Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
www.entomoljournal.com
JEZS 2024; 12(6): 122-138

Received: 03-11-2024
Accepted: 06-12-2024

Bhargavi L Thaker
Laboratory Assistant, Department of Biology, Christ College, Vidya Niketan, Nr. Saurashtra University Campus, Rajkot, Gujarat, India

Dr. Bhupat B Radadia
Associate Professor, Department of Biology, Shri M. & N. Virani Science College, Saurashtra University, Kalawad Road, Rajkot, Gujarat, India

Corresponding Author:
Bhargavi L Thaker
Laboratory Assistant, Department of Biology, Christ College, Vidya Niketan, Nr. Saurashtra University Campus, Rajkot, Gujarat, India

A comparative study of avian species distribution across different habitats in Rajkot city area, Gujarat

Bhargavi L Thaker and Bhupat B Radadia

DOI: https://doi.org/10.22271/j.ento.2024.v12.i6b.9424

Abstract
From January 2018 to December 2020, an investigation was conducted on the species diversity, guild, and present status of the avifauna in Rajkot city situated in Rajkot District. The study employed the point count approach. It was noted that there were 44 bird species in Garden habitat; 64 bird species in wetland habitats; 25 bird species in human habitation and 56 bird species in grassland habitat. In terms of relative diversity, passerine bird species outnumbered non-passerine bird species in all four habitats; 18 species, 24 species, 13 species and 24 species respectively in Garden, Wetland, Human habitation and Grassland habitats. The most prevalent feeding guild for all four habitats, was omnivore (36.36%) followed by carnivore (27.27%) in Garden habitat; was omnivore (37.5%) followed by carnivore (26.56%) in Wetland habitat; was omnivore (32%) followed by carnivore and granivore (24%) in human habitation; and was omnivore (37.93%) followed by carnivore (25.86%) in Grassland habitat. According to this study's IUCN status observations, one species, i.e. Black headed ibis, as Near Threatened were found in all four Garden, Wetland, Human habitation and Grassland habitats. It is hoped that this study will assist to bring awareness to Rajkot city officials and people to conserve and preserve of its bird fauna.

Keywords: Rajkot city, garden habitat, wetland habitat, human habitation, grassland habitat

Introduction
According to some scientist's biological diversity not only demonstrates the presence of a wide range of organisms but also the variety of ecological resources found in a given area (Shekhawat & Bhatnagar 2014) [1]. The availability, distribution, and usage of natural resources by organisms within a given habitat are all indicated by a place's biodiversity. Major elements influencing the variety of species and their presence in a given habitat are their availability, distribution, and reach to its biophysical resources (Kumar & Sahu 2020, Kumar & Sahu 2019) [2, 3]. Therefore, the biological community and environmental resources have a significant impact on the diversity of species and their existence (Pragasan & Madesh 2018) [4]. Various species choose various environments based on their ecological requirements, evolutionary learning, and survival success (Boyce *et al*. 2016, Young *et al*. 2019, Bailey & King 2019) [5, 6, 7]. An essential strategy for preserving biodiversity in any region under intense human pressure is the evaluation of the bird community (Rahman & Ismail 2018, Koshelev *et al*. 2019) [8, 9]. To choose the best course of action for avian conservation, one must have a thorough understanding of the diversity and structure of birds. A habitat's resident and migratory populations are crucial in determining the niche connection and the best management practices to preserve and safeguard its bird fauna.
Availability of feeding sites were less in Rajkot area. The distance of feeding sites was also far in Rajkot. Thus, food and shelter, two main necessities of bird habitat were not available in sufficient manner in Rajkot (Saiyad 2016) [10]. Maximum percentage of sparrow population was observed to roosts on Prosopis juliflora (61%) followed Alstromia scholaris (17%) whereas lowest percentage population was on Aegle marmelos, Cascabela thevetia and Azadirachta indica (Chavda *et al*. 2015) [11]. The mixed type of habitat supports maximum species richness of diverse vertebrate communities. The less vertebrate diversity observed in human habitat due to human interferences While more number of individuals of few bird communities found due to their human tolerance adaptation (Raval & Soni 2015) [12].

Bird species composition is found to be preliminary determined by land use and geographical difference (Jadav 2010) [13].

Materials and Methods

Study Area

Rajkot is located in the middle of Gujarat state's Saurashtra region at 22.3039° N, 70.8022° E. Rajkot has a hot, semi-arid climate with a wet monsoon; hot, dry summers and relatively cold winter. The cyclone is among the most significant meteorological events connected to Rajkot. The temperature in the summertime is between 24 and 42 °C and in the winter between 10 and 22 °C. With the exception of the monsoon months of July through September, the city is situated on the banks of the Aji and Nyari rivers, both of which are dry. The city occupies an area of 170.00 square kilometers (smartcityrajkot.in 2024) [14].

Rajkot is one of Gujarat's main industrial hubs, which makes its position significant. Rajkot is situated in the heart of the Kathiawar peninsula. The city is situated in Gujarat's Rajkot district. Botad lies to the east, Surendranagar to the north, Junagadh and Amreli to the south, Morbi to the northwest, Jamnagar to the west, and Porbandar to the southwest encircle the district. Located in the middle of Gujarat's Saurashtra region, Rajkot is the fourth-largest city in the Indian state of Gujarat, behind Ahmedabad, Vadodara, and Surat. As of 2021, Rajkot ranked 35th among India's major metropolitan areas, home to over 2 million people (smartcityrajkot.in 2024) [14].

The district of Rajkot is home to dry deciduous forests. There isn't a lot of deep woodland either in or near Rajkot City. Rajkot has medium-density garden patches, wetland patches surrounding the city, and parts of grassland surrounding the city. Thus, Rajkot City's research area has been separated into four primary habitat types. 1. Man-made parks and gardens with somewhat dense vegetation patches 2. Human habitats with little to no vegetation 3. Low dense vegetation is found in wetlands, and medium thick vegetation is found in grasslands.

