

AVIAN DIVERSITY WITH THE VARYING URBAN CONGESTIONS OF LAHORE

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ABSTRACT

A correlative study, testing the impact of urban congestion in Lahore upon the bird abundance and diversity, was conducted in the monsoon and winter season. A platform of 6 feet diameter and 4 feet height, with a variety of seeds, was offered to attract the grainivorous birds. The number and variety of birds visiting the feeding station was noted from dawn to dusk after a period of 6 day installation, which depicted the bird's urbanization in the area. A significant increase in the abundance of birds was observed in the winter season. Densely populated areas had the highest number of sparrow and pigeon population, whereas, areas with large sized pockets of vegetation supported the largest diversity of birds. Grain preference of the birds was also recorded in the different areas studied, which showed a relationship between the age long practices of feeding birds, with the habituation of birds. A total of 49 species of birds were observed in Lahore. The highest number of birds were observed in Nishtar Town followed by 41 species in Wagah Town. The most congested areas of Shalimar town and Ravi Town showed only 2 to 3 species which were urbanized enough to visit the feeding station. Nishtar Town had a maximum diversity of species of grainivorous birds visiting the table in the winter season. Bajra (*Pennisetum glaucum*), Indian Millet (*Setaria italica*) and Red Indian millet (*Setaria italica*) were the preferred type of seeds in all areas, while Mustard seeds (*Sinapis alba*), Corn (*Zea mays*) and Chick peas (*Cicer arietinum*) were the seeds of least preference.

Key Words: Urban congestion, avian diversity, point count method, feeding station, Pearl millet, Grain preference, Towns of Lahore.

INTRODUCTION

The avifauna of the world, like most other organisms, are a part of the food web. Each species has its unique ecological niche. Not only do birds help in pollination, these also help to biologically control the pest populations. These birds help to maintain the various carnivorous and omnivorous populations of the world and are reared worldwide for not only this purpose but for products such as down feathers too (Simeone *et al* 2002).

The local extinction of the Vultures, from the Punjab plains, has brought to light the importance of birds as scavengers since many road kills remain for days on the road, waiting to be picked up by the municipal committees, as other scavenger birds like Pariah Kite, Mynas and crows, in spite of their increased populations, are no match for the Vultures and their keen sense of detecting carcass.

Urbanization is a cyclical process through which a nation passes as it evolves from an agrarian to an industrial society. With a growing population and its increasing demands for industrialization and luxury, a mass shift has been observed from rural to urban areas. Statistical analysis reveals that an expected 92% of urban population growth will be observed in the developing countries during the next twenty years (Carr, 2009).

Lahore is the second largest city of Pakistan after Karachi. In 1941, the population of the city was 672,000 however, in 2008 this had risen to 10 million people. (Punjab Development Statistics 2010.)

To support such a growing population bomb, not only is the congestion in the city increasing, but the areas surrounding the city have also been encroached upon. Virgin areas supporting natural flora and fauna have been ravaged to be replaced by buildings. Most of the native vegetation has been replaced by the more pleasing exotic plant species. This type of vegetation, being foreign for the local fauna, usually drives away the diversity of species and only the fauna which is more tolerant to change is either left behind, or gradually moves in to this new habitat.

As a result of the invasion of exotic species in the urbanized areas, the native species are lost leading to biological homogenization which poses a threat to the biotic uniqueness of the local ecosystems (Mc Kinney 2005).

Species threatened by urbanization also tend to be threatened by agriculture, recreation, roads and many other human impacts, emphasizing the uniquely far reaching transformations that accompany urban sprawl (Mc Kinney 2005).

Species richness and abundance increases with decreased urbanization levels, both these variables were positively related to native vegetation and vegetation

cover, however, negatively related to construction, car rate, pedestrian rate and also the abundance of *Columba livia* (Villegas and Zavala 2010).

The newly emerging diseases might be a result of disturbed food webs which leads to an increase in the use of pesticides. A management plan has to be set and the behaviour of different species in question has to be studied, so that not only the amount of pesticides used is curbed but the niche of the animals can also be conserved.

