifrons*
YEWA	Yellow Warbler	*Dendroica petechia*

Appendix 2. Species totals per lake. Lakes are arranged according to development categories as determined by PC1 scores. (for a list of abbreviations used for each species, see Appendix 1)

	Developed Lakes					Moderately Developed Lakes									Undeveloped Lakes						
Species	Rhinehart	Helen	Jacqueline	Springville	Total	Bear	Emily	South Twin	Jordan	Adams	Rosholt	Sunset	Thomas	Total	Fountain	Skunk	Joanis	Wolf	Severson	Total	Grand Total
AMCR	1	0	0	0	1	1	10	0	0	5	0	0	2	18	0	0	0	0	0	0	19
AMGO	3	5	3	5	16	6	3	0	2	10	1	3	5	30	0	3	5	4	2	14	60
AMRO	4	5	7	2	18	2	3	2	3	9	0	3	1	23	3	1	2	2	2	10	51
BAEA	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	0	0	0	0	2
BASW	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1
BEKI	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	1	2
BLCH	1	2	0	0	3	0	4	9	0	0	5	2	0	20	4	2	11	1	6	24	47
BWHW	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1
BLJA	4	0	0	3	7	1	2	3	1	0	1	1	2	11	1	4	1	3	4	13	31
BWWA	0	0	0	0	0	1	0	0	0	1	0	0	0	2	0	0	0	0	0	0	2
BRTH	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
CATB	2	1	0	0	3	3	1	0	0	3	3	0	3	13	1	0	2	1	3	7	23
CEWA	1	0	0	0	1	0	0	0	3	0	0	0	0	3	3	0	0	0	0	3	7
CHSP	1	2	8	0	11	1	5	2	3	4	4	1	0	20	1	2	1	0	0	4	35
COGR	18	0	5	0	23	0	7	0	0	10	1	0	0	18	0	0	0	0	0	0	41
COYE	3	0	0	0	3	0	1	0	1	3	3	0	0	8	2	2	0	2	1	7	18
COHA	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1
COWB	0	0	0	0	0	1	0	1	0	6	0	1	0	9	0	1	0	0	1	2	11

	Developed Lakes					Moderately Developed Lakes									Undeveloped Lakes						
Species	Rhinehart	Helen	Jacqueline	Springville	Total	Bear	Emily	South Twin	Jordan	Adams	Rosholt	Sunset	Thomas	Total	Fountain	Skunk	Joanis	Wolf	Severson	Total	Grand Total
DOWO	1	2	0	1	4	0	0	0	0	1	0	1	1	3	0	0	0	0	0	0	7
EABL	1	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	2
EAKI	0	0	4	0	4	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	5
EAPE	0	0	0	0	0	0	1	0	1	0	2	0	1	5	0	3	0	4	0	7	12
FISP	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1
GRCF	0	0	1	0	1	0	0	0	1	0	1	0	1	3	0	1	0	0	0	1	5
GRHE	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1
HAWO	0	0	1	0	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	2
HOFI	0	0	6	1	7	0	1	0	0	3	0	1	1	6	0	0	0	0	0	0	13
HOWR	4	2	3	1	10	0	0	0	2	0	1	2	2	7	0	0	3	2	0	5	22
HOSP	0	3	0	0	3	0	1	0	0	1	0	0	0	2	0	0	0	0	0	0	5
INBU	0	0	0	0	0	0	1	0	2	0	1	0	0	4	0	0	0	3	0	3	7
LEFL	0	1	1	0	2	0	0	0	0	0	0	0	0	0	3	4	0	0	2	9	11
MODO	2	2	3	0	7	0	0	3	0	1	0	1	0	5	0	0	0	1	0	1	13
NOCA	0	0	1	3	4	2	1	0	2	1	0	0	0	6	0	0	1	0	0	1	11
NOMO	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1
NOOR	1	0	2	0	3	0	0	2	3	1	0	2	1	9	0	1	0	0	0	1	13
OVEN	0	0	0	0	0	0	0	0	0	0	3	0	0	3	1	3	0	1	2	7	10
PHOE	0	0	0	0	0	2	0	0	1	1	0	1	2	7	0	0	1	0	0	1	8