Methods

An initial survey was carried out with the primary goal of analyzing the research area. There are numerous gardens in Rajkot, and 14 of them have been chosen for this study. There are six wetlands in the Rajkot metropolitan region, all of which are covered in this study. Since Rajkot is an urban area, it is easy to find human settlement there. There aren't many patches of grassland in the Rajkot area, thus two or three of them were chosen for this study. Over the course of the study period, each study location has been visited roughly 22-24 times.

This research was carried out from January 2018 to December 2020. Although days with bad weather were avoided, several research locations were visited in the morning and evening, at least for an hour after sunrise and before sunset, respectively. Bird observations were collected using the point count method (Volpato *et al*. 2009, Hutto *et al*. 1986) [15, 16] and a total of five points within a 20-meter radius were computed at the chosen study site. Every point was carefully examined on foot in order to record any bird species observed within a 20-meter radius of the chosen place.

Binoculars (Porro Prism Black Olympus Binoculars 10 x 50 DPSI) were used for birding in order to capture physical characteristics for identification. A digital camera (COOLPIX P900) was also used to take pictures in order to aid identify the correct species (Plate A, Plate B, Plate C, Plate D, Plate E, Plate F, Plate G, Plate H, Plate I, Plate J). Reference books such as Birds of Northern India (Grimmett & Inskipp 2019) [17], Birds of the Indian Subcontinent (Grimmet *et al*. 2015) [18], and The Book of Indian Birds (Ali 2002) [19] were used to identify the birds seen in fields. Other reliable online resources were also consulted (IUCN Red list of Threatened Species 2021) [20].

Classification of recorded and identified avifauna was done according to family, order, zoological name, and common name (Praveen *et al*. 2019) [21]. Based on presence or absence and frequency of observation methods, the identified species were awarded a residential and local abundance status (Grimmett & Inskipp 2003, Ganpule 2016) [22, 23].

Conservation status of the recorded avifauna were assessed as per (IUCN Red list of Threatened Species 2021) [20]. Feeding guilds were decided as work of and field observations (Grimmett *et al*. 1999, Priya *et al*. 2022) [24, 25]. The local abundance of residential species was assessed by taking into account all 20-24 visits. The species observed in 76-100% of the visits were categorized as abundant, very common in 51–75% of the visits, common in 26-50% of the visits, and rare in 1-25% of the visits. The selection of feeding guilds was based on field observations and reliable sources (Trivedi & Vaghela 2020) [26].

Data Analysis

The recorded data were analysed for calculating relative diversity (RDi) of the orders and families by following formula (Priya *et al*. 2022) [25].

$$\text{Relative Diversity (RDi)} = \frac{\text{Number of species in respective order /family}}{\text{Total number of bird species}} \text{ x } 100$$

Results

There were 44 bird species in all that were identified at Garden Habitat; these were divided into 40 genera, 27 families, and 13 orders. The order Passeriformes had the greatest number of bird species (18 species total, divided into 12 families), followed by Pelecaniformes (6 species total, divided into 2 families), Coraciiformes (3 species total, divided into 2 families), Strigiformes (2 species total, divided into 2 families), Columbiformes (4 species total, divided into 4 families), Accipitriformes, Cuculiformes, and Galliformes (each containing 2 species of a single family), Apodiformes, Bucerotiformes, Charadriiformes, Piciformes, and Psittaciformes (each containing 1 species). Columbidae and Sturnidae (highest RDi= 9.09) were found to be the most diverse family with four species based on the relative diversity (RDi) values of the families (Table 1).

The 64 bird species that were found in Wetland habitats were divided into 18 orders, 39 families, and 58 genera. The order Passeriformes had the highest number of bird species (24 species, 18 families), followed by Coraciiformes (5 species, 3 families), Charadriiformes (3 species, 2 families), Pelecaniformes (8 species, 2 families), Strigiformes (2 species, 2 families), Columbiformes (4 species, 1 family), Cuculiformes and Galliformes (3 species each, 3 families), Accipitriformes and Suliformes (2 species each), Anseriformes, Apodiformes, Bucerotiformes, Caprimulgiformes, Gruiformes, Piciformes, Psittaciformes, and Pterocliformes (1 species each, 1 family). Columbidae and Sturnidae (highest RDi= 9.09) were found to be the most

diverse family with four species based on the relative diversity (RDi) values of the families (Table 2).

There were 24 genera, 17 families, and 6 orders out of the 25 bird species that have been documented as existing in human habitation. The order Passeriformes had the greatest number of bird species (13 species, divided into 10 families), followed by Pelecaniformes (3 species, divided into 2 families), Coraciiformes (2 species, divided into 2 families), Columbiformes (4 species, divided into 1 family), Accipitriformes (2 species, divided into 1 family), and Psittaciformes (1 species, divided into 1 family). The most diverse family, with four species, was Columbidae (highest RDi= 16), according to the relative diversity (RDi) values of the families (Table 3).

There were 53 genera, 36 families, and 15 orders comprised the total 56 bird species found in Grassland habitat. The order Passeriformes has the greatest number of bird species (24 species, divided into 17 families), followed by Coraciiformes (5 species, divided into 3 families), Charadriiformes (3 species, divided into 2 families), Pelecaniformes (8 species, divided into 2 families), Strigiformes (2 species, divided into 2 families), Columbiformes (4 species, divided into 4 families), Cuculiformes and Galliformes (3 species each, three species each), Accipitriformes and Suliformes (2 species each, divided into 2 families), Anseriformes, Apodiformes, Bucerotiformes, Caprimulgiformes, Gruiformes, Piciformes, Psittaciformes, and Pterocliformes (each with 1 species of 1 family). Columbidae and Sturnidae (highest RDi=7.14) were found to be the most diverse family with four species based on the relative diversity (RDi) values of the families (Table 4).

The most prevalent guild found in Garden habitat, out of 44 bird species, according to an examination of data on feeding guilds for documented species, 16 bird species were omnivore (36.36%), 12 bird species followed by carnivore (27.27%); other guilds that were most prevalent; 7 bird species were insectivorous (15.90%), 6 bird species were granivorous (13.63%), and 1 bird species was nectarivorous, frugivorous, and herbivorous (2.27%) (Figure 1).