MATERIALS AND METHODS

Lahore, the second largest city of Pakistan was selected as the study site. The point count method of bird counting was used and birds were identified using field guides and books like, Roberts (1991), (1992), Grimmett *et al.* (2001), Mirza (2007). A detachable table of six feet diameter and four feet height was designed and assembled to be used as a bird feeding station (Figure-1). The table top, made of hard board, for durability and light weightness, was designed to be foldable so that it can be carried from one station to the other with ease. However, as hardboard cannot withstand the changing weather conditions, such as moisture and rain, (it swells up) it was painted and covered by a dull grey plastic sheet to protect the hardboard from water. The plastic was tied upon the table top in such a way that the table top was partitioned into four quadrants.



Figure: Seeds set out in different quadrants of the feeding station

A round earthen dish, full of water, was placed in the center of the table top. A variety of seed types were spread out in different quadrants on the table to attract a variety of grainivorous birds and also to keep a check on the food preferences of birds of the different localities. The type of seeds set out in the different quadrants was noted each time (Table-1).

Table: 1 Types of seeds offered to the birds at the feeding station:

Common English Name	Common Urdu name	Scientific name
Sunflower seeds	Suraj Mukhee	<i>Helianthus annuus</i>
Chick Peas	Kalay Chanay	<i>Cicer arietinum</i>
Wheat	Gandam	<i>Triticum aestivum</i>
Barley	Jao	<i>Hordeum vulgare</i>
Rice	Chawal	<i>Oryza sativa</i>
Pearl Millet	Bajra	<i>Pennisetum glaucum</i>
Italian Millet	Kangani	<i>Setaria italica</i>
Red Italian Millet	Laal Kangani	<i>Setaria italica</i>
Mustard seeds	Rai kay danay	<i>Sinapis alba</i>
Corn	Makae	<i>Zea mays</i>
Safflower seeds	Kurtam	<i>Carthamus tinctorius</i>

The feeding station was set up in the residential areas of the nine administrative towns of Lahore to check the effect of urbanization on the birds in the different towns of Lahore namely; Aziz Bhatti Town, Allama Iqbal Town, Data Ganj Bakhsh town, Gulberg Town, Nishtar town, Ravi Town, Samnabad Town, Shalimar Town, Wagah Town.

The target population of birds was the grainivorous birds of Lahore. A set amount of seeds (500 grams) were scattered on the feeding station and the station was left for a week to ensure that the birds get used to the food and water on the feeding station. The station was set up preferably in a place that could be observed from inside a room so that the birds would not be disturbed by human presence. After seven days, the number and variety of birds, visiting the feeding station, was noted from sunrise till darkness, to test the utilization of the forage site set out for the birds by humans. This practice was repeated on all nine stations in both monsoon and post monsoon winter. The number of visits by the different bird species was noted. The species abundance and diversity was noted. A note was made of the quadrants that were most visited by a certain specie of bird to check for food preferences. A general survey of the area was made to assess the vegetation, and the population density of the area.

The types of birds in the area were observed in both the seasons by using Binoculars Model NZ 1083250. Data collected was correlated, using the Pearson coefficient of correlation, with the secondary data of urban congestion taken from the Punjab Bureau of Statistics using Minitab software 16.

RESULTS AND DISCUSSION

A total of 49 species (Table-2) of birds were observed in Lahore. The highest number of birds was observed in Nishtar Town (43 species), followed by 41 species in Wagah Town. This is cause for concern as this result is only 13.6% of the 375 species present in Lahore (Grimmett 2001) and the

Table-2 Avian Diversity in different towns of Lahore.

