

Avifaunal species richness and diversity at the premises of the University of Sri Jayewardenepura, Nugegoda, Sri Lanka

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Abstract

A study on avifaunal species richness and the species diversity at the University of Sri Jayewardenepura, Nugegoda, Sri Lanka was carried out with the objective of identification of the bird species inhabiting the university, using fixed radius point count method from August 2004 to March 2005. Seven circular plots with a 50m radius and their centers at least 150m apart were selected to represent all the habitat types available at the University. Avifaunal populations in those seven plots were recorded from 6:00 hrs to 9:00 hrs, four times each month. Thirty two bird species belonging to eight orders and twenty three families were recorded during the study period. Those included three migratory bird species, Forest wagtail (*Dendronanthus indicus*), Asian paradise-flycatcher (*Terpsiphone paradisi*), Grey wagtail (*Motacilla cinerea*) and one endemic species Crimson-fronted barbet (*Megalaima rubricapilla rubricapilla*). Four bird species, Rose ringed parakeet (*Psittacula krameri*), Red vented bulbul (*Pycnonotus cafer cafer*) and Yellow billed babbler (*Turdoides affinis taprobanus*) were recorded in all seven sites. Endemic Crimson fronted barbet was recorded only in the site which had canopy trees. Seventeen avian species were recorded in all the months from August 2004 to March 2005. There was no significant difference of the species diversity among months. Site with *Casuarina equisetifolis* had the highest species richness of 25 and site covered with grass had the lowest species richness of 11. Relative abundance indicated that Common myna was the most common bird followed by the Red-vented bulbul. Long-billed sunbird and Indian pond heron were the least common birds followed by Oriental white-eye and Crimson-fronted barbet. Although the University is situated 2 km away from the well known aquatic bird sanctuary, Bellanwila – Attidiya marsh, no aquatic birds were recorded. The University provides habitats for thirty two avian species despite the fact that it is situated in a highly urbanized area, and thus warrants step to protect them.

Key words: Avifauna, species, richness, diversity

Introduction

Measurements of species diversity in urban areas are crucial for assessing the natural richness, biological value and the uniqueness of a particular area and indices of species diversity have been used widely in studies of environmental factors influencing avian community dynamics (Verner 1999). Birds are useful biological indicators in studying the urban wildlife, because they are ecologically versatile, respond to secondary changes resulting from primary causes and can be monitored relatively inexpensively. Evenden (1974) noted that relatively small areas of appropriate habitat attract high number of bird species. Universities exist within the confines of most cities and given the spacious landscaped setting, they offer suitable habitat for birds despite heavy human traffic (Swank 1955). Present study attempted to document the avian species diversity and the species richness in the premises of the University of Sri Jayewardenepura, Nugegoda, Sri Lanka with the aim of highlighting the need for a management plan to conserve and improve the avian community within the university.

Materials and Methods

The study was conducted at the university premises of Sri Jayewardenepura, Nugegoda, Sri Lanka. Study area was relatively small (111,178 m²) and was isolated from the surrounding community by a six foot high wall. It had an infrastructure of roads and buildings with sporadically planted trees, grassy areas in the form of a large play ground and irregularly trimmed shrubs and bushes planted for landscaping purposes. It also had several open large garbage disposal bins. The study area had a human population of about 10,000 and was prone to be extremely disturbed while the university was functioning. However, during the vacations it provided an ideal sanctuary to the birds and numerous other wildlife.

Seven circular plots with a radius of 50 m were selected to represent seven habitat types available at the university as 1. Mixed species vegetation, 2. *Casuarina equisetifolis*, 3. Willow trees, 4. Grass, 5. Large trees with thick crown cover, 6. Vehicle parking area, 7. Shrubs & bushes. Bird populations in these seven habitats were recorded from 6:00 hrs to 9:00 hrs, four times each month from August 2004 to March 2005, using the fifty meter fixed radius point count method (DeGraaf et al 1991, Ralph et.al 1993). Observations were made from the center of each plot. Birds detected outside the 50 m radius plot were not counted. After arriving at the plot, one-minute equilibration period was allowed which was followed by an eight-minute sampling period. Birds were observed through a 15~60x25 spotting scope and 25x45 binocular.