The most prevalent guild found in Wetland habitat, out of 64 bird species, according to an examination of data on feeding guilds for documented species, 24 bird species were omnivore (37.5%), followed by 17 bird species were carnivore (26.56%); other guilds that were most prevalent; 12 bird species were insectivorous (18.75%), 6 bird species were granivorous (9.37%), 2 bird species were piscivorous (3.12%), and 1 bird species was nectarivorous, frugivorous, and herbivorous (1.56%) (Figure 2).

The most prevalent guild found in Human habitation, out of 25 bird species, according to a review of data on feeding guilds for reported species, 8 bird species were omnivore (32%) followed by 6 bird species were carnivore and granivore (24%), 3 bird species were insectivorous (12%), and 1 bird species was nectarivorous & herbivorous (4%) (Figure 3).

The most common guild found in Grassland habitat, out of 56 bird species, according to an analysis of data on feeding guilds for reported species, 22 bird species were omnivore (37.93%), which was followed by 15 bird species were carnivore (25.86%), 12 bird species were insectivorous (20.68%), 6 bird species were granivorous (10.34%) and 1 bird species was nectarivorous, frugivorous, and herbivorous (1.72%) (Figure 4).

Out of the 44 bird species identified in Garden habitat, 39 were resident, and 5 were migratory; 88.63% of the species were found to be resident, 9.09% to be winter migrants, 2.27% to be local migrants, and nil to be summer migrants.

Out of the 64 bird species identified in Wetland habitat, 56 were resident and 8 were migratory; 87.5% of the bird species were determined to be resident, 7.81% to be winter migrants, 1.56% to local migrants, and 3.12% to summer migrants.

Out of the 25 bird species that were found in Human habitation, 24 species were resident, and 1 species is migratory; 96% of the bird species were found to be resident, 4% to be winter migrants, nil to be local migrants, and nil to be summer migrants.

Out of the 58 bird species found in Grassland habitat, 50 were resident, while the remaining 8 were migratory. Of these, 86.2% were found to be resident, 5.8% to be winter migrants, 17.24% to local migrants, and 11.6% to summer migrants.

Among the migrating species observed were the local migrants, Jacobin cuckoo and Rain quail; the summer migrants, Mallard, Northern shoveler, Eurasian hoopoe, Pied avocet, Grey Wagtail, White Wagtail, Black redstart, Rosy starling, and Rosy pelican; and the winter migrants, Eurasian spoonbill and Glossy ibis.

Based on observations regarding the abundance status of the current study, 32 out of 44 species were found to be common and 12 to be very frequent in Garden habitat. Of the 64 species founded in Wetland habitat, 53 were common and 11 were very common. Of the 25 species that existed in Human habitation, 9 are common and 9 are very common. Of the 64 species found in Grassland habitat, 46 and 12 were common and very common, respectively.

According to the current study's IUCN status observations, 44 species-43 species (97.72%) of which were classified as Least Concern and 1 species (2.27%) as Near Threatened—were found in Garden habitat. Of the 64 species found in Wetland habitat, 63 species (98.43%) fell into the category of Least Concern, while just 1 species (1.56%) was classified as Near Threatened. Out of the 25 species that have been found in Human habitation, 24 species (96%) fall into the category of Least Concern, while 1 species (4%) is classified as Near Threatened. Of the 56 species found in Grassland habitat, 55 species (98.27%) fell into the category of Least Concern, and 1 species (1.72%) was classified as Near Threatened (Figure 5, Figure 6, Figure 7, Figure 8).

Out of 44 species found in the Garden habitat, 37 species (84.09%) preferred terrestrial habitat, 4 species (9.09%) preferred aquatic habitat and 3 species (6.81%) preferred combined aquatic and terrestrial habitat. Of the 64 species found in Wetland habitat, 50 species (78.12%) preferred terrestrial habitat, 10 species (15.62%) preferred aquatic habitat and 4 species (6.25%) preferred mixed aquatic and terrestrial habitat. Out of 25 species that coexisted with Human habitation, 22 species (88%) preferred terrestrial habitat, 1 species (4%) preferred aquatic habitat and 2 species (8%) preferred both aquatic and terrestrial habitat. 52 species (89.65%) of the 58 species found in Grasslands habitat preferred terrestrial habitat, 4 species (6.89%) preferred aquatic habitat and 2 species (3.44%) preferred mixed aquatic and terrestrial habitat (Figure 9, Figure 10, Figure 11, Figure 12).