Common Name	Scientific name	Allama Iqbal Town	Aziz Bhatti Town	Data Ganj Baksh Town	Gulberg Town	Nishtar Town	Sammabad Town	Shalamar Town	Ravi Town	Wagah Town
Alexanderan Parakeet	<i>Psittacula eupatria</i>	*				*				*
Bay Backed Shrike	<i>Lanius vittatus</i>		*			*				*
Bank Myna	<i>Acridotheres ginginianus</i>	*				*				*
Bar Tailed Tree Creeper	<i>Certhia himalayana</i>				*	*				*
Baya Weaver Bird	<i>Ploceus philippinus</i>	*				*				*
Black Drongo	<i>Dicurus macrocercus</i>	*	*			*			*	*
Black Red Start	<i>Phoenicurus ochruros</i>				*	*		*		*
Blue Rock Pigeon	<i>Columba livia</i>	*	*	*	*	*	*	*	*	*
Cattle Egret	<i>Bubulcus ibis</i>	*				*				*
Common babbler	<i>Turdoides caudata</i>			*	*	*				*
Common Myna	<i>Acridotheres tristis</i>	*	*	*	*	*	*	*	*	*
Copper Smith barbet	<i>Megalaima haemecephala</i>				*	*				*
Crow Pheasant	<i>Centropus sinensis</i>					*				*
Crows	<i>Corvus splendens</i>	*	*	*	*	*	*	*	*	*
Golden Backed Woodpecker	<i>Dinopium benghalense</i>	*		*	*	*				*
Golden Oriole	<i>Oriolus oriolus</i>	*				*				*
Hoopoe	<i>Upupa epops</i>	*		*	*	*				*
House Sparrow	<i>Passer domesticus</i>	*	*	*	*	*	*	*	*	*
Indian Grey Hornbill	<i>Ocyrceros birostris</i>			*	*	*				*
Jungle Babbler	<i>Turdoides striata</i>			*		*				*
Kites	<i>Milvus migrans</i>	*	*	*	*	*	*	*	*	*
Koel	<i>Eudynamys scolopaceus</i>	*	*			*	*			*
Little Green Bee Eater	<i>Merops orientalis</i>	*				*				*
Little Brown Dove	<i>Stigmatopelia senegalensis</i>	*	*	*	*	*	*	*	*	*
Oriental magpie Robin	<i>Copsychus saularis</i>			*	*	*				*
Purple Sunbird	<i>Cinnyris asiaticus</i>	*	*	*	*	*	*		*	*
Pond Heron	<i>Ardeola grayii</i>	*			*	*				*
Rose Ringed Parakeet	<i>Psittacula krameri</i>	*	*	*	*	*	*	*	*	*
Red Breasted flycatcher	<i>Ficedula parva</i>	*			*	*				*
Red Vented Bulbul	<i>Pycnonotus cafer</i>	*	*	*	*	*	*	*	*	*
Red Wattled Lapwing	<i>Vanellus indicus</i>	*				*				*
Ring necked Dove	<i>Streptopelia capicola</i>	*	*	*	*	*	*		*	*
Silver Bill	<i>Euodice malabarica</i>	*		*		*				*
Spotted Owlet	<i>Athene brama</i>	*			*	*				*
Tailor Bird	<i>Orthotomus sutorius</i>			*	*	*				*
Yellow Footed Green Pigeon	<i>Treeron phoenicoptera</i>	*	*	*	*	*	*		*	*
Yellow Wagtail	<i>Motacilla flava</i>					*				
Pond Heron	<i>Ardeola grayii</i>	*	*			*				*
Pied Wagtail	<i>Motacilla alba</i>			*	*	*				*
White breasted King Fisher	<i>Halcyon smyrnensis</i>	*	*			*	*		*	*
White Browed Fantail Flycatcher	<i>Rhipidura aureola</i>				*	*				*
Wire tailed swallow	<i>Hirundo smithii</i>		*		*	*	*			*
Brown Rock Chat	<i>Cercomela fusca</i>									*
Pied King Fisher	<i>Ceryle rudis</i>	*	*							*
Sand Martin	<i>Riparia riparia</i>									*
Pied Starling	<i>Gracupica contra</i>				*					*
Indian Roller	<i>Coracias benghalensis</i>									*
Oriental White Eye	<i>Zosterops palpebrosus</i>				*					*
Common House Martin	<i>Delichon urbicum</i>	*	*	*	*	*	*	*		□
Common House Swift	<i>Apus affinis</i>	*		*						

surrounding areas. This is a clear statement, that urbanization in Lahore is playing a significant role in the loss of biodiversity especially birds. The most congested areas of Shalimar town and Ravi Town showed only 2 to 3 species which were urbanized enough to visit the feeding station. Nishtar Town had a maximum diversity of species of grainivorous birds visiting the table in the winter season (6 species in the winter season.)