Monthly avifaunal species richness (S) was recorded and Shannon-Weiner Diversity Index {H'} and Shannon-Weiner evenness {J'} were calculated for

each habitat. Shannon-Weiner Index was calculated using the equation $H' = -\sum P_i \ln P_i$, where P_i = the proportion of the total sample belonging to the i^{th} species to measure the avifaunal diversity. Significance differences between the monthly diversity indices were calculated using the t test. $[t = (H_1 - H_2) / (\text{var } H_1 + \text{var } H_2)^{1/2}]$ (Magurran, 1980).

Results

Thirty two bird species belonging to eight orders and twenty three families were recorded within the university premises during the study period. These included three migratory bird species, Forest wagtail (*D. indicus*), Asian paradise flycatcher (*T. paradise*), Grey wagtail (*M. cinerea*) and one endemic species Crimson fronted barbet (*M. rubricapilla rubricapilla*) (Table 1).

Table 1. Diurnal bird species composition inside the University premises of Sri Jayewardenepura, Sri Lanka during the period of August 2004 - March 2005.

ORDER	FAMILY	COMMON NAME	SCIENTIFIC NAME
Ciconiiformes	Ardeidae	Indian pond heron	<i>Ardeola grayii</i>
Charadriiformes	Charadriidae	Red wattled lapwing	<i>Vanellus indicus</i>
Columbiformes	Columbidae	Rock pigeon	<i>Columba livia</i>
		Spotted dove	<i>Sreptopelia chinensis ceylonensis</i>
Psittaciformes	Psittacidae	Rose-ringed parakeet	<i>Psittacula krameri</i>
Cuculiformes	Cuculidae	Asian koel	<i>Eudynamis scolopacea</i>
		Greater coucal	<i>Centropus sinensis</i>
Coraciiformes	Alcedinidae	White throated kingfisher	<i>Halcyon smyrnensis</i>
Piciformes	Capitonidae	Brown headed barbet	<i>Megalaima zeylanica</i>
		Crimson fronted barbet	<i>Megalaima rubricapilla rubricapilla**</i>
Passeriformes	Picidae	Greater flameblack	<i>Chrysocolaptes lucidus stricklandi</i>
	Corvidae	House crow	<i>Corvus splendens</i>
		Forest wagtail	<i>Dendronanthus indicus*</i>
	Motacillidae	Grey wagtail	<i>Motacilla cinerea*</i>
		Paddy field pipit	<i>Anthus rufulus</i>
	Pycnonotidae	Red vented bulbul	<i>Pycnonotus cafer cafer</i>
	Oriolidae	Black hooded oriole	<i>Oriolus xanthoramus ceylonensis</i>
	Turdidae	Oriental magpie robin	<i>Copsychus saularis</i>
		Black-backed robin	<i>Saxicoloides fulicata leucoptera</i>
	Timaliidae	Yellow billed babbler	<i>Turdoides affinis taprobanus</i>
	Sylviidae	Common tailorbird	<i>Orthotomus sutorius sutorius</i>
	Monarchidae	Asian paradise flycatcher	<i>Terpsiphone paradisi*</i>
Nectariniidae	Paridae	Great tit	<i>Parus major</i>
	Nectariniidae	Purple sunbird	<i>Nectarinia asiatica</i>
		Purple rumped sunbird	<i>Nectarinia zeylonica zeylonica</i>
		Long billed sunbird	<i>Nectarinia lotenia lotenia</i>

Zosteropidae	Oriental white eye	<i>Zosterops palpebrosa</i>
Ploceidae	House sparrow	<i>Passer domesticus</i>
Estrildidae	White rumped munia	<i>Lonchura striata</i>
	Scaly breasted munia	<i>Lonchura punctulata</i>
Dicruridae	White bellied drongo	<i>Dicrurus caerulescens leucopugialis</i>
Sturnidae	Common myna	<i>Acridotheres tristis melanosternus</i>

* - Migratory Birds

** - Endemic Birds

Of the thirty two bird species recorded, three species were recorded in all seven sites where as the endemic Crimson fronted barbet was recorded only in site five (Table 2).

Table 2. Total number of birds recorded at different sites of the university during the period of August 2004 - March 2005.