Table 1: Relative Diversity Index of Garden habitat in and around Rajkot city

Sr. No.	Name of the bird species	Scientific name of bird species	Family of bird species	Order of bird species	Feeding guilds	Residential status	Local abundance	IUCN status
1 Accipitriformes (no. of families: 1, no. of species: 2, RDi: 4.54) 1.1 Accipitridae (no. of species: 2, RDi: 4.54)								
1	Black kite	*Milvus migrans*	Accipitriformes	Accipitridae	Carnivore	Resident	Common	LC
2	Shikra	*Accipiter badius*	Accipitriformes	Accipitridae	Carnivore	Resident	Common	LC
2 Apodiformes (no. of families: 1, no. of species: 1, RDi: 2.27) 2.1 Apopidae (no. of species: 1, RDi: 2.27)								
3	Little swift	*Apus affinis*	Apodiformes	Apodidae	Insectivore	Resident	Common	LC
3 Bucerotiformes (no. of families: 1, no. of species: 1, RDi: 2.27) 3.1 Upupidae (no. of species: 1, RDi: 2.27)								
4	Eurasian hoopoe	*Upupa epops*	Bucerotiformes	Upupidae	Omnivore	Winter migrant	Common	LC
4 Charadriiformes (no. of families: 1, no. of species: 1, RDi: 2.27) 4.1 Charadriidae (no. of species: 1, RDi: 2.27)								
5	Red wattled lapwing	*Vanellus indicus*	Charadriiformes	Charadriidae	Carnivore	Resident	Very common	LC
5 Columbiformes (no. of families: 1, no. of species: 4, RDi: 9.09) 5.1 Columbidae (no. of species: 4, RDi: 9.09)								
6	Blue Rock Pigeon	*Columba livia*	Columbiformes	Columbidae	Granivore	Resident	Very common	LC
7	Eurasian collared dove	*Streptopelia decaocto*	Columbiformes	Columbidae	Granivore	Resident	Common	LC
8	Spotted dove	*Spilopelia chinensis*	Columbiformes	Columbidae	Granivore	Resident	Common	LC
9	Laughing dove	*Spilopelia senegalensis*	Columbiformes	Columbidae	Granivore	Resident	Common	LC
6 Coraciiformes (no. of families: 2, no. of species: 3, RDi: 6.81) 6.1 Alcedinidae (no. of species: 2, RDi: 4.54)								
10	Pied kingfisher	*Ceryle rudis*	Coraciiformes	Alcedinidae	Carnivore	Resident	Common	LC
11	White throated kingfisher	*Halcyon smyrnensis*	Coraciiformes	Alcedinidae	Carnivore	Resident	Very common	LC
6.2 Meropidae (no. of species: 1, RDi: 2.27)								
12	Green bee eater	*Merops orientalis*	Coraciiformes	Meropidae	Insectivore	Resident	Common	LC
7 Cuculiformes (no. of families: 1, no. of species: 2, RDi: 4.54) 7.1 Cuculidae (no. of species: 2, RDi: 4.54)								
13	Asian koel	*Eudynamys scolopaceus*	Cuculiformes	Cuculidae	Omnivore	Resident	Common	LC
14	Greater coucal (crow pheasant)	*Centropus sinensis*	Cuculiformes	Cuculidae	Carnivore	Resident	Common	LC
8 Galliformes (no. of families: 1, no. of species: 2, RDi: 4.54) 8.1 Phasianidae (no. of species: 2, RDi: 4.54)								
15	Grey francolin	*Francolinus pondicerianus*	Galliformes	Phasianidae	Omnivore	Resident	Common	LC
16	Indian peafowl	*Pavo cristatus*	Galliformes	Phasianidae	Omnivore	Resident	Common	LC
9 Passeriformes (no. of families: 12, no. of species: 18, RDi: 40.9) 9.1 Alaudidae (no. of species: 1, RDi: 2.27)								
17	Ashy-crowned sparrow-lark	*Eremopterix griseus*	Passeriformes	Alaudidae	Omnivore	Resident	Very common	LC
9.2 Cisticolidae (no. of species: 1, RDi: 1.22)								
18	Common tailorbird	*Orthotomus sutorius*	Passeriformes	Cisticolidae	Omnivore	Resident	Common	LC
9.3 Corvidae (no. of species: 2, RDi: 4.54)								
19	House crow	*Corvus splendens*	Passeriformes	Corvidae	Omnivore	Resident	Very common	LC
20	Rufous treepie	*Dendrocitta vagabunda*	Passeriformes	Corvidae	Omnivore	Resident	Common	LC
9.4 Dicruridae (no. of species: 1, RDi: 2.27)								
21	Black drongo	*Dicrurus macrocercus*	Passeriformes	Dicruridae	Insectivore	Resident	Very common	LC
9.5 Estrildidae (no. of species: 1, RDi: 2.27)								
22	Indian silverbill	*Euodice malabarica*	Passeriformes	Estrildidae	Granivore	Resident	Common	LC
9.6 Motacillidae (no. of species: 2, RDi: 4.54)								
23	Grey wagtail	*Motacilla cinerea*	Passeriformes	Motacillidae	Insectivore	Winter migrant	Common	LC

24	White wagtail	*Motacilla alba*	Passeriformes	Motacillidae	Insectivore	Winter migrant	Common	LC
9.7 Muscicapidae (no. of species: 2, RDi: 4.54)								
25	Indian robin	*Copsychus fulicatus*	Passeriformes	Muscicapidae	Insectivore	Resident	Common	LC
26	Oriental magpie robin	*Copsychus saularis*	Passeriformes	Muscicapidae	Insectivore	Resident	Common	LC
9.8 Nectariniidae (no. of species: 1, RDi: 2.27)								
27	Purple sunbird	*Cinnyris asiaticus*	Passeriformes	Nectariniidae	Nectarivore	Resident	Common	LC
9.9 Passeridae (no. of species: 1, RDi: 2.27)								
28	House sparrow	*Passer domesticus*	Passeriformes	Passeridae	Granivore	Resident	Common	LC
9.10 Ploceidae (no. of species: 1, RDi: 2.27)								
29	Baya weaver	*Ploceus philippinus*	Passeriformes	Ploceidae	Omnivore	Resident	Common	LC
9.11 Pycnonotidae (no. of species: 1, RDi: 2.27)								
30	Red vented bulbul	*Pycnonotus cafer*	Passeriformes	Pycnonotidae	Omnivore	Resident	Very common	LC
9.12 Sturnidae (no. of species: 4, RDi: 9.09)								
31	Bank Myna	*Acridotheres ginginianus*	Passeriformes	Sturnidae	Omnivore	Resident	Very common	LC
32	Brahminy Myna	*Sturnia pagodarum*	Passeriformes	Sturnidae	Omnivore	Resident	Very common	LC
33	Common Myna	*Acridotheres tristis*	Passeriformes	Sturnidae	Omnivore	Resident	Very common	LC
34	Rosy starling	*Pastor roseus*	Passeriformes	Sturnidae	Omnivore	Winter migrant	Very common	LC
10 Pelecaniformes (no. of families: 2, no. of species: 6, RDi: 13.63) 10.1 Ardeidae (no. of species: 3, RDi: 6.81)								
35	Cattle Egret	*Bubulcus ibis*	Pelecaniformes	Ardeidae	Carnivore	Resident	Common	LC
36	Great Egret	*Ardea alba*	Pelecaniformes	Ardeidae	Carnivore	Resident	Common	LC
37	Little egret	*Egretta garzetta*	Pelecaniformes	Ardeidae	Carnivore	Resident	Common	LC
10.2 Threskiornithidae (no. of species: 3, RDi: 6.81)								
38	Black headed ibis	*Threskiornis melanocephalus*	Pelecaniformes	Threskiornithidae	Carnivore	Resident	Common	NT
39	Glossy ibis	*Plegadis falcinellus*	Pelecaniformes	Threskiornithidae	Carnivore	Local migrant	Common	LC
40	Red naped ibis	*Pseudibis papillosa*	Pelecaniformes	Threskiornithidae	Carnivore	Resident	Common	LC
11 Piciformes (no. of families: 1, no. of species: 1, RDi: 2.27) 11.1 Megalaimidae (no. of species: 1, RDi: 2.27)								
41	Coppersmith barbet	*Psilopogon haemacephalus*	Piciformes	Megalaimidae	Frugivore	Resident	Common	LC
12 Psittaciformes (no. of families: 1, no. of species: 1, RDi: 2.27) 12.1 Psittaculidae (no. of species: 1, RDi: 2.27)								
42	Rose ringed parakeet	*Psittacula krameri*	Psittaciformes	Psittaculidae	Herbivore	Resident	Very common	LC
13 Strigiformes (no. of families: 2, no. of species: 2, RDi: 4.54) 13.1 Tytonidae (no. of species: 1, RDi: 2.27)								
43	Barn owl	*Tyto javanica*	Strigiformes	Tytonidae	Omnivore	Resident	Common	LC
13.2 Strigidae (no. of species: 1, RDi: 2.27)								
44	Spotted owlet	*Athene brama*	Strigiformes	Strigidae	Omnivore	Resident	Common	LC