The types of seeds, consumed by the birds, according to preference were:

- 1) Bajra (*Pearl Millet*) and Rice (*Oryza sativa*)
- 2) Italian millet and Red Indian Millet (*Setaria italic*)
- 3) Sunflower seeds (*Helianthus annuus*) and Wheat (*Triticum aestivum*)
- 4) Safflower seeds (*Carthamus tinctorius*) and Barley (*Hordeum vulgare*)

- 5) Chickpeas (*Cicer arietinum*), Corn (*Zea mays*) and Mustard seeds (*Sinapis alba*)

It was observed that if House Sparrows are fed a single type of seed through the years i.e. Pearl millet in Aziz Bhatti Town, the birds get used to the feed and stop considering other types of seeds edible.

The Pearson coefficient of correlation with a P value of 0.6 shows a weak correlation between the number of House Sparrows and the population congestions. The P value which is above 0.5 i.e. 0.6 shows that the results obtained are significant. The difference between two means shows that there was a very significant difference between the birds that visited the station in summer and winter seasons (Table, 2 and 3).

Table 2: Number of birds visiting the feeding station in the Summer Season: (July2010-September 2011.)

Name of Town	House Sparrows	Laughing Dove	Blue Rock Pigeon	Silver Bill	Common Babbler	Common Myna	Ring-necked Dove	Rose Ringed Parakeet	Red Vented Bulbul	Bank Myna
Aziz Bhatti Town	169	7	5	0	0	0	1	0	0	0
Nishtar Town	375	5	0	29	0	0	0	0	0	0
Gulberg Town	1266	19	0	0	35	0	0	0	0	0
Wagah Town	217	0	0	0	0	0	0	0	0	0
Data Gunj Baksh Town	59	18	0	8	0	0	0	0	0	0
Allama Iqbal Town	5	0	0	0	0	5	0	0	0	0
Shalimar Town	110	0	0	0	0	0	0	0	0	0
Ravi Town	239	0	8	0	0	0	0	0	0	0
Samnabad Town	289	13	17	0	0	0	0	0	0	0

Table 3: Number of birds visiting the feeding station in the Winter Season: (December 2010- February 2011.)

Name Of Town	House Sparrows	Laughing Dove	Blue Rock Pigeon	Silver Bill	Common Babbler	Common Myna	Ring-necked Dove	Rose-ringed Parakeet	Red-vented Bulbul	Bank Myna
Aziz Bhatti Town	122	2	0	0	0	7	0	0	0	0
Nishtar Town	2164	5	0	0	0	2	4	11	32	0
Gulberg Town	1164	30	0	0	16	0	2	0	0	0
Wagah Town	664	1	0	0	0	4	0	0	0	11
Data Gunj Baksh Town	258	4	0	18	0	5	0	0	7	0
Allama Iqbal Town	12	0	8	0	0	0	0	0	1	0
Shalimar Town	241	1	0	0	0	0	0	0	0	0
Ravi Town	985	3	35	0	0	0	0	0	0	0
Samnabad Town	310	11	2	0	0	0	0	0	0	0

A considerable amount of research has been done on the urban avian diversity of Lahore by many scientists like Saeed (2004), Mahmood (2000), Masood (2004), however urban congestion of Lahore in different towns was never considered for different species of birds. In this study, a correlation was sought between population congestions in different towns and the number of birds that would come to feed at the feeding station. The target population of birds was that of grainivorous birds, as fruits and flesh would have invited a number of Crows and Kites, which would have affected the result.