	Developed Lakes					Moderately Developed Lakes									Undeveloped Lakes						
Species	Rhinehart	Helen	Jacqueline	Springville	Total	Bear	Emily	South Twin	Jordan	Adams	Rosholt	Sunset	Thomas	Total	Fountain	Skunk	Joanis	Wolf	Severson	Total	Grand Total
PIWO	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
PUFI	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
PUMA	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
RENU	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1
RBWO	2	0	0	0	2	0	0	0	1	0	2	0	0	3	0	0	0	0	1	1	6
REVI	1	1	2	0	4	1	1	0	0	0	2	1	1	6	5	5	2	0	0	12	22
RWBL	34	0	3	0	37	27	14	2	3	19	2	0	5	72	5	4	1	0	1	11	120
RBGR	2	0	0	0	2	1	0	0	0	0	0	1	0	2	0	1	0	3	3	7	11
RWSW	2	0	0	0	2	0	0	1	0	0	1	0	0	2	0	0	0	0	0	0	4
RTHU	0	1	1	0	2	0	0	0	0	0	0	1	0	1	0	1	0	0	0	1	4
SCTA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	2	2
SOSP	1	3	3	0	7	2	1	2	1	7	2	0	6	21	1	4	4	2	2	13	41
STAR	1	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
TRSW	3	1	0	0	4	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	5
WAVI	0	0	0	0	0	0	1	0	0	0	0	0	1	2	0	0	0	0	0	0	2
WBNU	0	1	0	1	2	0	0	0	1	1	2	2	2	8	2	0	0	1	0	3	13
YTVI	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	1	2
YEWA	0	0	0	0	0	0	0	0	0	3	2	0	0	5	0	0	0	0	0	0	5
Total	93	33	55	23	204	51	61	28	36	93	40	26	37	372	33	43	34	32	30	172	748

Appendix 3. Major guild associations of species detected (from Ehrlich et al., 1988).

Species	Food	Foraging	Nest Type	Nest Location
AMCR	omnivore	ground gleaner	cup	deciduous
AMGO	seeds	foliage gleaner	cup	shrub
AMRO	insects	ground gleaner	cup	deciduous
BAEA	fish	high patrol	platform	coniferous
BASW	insects	aerial foliager	cup	building
BEKI	fish	high dive	burrow	bank
BLCH	insects	foliage gleaner	cavity	deciduous
BWHW	insects	bark gleaner	cup	ground
BLJA	omnivore	ground gleaner	cup	coniferous
BWWA	insects	foliage gleaner	cup	ground
BRTH	omnivore	ground gleaner	cup	shrub
CATB	insects	ground gleaner	cup	shrub
CEWA	fruit	foliage gleaner	cup	deciduous
CHSP	insects	ground gleaner	cup	coniferous
COGR	omnivore	ground gleaner	cavity	deciduous
COYE	insects	foliage gleaner	cup	shrub
COHA	birds	aerial foliager	platform	deciduous
COWB	insects	ground gleaner	parasite	deciduous
DOWO	insects	bark gleaner	cavity	snag
EABL	insects	hawker	cavity	snag
EAKI	insects	hawker	cup	deciduous
EAPE	insects	hawker	cup	deciduous
FISP	insects	ground gleaner	cup	ground
GRCF	insects	hawker	cavity	deciduous
GRHE	fish	stalk and strike	platform	deciduous
HAWO	insects	bark gleaner	cavity	deciduous
HOFI	seeds	ground gleaner	cup	deciduous
HOWR	insects	ground gleaner	cavity	deciduous
HOSP	seeds	ground gleaner	cavity	building
INBU	insects	foliage gleaner	cup	shrub
LEFL	insects	hover gleaner	cup	deciduous
MODO	seeds	ground gleaner	saucer	deciduous
NOCA	insects	ground gleaner	cup	shrub
NOMO	insects	ground gleaner	cup	shrub

Species	Food	Foraging	Nest Type	Nest Location
OVEN	insects	ground gleaner	oven	ground
PHOE	insects	hawker	cup	bridge
PIWO	insects	bark gleaner	cavity	snag
PUFI	seeds	ground gleaner	cup	coniferous
NOOR	insects	foliage gleaner	pendant	deciduous
PUMA	insects	aerial foliager	cavity	snag
RENU	insects	bark gleaner	cavity	coniferous
RBWO	insects	bark gleaner	cavity	snag
REVI	insects	hover gleaner	cup	shrub
RWBL	insects	ground gleaner	cup	reed
RBGR	insects	foliage gleaner	cup	deciduous
RWSW	insects	aerial foliager	burrow	bank
RTHU	nectar	hover gleaner	cup	deciduous
SCTA	insects	hover gleaner	saucer	deciduous
SOSP	insects	ground gleaner	cup	ground
STAR	insects	ground gleaner	cavity	deciduous
TRSW	insects	aerial foliager	cavity	snag
WAVI	insects	foliage gleaner	cup	deciduous
WBNU	insects	bark gleaner	cavity	deciduous
YTVI	insects	foliage gleaner	cup	deciduous
YEWA	insects	foliage gleaner	cup	shrub