COMMON NAME	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Total
Indian pond heron	0	0	0	0	4	0	0	4
Red wattled lapwing	2	0	2	97	0	0	5	106
Rock pigeon	3	0	0	0	0	0	80	83
Spotted dove	5	45	110	72	0	12	28	272
Rose-ringed parakeet	14	4	13	5	12	4	2	54
Asian koel	2	1	0	0	6	1	3	13
Greater coucal	3	2	0	0	0	0	1	6
White throated kingfisher	1	1	5	5	0	0	1	13
Brown headed barbet	6	5	8	2	2	3	0	26
Crimson fronted barbet	0	0	0	0	2	0	0	2
Greater flameblack	8	18	2	0	3	3	2	36
House crow	7	14	17	0	4	4	1	47
Forest wagtail	0	0	0	0	32	0	0	32
Grey wagtail	0	4	0	0	0	0	0	4
Paddy field pipit	0	0	0	52	0	0	0	52
Red vented bulbul	69	208	37	11	31	153	58	567
Black hooded oriole	12	91	9	1	0	8	2	123
Oriental magpie robin	6	30	10	5	0	19	8	78
Black-backed robin	0	13	0	0	0	0	65	78
Yellow billed babbler	73	186	80	105	42	42	48	576
Common tailorbird	15	15	0	0	4	7	20	61
Asian paradise flycatcher	0	16	0	0	0	0	0	16
Great tit	8	3	0	0	0	0	0	11
Purple sunbird	25	12	0	0	0	4	44	85
Purple rumped sunbird	1	5	0	0	0	3	32	41
Long billed sunbird	1	2	0	0	0	2	0	5
Oriental white eye	0	2	0	0	0	0	0	2

House sparrow	0	0	0	0	0	0	12	12
White rumped munia	0	5	23	0	0	7	3	38
Scaly breasted munia	6	4	4	0	0	0	0	14
White bellied drongo	7	47	10	0	8	14	2	88
Common myna	42	169	178	460	0	26	18	893
Total	316	902	508	815	150	312	435	3438

Site 1- Mixed Species Vegetation, Site 2 - *Casuarina equisetifolis*, Site 3 - Willow Trees,
Site 4 - Grass, Site 5 - Large trees, Site 6 - Vehicle Parking Area, Site 7 - Shrubs and Bushes

Of the migrating species, Forest wagtail was first recorded in October 2004 and occurred up to March 2005. Asian paradise flycatcher was recorded from November 2004 to March 2005 and Grey wagtail was recorded in December 2004 and February 2005. Seventeen species occurred within the university premises throughout the study period and their populations remained at approximately the same densities among months (Table 3).

Table 3. Number of individuals of each species of bird recored during the period of August 2004 to March 2005.

COMMON NAME	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Total
Indian pond heron	0	0	0	0	0	2	2	0	4
Red wattled lapwing	15	14	15	12	15	13	10	12	106
Rock pigeon	9	5	21	13	12	10	10	3	83
Spotted dove	42	38	32	40	42	35	27	16	272
Rose-ringed parakeet	5	12	20	6	2	2	4	3	54
Asian koel	2	2	0	2	0	2	3	2	13
Greater coucal	0	0	1	2	1	0	2	0	6
White throated kingfisher	2	0	1	3	3	3	1	0	13
Brown headed barbet	2	1	5	6	2	1	7	2	26
Crimson fronted barbet	0	0	0	0	0	0	2	0	2
Greater flameblack	3	4	1	11	9	6	0	2	36
House crow	5	4	4	5	5	10	7	7	47
Forest wagtail	0	0	2	4	4	2	4	16	32
Grey wagtail	0	0	0	0	2	0	2	0	4
Paddy field pipit	1	7	8	8	8	10	4	6	52
Red vented bulbul	40	59	106	91	69	84	63	55	567
Black hooded oriole	5	12	27	19	10	21	15	14	123
Oriental magpie robin	5	6	14	12	19	12	4	6	78
Black-backed robin	1	10	11	13	9	13	11	10	78
Yellow billed babbler	60	80	76	80	83	80	72	45	576
Common tailorbird	6	4	11	11	6	5	6	12	61
Asian paradise flycatcher	0	0	0	3	3	5	1	4	16
Great tit	0	0	0	5	5	1	0	0	11
Purple sunbird	2	5	13	14	10	13	12	16	85

Purple rumped sunbird	4	3	13	2	0	9	9	1	41
Long billed sunbird	0	0	2	0	0	2	1	0	5
Oriental white eye	0	0	0	0	0	0	2	0	2
House sparrow	0	0	8	2	0	2	0	0	12
White rumped munia	1	7	4	6	18	0	0	2	38
Scaly breasted munia	2	7	3	2	0	0	0	0	14
White bellied drongo	21	9	14	11	11	9	8	5	88
Common myna	74	77	113	130	117	180	103	99	893
Total	307	366	525	513	465	532	392	338	3438

Highest species richness of 27 species was recorded in November 2004 and February 2005. Lowest species richness of 21 species was recorded in September 2004. October 2004 had the highest species diversity and September 2004 had the highest evenness (Table 4).