Statistical analysis however showed that there is no strong correlation between the number of birds visiting the feeding station and the population congestion of the different towns of Lahore. The weak correlation between urban population congestion and the number of House Sparrows can be explained as the amount of congestion in the area has no effect on the number of House Sparrows in the area. This is because House Sparrows, Pigeons, Doves, Babbler and Silver Bills adapt easily to human settlement. Shy species of grainivorous birds did not come to the feeding station at all.

A marked difference was observed in the number of House Sparrows counted in both the seasons. Karr (1976) supports this observation, that seasonal variation and rainfall affects the abundance of food resources, especially the number of insects and seasonal fruits which the avifauna exploits. This Result was consistent in all the towns of Lahore except Aziz Bhatti Town and Gulberg Town. The rise in numbers in the winter season was because there is a drop in the availability of insects in the winter season and the agricultural fields in the outskirts of the Town were not in the fruiting season yet. The number of birds feeding at the station increased in the winter season for all birds. The feeding station was left in the town for a week before the reading was taken, this was done so that the birds get used to the apparatus and do not consider it as a possible threat. Observations during the summer seasons showed that the birds seemed to prefer insects over seeds; this was perhaps, because the Monsoon season results in an abundance of insect species and the birds fulfill their protein requirements in this season. This is primarily the breeding and egg laying season for most of the bird species that were observed (Saeed 2004). Seed of preference in all places was Bajra (Pearl Millet), and Rice, followed by Indian Millet and Red Millet, when the amount of Pearl millet, Rice and Red Millet decreased, Sunflower seeds and Safflower seeds were consumed. Seeds of least preference were Chick Peas, Mustard Seeds, and Corn.

Allama Iqbal Town: The feeding station was left in the Asif Block of Allama Iqbal Town area for a week. The area of study was devoid of tall trees, the few tree that were on the main road were those of medium size and did not seem to be very good roosting sites for birds. Although the reading was taken from 5:30 till 7:00 pm, no birds were observed during the whole day. To test for shyness of the birds in the area, the station was left for another week, however, only five house sparrows and five Common Myna visited the feeding station. Many houses in the neighborhood had small containers on their roofs and terraces in which bread (Roti) could be observed; this explained the abundance of Crows in the area. Observations made in the other towns suggest that the presence of Crows was somewhat disturbing for the sparrows. Allama Iqbal Town has an area of 387,437sq m and a population of 567,000 (Population Census Report, 1998). This number was estimated to have risen to 773,000 in 2010. Congestion calculated for the area is 1.463 which is low compared to the other towns. The absence of grainivorous birds in the area except for a few House Sparrows was possibly because of the kitchen scraps given to the birds which attracted crows and mynas which possibly scared away the major avian diversity. The lack of roosting sites in the form of vegetation, however, was remarkable. The Punjab

University which is spread out on 1781 acres of land is also a part of this town. It maintains its own agricultural fields, apiaries, and fish farms. These areas are good sites for food and shelter so the birds possibly prefer the area of vegetation and insect diet over the bare lanes of Asif Block. The winter season however, brought in a few more birds to the area possibly because the crops in the fields had not matured yet and the insect population was not enough.

Aziz Bhatti Town (Infantry road): Aziz Bhatti town was the fifth largest town of Lahore covering an area of 74,554 sq m and a population size of 414,000 revealing a congestion of 5.55 persons per sq m. The area does not have much vegetation around. A channel of the BRB canal passes at a distance of about 1 Km from the study site. The monsoon season resulted in an increase in the insect population and many birds were observed preferring insects over seeds. Birds first sat on the wires nearby before they perched on the table showing cautious behaviour. While some birds were facing the food, the others kept a vigilant eye looking for predators. A strange observation was made that the House Sparrows chose to feed exclusively on the Pearl Millet (Bajra), in both the seasons, and left the other seeds undisturbed. Winter and summer survey, and comparison with the other towns suggest that the birds in this area have accustomed themselves to only Pearl Millet as food among seeds. A general survey of the vicinity showed that the residents usually give out Pearl Millet to the birds and the birds only see it as food even when there is an abundance of other seeds.