Abbreviations: LC- Least Concern; NT- Near Threatened

Table 2. Relative Diversity Index of Wetland habitat in and around Rajkot city

Sr. No.	Name of the bird species	Scientific name of bird species	Family of bird species	Order of bird species	Feeding guilds	Residential status	Local abundance	IUCN status
1 Accipitriformes (no. of families: 1, no. of species: 2, RDi: 3.12) 1.1 Accipitridae (no. of species: 2, RDi: 3.12)								
1	Black kite	*Milvus migrans*	Accipitriformes	Accipitridae	Carnivore	Resident	Common	LC
2	Shikra	*Accipiter badius*	Accipitriformes	Accipitridae	Carnivore	Resident	Common	LC
2 Anseriformes (no. of families: 1, no. of species: 1, RDi: 1.56) 2.1 Anatidae (no. of species: 1, RDi: 1.56)								
3	Spot billed duck	*Anas poecilorhyncha*	Anseriformes	Anatidae	Omnivore	Resident	Common	LC
3 Apodiformes (no. of families: 1, no. of species: 1, RDi: 1.56) 3.1 Apopidae (no. of species: 1, RDi: 1.56)								
4	Little swift	*Apus affinis*	Apodiformes	Apodidae	Insectivore	Resident	Common	LC
4 Bucerotiformes (no. of families: 1, no. of species: 1, RDi: 1.56) 4.1 Upupidae (no. of species: 1, RDi: 1.56)								
5	Eurasian hoopoe	*Upupa epops*	Bucerotiformes	Upupidae	Omnivore	Winter migrant	Common	LC
5 Caprimulgiformes (no. of families: 1, no. of species: 1, RDi: 1.56) 5.1 Caprimulgidae (no. of species: 1, RDi: 1.56)								
6	Indian nightjar	*Caprimulgus asiaticus*	Caprimulgiformes	Caprimulgidae	Insectivore	Resident	Common	LC
6 Charadriiformes (no. of families: 2, no. of species: 3, RDi: 4.68) 6.1 Burhinidae (no. of species: 1, RDi: 1.56)								
7	Indian stone-curlew (Indian thick-knee)	*Burhinus indicus*	Charadriiformes	Burhinidae	Omnivore	Resident	Common	LC
6.2 Charadriidae (no. of species: 2, RDi: 3.12)								
8	Red wattled lapwing	*Vanellus indicus*	Charadriiformes	Charadriidae	Carnivore	Resident	Very common	LC
9	Yellow wattled lapwing	*Vanellus malabaricus*	Charadriiformes	Charadriidae	Carnivore	Resident	Common	LC
7 Columbiformes (no. of families: 1, no. of species: 4, RDi: 6.25) 7.1 Columbidae (no. of species: 4, RDi: 6.25)								
10	Blue Rock Pigeon	*Columba livia*	Columbiformes	Columbidae	Granivore	Resident	Very common	LC
11	Eurasian collared dove	*Streptopelia decaocto*	Columbiformes	Columbidae	Granivore	Resident	Common	LC
12	Spotted dove	*Spilopelia chinensis*	Columbiformes	Columbidae	Granivore	Resident	Common	LC
13	Laughing dove	*Spilopelia senegalensis*	Columbiformes	Columbidae	Granivore	Resident	Common	LC
8 Coraciiformes (no. of families: 3, no. of species: 5, RDi: 7.81) 8.1 Alcedinidae (no. of species: 3, RDi: 4.68)								
14	Common kingfisher	*Alcedo atthis*	Coraciiformes	Alcedinidae	Carnivore	Resident	Common	LC
15	Pied kingfisher	*Ceryle rudis*	Coraciiformes	Alcedinidae	Carnivore	Resident	Common	LC
16	White throated kingfisher	*Halcyon smyrnensis*	Coraciiformes	Alcedinidae	Carnivore	Resident	Very common	LC
8.2 Coraciidae (no. of species: 1, RDi: 1.56)								
17	Indian roller	*Coracias benghalensis*	Coraciiformes	Coraciidae	Omnivore	Resident	Common	LC
8.3 Meropidae (no. of species: 1, RDi: 1.56)								
18	Green bee eater	*Merops orientalis*	Coraciiformes	Meropidae	Insectivore	Resident	Common	LC
9 Cuculiformes (no. of families: 1, no. of species: 3, RDi: 4.68) 9.1 Cuculidae (no. of species: 3, RDi: 4.68)								
19	Asian koel	*Eudynamys scolopaceus*	Cuculiformes	Cuculidae	Omnivore	Resident	Common	LC
20	Greater coucal (crow pheasant)	*Centropus sinensis*	Cuculiformes	Cuculidae	Carnivore	Resident	Common	LC
21	Jacobin cuckoo	*Clamator jacobinus*	Cuculiformes	Cuculidae	Carnivore	Summer migrant	Common	LC
10 Galliformes (no. of families: 1, no. of species: 3, RDi: 4.68) 10.1 Phasianidae (no. of species: 3, RDi: 4.68)								
22	Grey francolin	*Francolinus pondicerianus*	Galliformes	Phasianidae	Omnivore	Resident	Common	LC
23	Indian peafowl	*Pavo cristatus*	Galliformes	Phasianidae	Omnivore	Resident	Common	LC
24	Rain quail	*Coturnix coromandelica*	Galliformes	Phasianidae	Omnivore	Summer migrant	Common	LC
11 Gruiformes (no. of families: 1, no. of species: 1, RDi: 1.56) 11.1 Rallidae (no. of species: 1, RDi: 1.56)								
25	Common coot	*Fulica atra*	Gruiformes	Rallidae	Omnivore	Resident	Common	LC
12 Passeriformes (no. of families: 18, no. of species: 25, RDi: 39.06) 12.1 Aegithinidae (no. of species: 1, RDi: 1.56)								
26	Common iora	*Aegithina tiphia*	Passeriformes	Aegithinidae	Omnivore	Resident	Common	LC
12.2 Alaudidae (no. of species: 1, RDi: 1.56)								
27	Ashy-crowned sparrow-lark	*Eremopterix griseus*	Passeriformes	Alaudidae	Omnivore	Resident	Very common	LC
12.3 Cisticolidae (no. of species: 1, RDi: 1.56)								
28	Common tailorbird	*Orthotomus sutorius*	Passeriformes	Cisticolidae	Omnivore	Resident	Common	LC
12.4 Corvidae (no. of species: 2, RDi: 3.12)								
29	House crow	*Corvus splendens*	Passeriformes	Corvidae	Omnivore	Resident	Very common	LC
30	Rufous treepie	*Dendrocitta vagabunda*	Passeriformes	Corvidae	Omnivore	Resident	Common	LC
12.5 Dicruridae (no. of species: 1, RDi: 1.56)								
31	Black drongo	*Dicrurus macrocercus*	Passeriformes	Dicruridae	Insectivore	Resident	Very common	LC
12.6 Estrildidae (no. of species: 1, RDi: 1.56)								