Table 4. Monthly species richness evenness and Shannon-weine diversity, of the Avifauna recorded during the study period

	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar
Species richness (S)	22	21	25	27	24	26	27	22
Shannon-weine diversity (H')	2.30	2.37	2.50	2.49	2.44	2.29	2.44	2.39
Shannon-weiner evenness (J)	0.74	0.78	0.78	0.76	0.77	0.70	0.74	0.77

There was no significant difference of the species diversity among months. Lowest species richness was recorded among the grass habitat. Site two with *C. equisetifolis* had the highest species richness of 25 and site four covered with grass had the lowest species richness of 11 (Table 5).

Table 5. Species richness, diversity, evenness and Shannon - Weiner diversity of Avifauna recorded during the study period

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7
Species richness (S)	22	25	15	11	12	17	21
Shannon-weine diversity (H')	2.40	2.26	2.06	1.30	1.98	1.88	2.41
Shannon-weiner evenness (J)	0.78	0.70	0.76	0.54	0.80	0.66	0.79

Species diversity at sites with shrubs and bushes and mixed species vegetation was significantly highest among the other sites (Table 6).

Table 6 t value of the Significance test for Shannon Wiener Diversity Index between sites

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7
Site 1		t=2.024 df=572.644 p.001	t=4.712 df=604.076 p.001	t=15.194 df=654.963 p.001	t=4.511 df=347.234 p.001	t=5.531 df=597.390 p.001	t=-0.201 df=580.278 p.001
Site 2			t=3.618 df=1338.425 p.001	t=17.241 df=1549.95 p.001	t=3.464 df=234.911 p.001	t=4.647 df=472.270 p.001	t=-2.872 df=1098.589 p.001
Site 3				t=13.163 df=1316.895 p.001	t=1.002 df=252.342 p.001	t=2.221 df=499.480 p.001	t=-6.214 df=994.579 p.001
Site 4					t=-8.253 df=268.117 p.001	t=-6.839 df=529.406 p.001	t=-19.243 df=1135.148 p.001
Site 5						t=1.015 df=413.803 p.001	t=-5.288 df=248.411 p.001
Site 6							t=-6.408 df=489.209 p.001

Relative abundance indicated that common myna was the most common bird followed by the Red vented bulbul. Common mynah, Yellow billed babbler, Red vented bulbul and Spotted dove accounted for 67.13% of the total population. Long billed sunbird and Indian pond heron were the least common birds followed by Oriental white eye and Crimson fronted barbet (Table 7).

Table 7. Relative abundance of the birds at the university of Sri Jayewardenepura.

Common Names	Relative Abundance
Common myna	25.97
Yellow billed babbler	16.75
Red vented bulbul	16.49
Spotted dove	7.91
Black hooded oriole	3.58
Red wattledlapwing	3.08
White bellied drongo	2.56
Purple sunbird	2.47
Rock pigeon	2.41
Oriental magpie robin	2.27
Black-backed robin	2.27
Common tailorbird	1.77
Rose-ringed parakeet	1.57
Paddy field pipit	1.51
House crow	1.37
Purple rumped sunbird	1.19
White rumped munia	1.11
Greater flameblack	1.05
Forest wagtail	0.93
Brown headed barbet	0.76
Asian paradise flycatcher	0.47
Scaly breasted munia	0.41
Asian koel	0.38
White throated kingfisher	0.38
House sparrow	0.35
Great tit	0.32
Greater coucal	0.17
Long billed sunbird	0.15
Indian pond heron	0.12
Grey wagtail	0.12
Crimson fronted barbet	0.06
Oriental white eye	0.06

Discussion

Species richness is linked pervasively to ecosystem productivity (Wilson 1992, Rozenzweig and Abramsky 1993, Wright et al., 1993, Waide et al., 1997). Holmes et al (1991) identified changing food abundance as one of the major reasons that affects the bird species richness in a particular area. Common mynah, Yellow billed babbler, Red vented bulbul and Spotted dove that accounted for 67.13% of the total population recorded are generalists. The open garbage disposal bins located inside the university premises provided these birds with ample food which in turn resulted in their presence in higher numbers.