Data Ganj Bakhsh Town (Mall road opposite high court): With a total Population of 712,000 persons according to the 1998 census and an area of 28,110 sq m. Data Ganj Baksh ranks the second highest in congestion i.e. 25.33 persons per sq m. It is one of the smallest towns of Lahore, equal in size to Gulberg Town and larger in size only to Samanabad Town. Observations at the town showed that House Sparrows chose to feed on organisms in the soil as compared to the seeds on the table. Approximately eighty Pigeons sat on the eaves of the church nearby but none of them came to feed at the station. It was observed in all the Towns that although the town may have a number of Blue Rock Pigeons very few of them come to feed from a new area within seven days. A number of dividers in the road such as the crossroad at China Chowk, The Gun opposite the Museum at the Mall Road, the road divider, opposite the State Bank were examples of areas where, over the years, people have been giving out seeds for the birds. Although these were the areas of very high traffic flow, a large number of Blue Rock Pigeons descend to the ground to feed on the seeds, almost oblivious of the traffic.

About 10 Hoopoes were observed feeding, simultaneously, in the lawn where the station was set at

Data Ganj Baksh, this indicated an abundance of protein meal such as ants and worms in the soil. No birds were observed at the feeding station till 6:30 am, this was strange, as previous studies on estimating bird Density state that the optimal time to count birds was during the first four hours after sunrise. (Ding *et al* 2005). There was an obvious abundance of dragonflies in the area. Many House Swifts were observed flying with their mouth open over small shrubs. This has also been observed by Lack and Owen (1955). Turner, (1984) has seen a similar behaviour in House Martins whose biomass increases with the abundance of airborne insects especially Dragonfly. The nests of these House Swifts could be seen in the corners of ceilings of buildings. None of these house swifts were observed in the winter season, their abandoned nests had been taken over by the house sparrows. It was observed that during the winter months, even though it was light outside, the birds did not come to feed at the station till 8:30 am when the warm rays of the sun directly hit the feeding station. This behaviour was also observed in Aziz Bhatti Town and Gulberg Town.

Gulberg Town (Gulberg III): Area wise Gulberg Town and Data Ganj Baksh Town were similar in size, (28,110 sq m) however; a total population of 571,000 persons according to the 1998 determines congestion level, 20.31, which is less than that at Data Ganj Baksh Town. The Gulberg Town is generally a residential area of the elite class. Large areas of the town have been commercialized with big shopping areas such as the liberty market, Hafiz Center, Pace, etc. However, this area has a considerable amount of vegetation. Most of the houses have big lawns with many exotic and sometimes native trees. People take interest in plants and invest in the beautification of these gardens, which are seen as status symbols.

Contrary to observations at Aziz Bhatti Town, birds in this area fed on all types of seeds. It was observed that a pair of Laughing Doves, while feeding at the station, did not allow a third one to sit on the table. Many laughing doves and Ring necked Doves were observed sitting under the table but none on the table. When the Common Babbler first visited the table, it did not allow any other bird to feed at the table by flapping its wings, chasing and chirping loudly. This behavior, however, stopped after a while when the bird got tolerant of the other species. The birds chose to feed on the insects to fulfill their protein requirement of the year. The number of birds visiting the site decreased in the afternoon. This can be explained as the birds, having digested their food during the night, need to fill their crops which when full by the afternoon can sustain the birds till evening time when bird activity increases again to withstand the periods of darkness. Birds ate all types of seeds, however, Bajra was the first to be consumed.

The Common Babbler seemed to have gained weight during the winter season. This is a very common

occurrence in the migratory birds. Although, the Common Babbler was considered a resident of the plains, Gaston (1981) states that the weight of birds is correlated inversely to the mean temperature during the season. A few Kite's nests were observed on the Eucalyptus trees in the vicinity, and upon close observation with the binoculars, a total of five metal coat hangers were observed decorating the Kite's nest. As stated by Rowland (2008) this behaviour of decorating the nest is also common in Bower Birds. Birds had consumed all types of seeds however the seed of least preference was again Chick Peas, Mustard Seeds and Corn.