32	Indian silverbill	*Euodice malabarica*	Passeriformes	Estrildidae	Granivore	Resident	Common	LC
12.7 Hirudinidae (no. of species: 1, RDi: 1.56)								
33	Wire-tailed swallow	*Hirundo smithii*	Passeriformes	Hirundinidae	Insectivore	Resident	Common	LC
12.8 Laniidae (no. of species: 1, RDi: 1.56)								
34	Long-tailed shrike	*Lanius schach*	Passeriformes	Laniidae	Insectivore	Resident	Common	LC
12.9 Motacillidae (no. of species: 2, RDi: 3.12)								
35	Grey wagtail	*Motacilla cinerea*	Passeriformes	Motacillidae	Insectivore	Winter migrant	Common	LC
36	White wagtail	*Motacilla alba*	Passeriformes	Motacillidae	Insectivore	Winter migrant	Common	LC
12.10 Muscicapidae (no. of species: 3, RDi: 4.68)								
37	Black redstart	*Phoenicurus ochruros*	Passeriformes	Muscicapidae	Insectivore	Winter migrant	Common	LC
38	Indian robin	*Copsychus fulicatus*	Passeriformes	Muscicapidae	Insectivore	Resident	Common	LC
39	Oriental magpie robin	*Copsychus saularis*	Passeriformes	Muscicapidae	Insectivore	Resident	Common	LC
12.11 Nectariniidae (no. of species: 1, RDi: 1.56)								
40	Purple sunbird	*Cinnyris asiaticus*	Passeriformes	Nectariniidae	Nectarivore	Resident	Common	LC
12.12 Passeridae (no. of species: 1, RDi: 1.56)								
41	House sparrow	*Passer domesticus*	Passeriformes	Passeridae	Granivore	Resident	Common	LC
12.13 Ploceidae (no. of species: 1, RDi: 1.56)								
42	Baya weaver	*Ploceus philippinus*	Passeriformes	Ploceidae	Omnivore	Resident	Common	LC
12.14 Pycnonotidae (no. of species: 1, RDi: 1.56)								
43	Red vented bulbul	*Pycnonotus cafer*	Passeriformes	Pycnonotidae	Omnivore	Resident	Very common	LC
12.15 Sturnidae (no. of species: 4, RDi: 6.25)								
44	Bank Myna	*Acridotheres ginginianus*	Passeriformes	Sturnidae	Omnivore	Resident	Very common	LC
45	Brahminy Myna	*Sturnia pagodarum*	Passeriformes	Sturnidae	Omnivore	Resident	Very common	LC
46	Common Myna	*Acridotheres tristis*	Passeriformes	Sturnidae	Omnivore	Resident	Very common	LC
47	Rosy starling	*Pastor roseus*	Passeriformes	Sturnidae	Omnivore	Winter migrant	Very common	LC
12.16 Oriolidae (no. of species: 1, RDi: 1.56)								
48	Indian golden oriole	*Oriolus kundoo*	Passeriformes	Oriolidae	Omnivore	Resident	Common	LC
12.17 Zosteropidae (no. of species: 1, RDi: 1.56)								
49	Oriental white-eye	*Zosterops palpebrosus*	Passeriformes	Zosteropidae	Insectivore	Resident	Common	LC
13 Pelecaniformes (no. of families: 2, no. of species: 8, RDi: 12.5) 13.1 Ardeidae (no. of species: 5, RDi: 7.81)								
50	Cattle Egret	*Bubulcus ibis*	Pelecaniformes	Ardeidae	Carnivore	Resident	Common	LC
51	Great Egret	*Ardea alba*	Pelecaniformes	Ardeidae	Carnivore	Resident	Common	LC
52	Indian pond heron	*Ardeola grayii*	Pelecaniformes	Ardeidae	Carnivore	Resident	Common	LC
53	Little egret	*Egretta garzetta*	Pelecaniformes	Ardeidae	Carnivore	Resident	Common	LC
54	Purple heron	*Ardea pupurea*	Pelecaniformes	Ardeidae	Carnivore	Resident	Common	LC
13.2 Threskiornithidae (no. of species: 3, RDi: 4.68)								
55	Black headed ibis	*Threskiornis melanocephalus*	Pelecaniformes	Threskiornithidae	Carnivore	Resident	Common	NT
56	Glossy ibis	*Plegadis falcinellus*	Pelecaniformes	Threskiornithidae	Carnivore	Local migrant	Common	LC
57	Red naped ibis	*Pseudibis papillosa*	Pelecaniformes	Threskiornithidae	Carnivore	Resident	Common	LC
14 Piciformes (no. of families: 1, no. of species: 1, RDi: 1.56) 14.1 Megalaimidae (no. of species: 1, RDi: 1.56)								
58	Coppersmith barbet	*Psilopogon haemacephalus*	Piciformes	Megalaimidae	Frugivore	Resident	Common	LC
15 Psittaciformes (no. of families: 1, no. of species: 1, RDi: 1.56) 15.1 Psittaculidae (no. of species: 1, RDi: 1.56)								
59	Rose ringed parakeet	*Psittacula krameri*	Psittaciformes	Psittaculidae	Herbivore	Resident	Very common	LC
16 Pterocliformes (no. of families: 1, no. of species: 1, RDi: 1.56) 16.1 Pteroclidae (no. of species: 1, RDi:)								
60	Chestnut-bellied sandgrouse	*Pterocles exustus*	Pterocliformes	Pteroclidae	Omnivore	Resident	Common	LC
17 Strigiformes (no. of families: 2, no. of species: 2, RDi: 3.12) 17.1 Tytonidae (no. of species: 1, RDi: 1.56)								
61	Barn owl	*Tyto javanica*	Strigiformes	Tytonidae	Omnivore	Resident	Common	LC
17.2 Strigidae (no. of species: 1, RDi: 1.56)								
62	Spotted owlet	*Athene brama*	Strigiformes	Strigidae	Omnivore	Resident	Common	LC
18 Suliformes (no. of families: 1, no. of species: 2, RDi: 3.12) 18.1 Phalacrocoracidae (no. of species: 2, RDi: 3.12)								
63	Indian cormorant	*Phalacrocorax fuscicollis*	Suliformes	Phalacrocoracidae	Piscivore	Resident	Common	LC
64	Little cormorant	*Microcarbo niger*	Suliformes	Phalacrocoracidae	Piscivore	Resident	Common	LC