The presence of insects in and around the garbage disposal sites attracted fly catching species like Asian paradise flycatcher (*T. paradise*) and White bellied drongo (*D. caerulescens leucopugialis*). Fallen litter under the trees provided suitable foraging sites to the migratory bird species, Forest wagtail (*D. indicus*) and Grey wagtail (*M. cinerea*). However, the low number of endemic species, Crimson fronted barbet (*M. rubricapilla rubricapilla*) could be attributed to the lack of fruiting trees within the university premises.

Low species richness observed at site four which was covered with grass indicated that large grassy areas are not the preferred habitat of many bird species. However, grassy areas are vital for species such as Red wattled lapwing and Paddy field pipit as they are highly dependent on grassy areas for foraging and nesting sites. Large uninhabited open spaces are becoming increasingly rare in the environs of Colombo. Even in the university of the Sri Jayewardenepura, open spaces are becoming scarce as more and more buildings are put up to accommodate increasing student intakes. Hence, it is of utmost importance to preserve the remaining open grassy areas in the universities and the shrubs to provide a suitable habitat for grass habitat dependent bird species.

In contrast, site two with *C. equisetifolis* trees had the highest species richness. Birds at the university were prone to high disturbances both by pedestrians and passing vehicles. At such times it was vital to have suitable perching and resting sites. *C. equisetifolis* trees offered the avian species vital perching and resting sites which contributed for the high species richness at this site.

Except for the three migratory bird species and the endemic Crimson fronted barbet other species including Common mynas, Yellow billed babblers and Spotted doves are known to live in close proximity to human habitations. They are common in city environs which may have contributed to the similar avian species richness among months.

The conservation implication of present findings is that the availability of different habitat types enhances the bird species richness within the university premises of Sri Jayewardenepura, Gangodawila, Nugegoda. However, no aquatic birds were observed inside the university despite the fact that the Bellanwila-Attidiya marsh which is a known aquatic bird sanctuary of Sri Lanka is located about

two kilometers away from the study. Except for a few Indian pond herons other common semi aquatic birds including egrets and water hens were not recorded within the university. Hence, by providing suitable water features such as shallow ponds the management can attract the water birds and increase the avian species richness inside the university. The present study also demonstrated that the university premises have a high bird species richness of thirty two avian species. Hence the management should carefully evaluate the adverse impacts of further developments of the university on the avian community and take necessary steps to minimize mitigate such impacts and improve these important resources

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References

- DeGraaf, R.M., A.D.Geis, and P.A. Healy, 1991. Bird population and habitat surveys in urban areas, *Landscape and Urban Planning* 21: 173-180.
- Evenden , F.G.,1974. Wildlife as an indicator of a quality environment. Pp 19-21 in A symposium on wildlife in an urbanizing environment (J.H. Noyes and D.R. Progulske, eds.) Univ.Mass.Coop, Ext. Serv., Amherst, MA. 182pp.
- Holmes, R.T., T.W.Sherry, F.W.Sturges. 1991. Numerical and Demographic responses of temperate forest birds to annual fluctuations in their food resources. *Proceedings from the XX th International Ornithological Congress*: 1559-1567.
- Ralph ,C.J., G.R. Geupel, P.Pyle, T.E. Martin, and D.F. DeSante, 1993.*Handbook of field methods for monitoring landbirds*. General technical report PSW-GTR-000. U.S. Forest Service Pacific South-West Research Station, Albany, California.
- Rozenzweig , M.L., and Z. Abramsky. 1993, How are diversity and productivity related? Pp. 52-65. *Species Diversity in Ecological Communities* (R.E.Ricklefs and D.Schluter,eds.). Chicago IL: University of Chicago Press
- Swank, W.G. 1955. Nesting and production of the mourning dove in Texas. *Ecology* 36: 495-505.
- Verner, J., 1999. Assessment of counting techniques. P 247-295. *Forestry Science Laboratory Press*. California.

Waide R.B., D.J.Lodge, Camilo, and W.Silver. 1997. Biodiversity at the LUQ Long – term Ecological Research Site. http://atlantic.evsc.virginia.edu/LTER_biod//luq.html

Wilson, E.O. 1992. The diversity of life. Harvard Univ. Press, Cambridge, MA. 424pp.

Wright D.H., D.J.Currie, and B.A.Maurer., 1993. Energy supply and patterns of species richness on local and regional scales. Pp.66 – 74. Species Diversity in Ecological Communities (R.E.Ricklefs and D.Schluter, eds.). Chicago IL: University of Chicago Press.