Nishtar Town (Askari III Baidian Road): Area wise Nishtar Town was the largest town of Lahore. It ranks in the second least congested area with a congestion level of 1.44 It lies on the outskirts of the city and has many open areas that were being converting from agricultural land into residential areas. The City's Airport was also a part of this town. Birds seem to stay for longer at the feeding station. Silver bills seem to feed for long periods than house sparrows. In the study it was observed that Silver Bills were only found in the areas where there was more vegetation. Contrary to the observations at the other study sites and to the literature reviewed, (Ding *et al* 2005), the number of birds visiting the feeding station increased in the afternoon of the summer season. This was perhaps because the cloud cover in the sky threatened showers; the birds seemed to react to this, by rushing to the feeding station as if in a hurry to appease their appetite before the rain started. Birds in this area fed on all types of seeds, however, Chick Peas, Mustard Seeds and Corn seem to be the seed of least preference. The feeding station was visited by Rose Ringed Parakeet of both genders in the winter season. These birds fed exclusively on Safflower seeds (*Carthamus tinctorius*) and did not seem to be interested in any other type of seed even though Sunflower seeds, which is the food of choice among pet Parakeets, had been present in clear view. This observation was also explained by (Ullrey *et al* 1991) who states that a difference in diets occurs in the captive birds and their wild relatives which co-evolved with their food supplies.

Ravi Town (Shairan Wala gate): Area wise, Ravi Town was the fifth largest town of Lahore with a congestion level of 21.63 which is the fourth highest among the towns. The level of congestion in the residential areas was however, much higher as most of the residential areas especially the study site was in the walled city. Although a large amount of seeds were put out on the table to suffice for a week in each town, this was the only town where the seeds finished on the very first day. This is because most of the residents of the town give out seeds to the birds and this practice has continued since centuries and is considered a part of the culture. As a large quantity of seeds was offered to the birds and

because the rooftops are very close to each other, the birds probably did not consider the feeding station as something out of the ordinary. While it took about four or five days for the birds to get used to the feeding station at all the other towns, the birds at Ravi town, not only started visiting the feeding station on the first day but also finished off all the seeds on the very first day.

Samanabad Town (N Block): This was the third smallest town with a population congestion of 22.72. This town too has very little vegetation which is why only thirteen species of birds were observed in this town. Most of these birds were totally urbanized and have learnt to live with humans. Residents' claim, that the Pigeons and Doves feasted on the wheat seeds, showed that very few house holds put out food for the birds. The offering of variety of the seeds, to the birds of the area, showed an obvious preference for pearl millet and rice followed by Italian and Red Millet.

Shalimar Town (SinghPura): Shalimar town was also one of the smallest town of Lahore with the population congestion of 31.8. Being small and centrally located, and with the highest level of congestion, this area does not support much avian diversity. This was also because large areas of the town are devoid of vegetation and the number of gardens are very far spaced. These possibly support and act as the only refuge place of the birds. As these gardens were properly cared for and have mostly exotic trees and very little native vegetation, only those species which can live in this type of vegetation survive there. If these birds want to increase their distribution, they would prefer vegetation for roosting sites. Hence, the residential areas only get the most urbanized birds.

Wagah Town (Batapur): Wagah Town was the third largest town of Lahore with the population congestion of 1.325. It lies on the out skirts of Lahore. The study site can be considered as part of the suburban area of Lahore. This explains the largest diversity of birds present in the area. The number of birds that visited the feeding station was however very low especially in the summer. This was because of large fields of crops and the native vegetation of the areas, which not only provide good roosting sites but also act as a good source of food for the birds. As the natural food source of the birds is available, they preferred to feed there instead of visiting the feeding station, that was a man made construction. In the winter season, however, the case was different as the crops were not in the seeding season and the number of insects available during the summer season had decreased as the season changed. The number of House Sparrows that foraged at the feeding station in the winter season increased three fold. Not only did the abundance increase but the diversity of birds at the feeding station also increased during the winter season.

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