Abbreviations: LC- Least Concern; NT- Near Threatened

Table 3. Relative Diversity Index of Human habitation in and around Rajkot city

Sr. No.	Name of the bird species	Scientific name of bird species	Family of bird species	Order of bird species	Feeding guilds	Residential status	Local abundance	IUCN status
1 Accipitriformes (no. of families: 1, no. of species: 2, RDi: 8) 1.1 Accipitridae (no. of species: 2, RDi: 8)								
1	Black kite	*Milvus migrans*	Accipitriformes	Accipitridae	Carnivore	Resident	Common	LC
2	Shikra	*Accipiter badius*	Accipitriformes	Accipitridae	Carnivore	Resident	Common	LC
2 Columbiformes (no. of families: 1, no. of species: 4, RDi: 16) 2.1 Columbidae (no. of species: 4, RDi: 16)								
3	Blue Rock Pigeon	*Columba livia*	Columbiformes	Columbidae	Granivore	Resident	Very common	LC
4	Eurasian collared dove	*Streptopelia decaocto*	Columbiformes	Columbidae	Granivore	Resident	Common	LC
5	Spotted dove	*Spilopelia chinensis*	Columbiformes	Columbidae	Granivore	Resident	Common	LC
6	Laughing dove	*Spilopelia senegalensis*	Columbiformes	Columbidae	Granivore	Resident	Common	LC
3 Coraciiformes (no. of families: 2, no. of species: 2, RDi: 8) 3.1 Alcedinidae (no. of species: 1, RDi: 4)								
7	White throated kingfisher	*Halcyon smyrnensis*	Coraciiformes	Alcedinidae	Carnivore	Resident	Very common	LC
3.2 Meropidae (no. of species: 1, RDi: 4)								
8	Green bee eater	*Merops orientalis*	Coraciiformes	Meropidae	Insectivore	Resident	Common	LC
4 Passeriformes (no. of families: 10, no. of species: 13, RDi: 52) 4.1 Cisticolidae (no. of species: 1, RDi: 4)								
9	Common tailorbird	*Orthotomus sutorius*	Passeriformes	Cisticolidae	Omnivore	Resident	Common	LC
4.2 Corvidae (no. of species: 2, RDi: 8)								
10	House crow	*Corvus splendens*	Passeriformes	Corvidae	Omnivore	Resident	Very common	LC
11	Rufous treepie	*Dendrocitta vagabunda*	Passeriformes	Corvidae	Omnivore	Resident	Common	LC
4.3 Dicruridae (no. of species: 1, RDi: 4)								
12	Black drongo	*Dicrurus macrocercus*	Passeriformes	Dicruridae	Insectivore	Resident	Very common	LC
4.4 Estrildidae (no. of species: 1, RDi: 4)								
13	Indian silverbill	*Euodice malabarica*	Passeriformes	Estrildidae	Granivore	Resident	Common	LC
4.5 Muscicapidae (no. of species: 1, RDi: 4)								
14	Indian robin	*Copsychus fulicatus*	Passeriformes	Muscicapidae	Insectivore	Resident	Common	LC
4.6 Nectariniidae (no. of species: 1, RDi: 4)								
15	Purple sunbird	*Cinnyris asiaticus*	Passeriformes	Nectariniidae	Nectarivore	Resident	Common	LC
4.7 Passeridae (no. of species: 1, RDi: 4)								
16	House sparrow	*Passer domesticus*	Passeriformes	Passeridae	Granivore	Resident	Common	LC
4.8 Ploceidae (no. of species: 1, RDi: 4)								
17	Baya weaver	*Ploceus philippinus*	Passeriformes	Ploceidae	Omnivore	Resident	Common	LC
4.9 Pycnonotidae (no. of species: 1, RDi: 4)								
18	Red vented bulbul	*Pycnonotus cafer*	Passeriformes	Pycnonotidae	Omnivore	Resident	Very common	LC
4.10 Sturnidae (no. of species: 3, RDi: 12)								
19	Brahminy Myna	*Sturnia pagodarum*	Passeriformes	Sturnidae	Omnivore	Resident	Very common	LC
20	Common Myna	*Acridotheres tristis*	Passeriformes	Sturnidae	Omnivore	Resident	Very common	LC
21	Rosy starling	*Pastor roseus*	Passeriformes	Sturnidae	Omnivore	Winter migrant	Very common	LC
5 Pelecaniformes (no. of families: 2, no. of species: 3, RDi: 12) 5.1 Ardeidae (no. of species: 1, RDi: 4)								
22	Cattle Egret	*Bubulcus ibis*	Pelecaniformes	Ardeidae	Carnivore	Resident	Common	LC
5.2 Threskiornithidae (no. of species: 2, RDi: 8)								
23	Black headed ibis	*Threskiornis melanocephalus*	Pelecaniformes	Threskiornithidae	Carnivore	Resident	Common	NT
24	Red naped ibis	*Pseudibis papillosa*	Pelecaniformes	Threskiornithidae	Carnivore	Resident	Common	LC
6 Psittaciformes (no. of families: 1, no. of species: 1, RDi: 4) 6.1 Psittaculidae (no. of species: 1, RDi: 4)								
25	Rose ringed parakeet	*Psittacula krameri*	Psittaciformes	Psittaculidae	Herbivore	Resident	Very common	LC

Abbreviations: LC- Least Concern; NT- Near Threatened

Table 4. Relative Diversity Index of Grassland in and around Rajkot city

Sr. No.	Name of the bird species	Scientific name of bird species	Family of bird species	Order of bird species	Feeding guilds	Residential status	Local abundance	IUCN status
1 Accipitriformes (no. of families: 1, no. of species: 2, RDi: 3.44) 1.1 Accipitridae (no. of species: 2, RDi: 3.44)								
1	Black kite	*Milvus migrans*	Accipitriformes	Accipitridae	Carnivore	Resident	Common	LC
2	Shikra	*Accipiter badius*	Accipitriformes	Accipitridae	Carnivore	Resident	Common	LC
2 Apodiformes (no. of families: 1, no. of species: 1, RDi: 1.72) 2.1 Apopidae (no. of species: 1, RDi: 1.72)								
3	Little swift	*Apus affinis*	Apodiformes	Apodidae	Insectivore	Resident	Common	LC
3 Bucerotiformes (no. of families: 1, no. of species: 1, RDi: 1.72) 3.1 Upupidae (no. of species: 1, RDi: 1.72)								
4	Eurasian hoopoe	*Upupa epops*	Bucerotiformes	Upupidae	Omnivore	Winter migrant	Common	LC
4 Caprimulgiformes (no. of families: 1, no. of species: 1, RDi: 1.72) 4.1 Caprimulgidae (no. of species: 1, RDi: 1.72)								
5	Indian nightjar	*Caprimulgus asiaticus*	Caprimulgiformes	Caprimulgidae	Insectivore	Resident	Common	LC
5 Charadriiformes (no. of families: 2, no. of species: 3, RDi: 5.17) 5.1 Burhinidae (no. of species: 1, RDi: 1.72)								
6	Indian stone-curlew (Indian thick-knee)	*Burhinus indicus*	Charadriiformes	Burhinidae	Omnivore	Resident	Common	LC
5.2 Charadriidae (no. of species: 2, RDi: 3.44)								
7	Red wattled lapwing	*Vanellus indicus*	Charadriiformes	Charadriidae	Carnivore	Resident	Very common	LC
8	Yellow wattled lapwing	*Vanellus malabaricus*	Charadriiformes	Charadriidae	Carnivore	Resident	Common	LC
6 Columbiformes (no. of families: 1, no. of species: 4, RDi: 6.89) 6.1 Columbidae (no. of species: 4, RDi: 6.89)								
9	Blue Rock Pigeon	*Columba livia*	Columbiformes	Columbidae	Granivore	Resident	Very common	LC
10	Eurasian collared dove	*Streptopelia decaocto*	Columbiformes	Columbidae	Granivore	Resident	Common	LC
11	Spotted dove	*Spilopelia chinensis*	Columbiformes	Columbidae	Granivore	Resident	Common	LC
12	Laughing dove	*Spilopelia senegalensis*	Columbiformes	Columbidae	Granivore	Resident	Common	LC
7 Coraciiformes (no. of families: 3, no. of species: 5, RDi: 8.62) 7.1 Alcedinidae (no. of species: 3, RDi: 5.17)								
13	Common kingfisher	*Alcedo atthis*	Coraciiformes	Alcedinidae	Carnivore	Resident	Common	LC
14	Pied kingfisher	*Ceryle rudis*	Coraciiformes	Alcedinidae	Carnivore	Resident	Common	LC
15	White throated kingfisher	*Halcyon smyrnensis*	Coraciiformes	Alcedinidae	Carnivore	Resident	Very common	LC
7.2 Coraciidae (no. of species: 1, RDi: 1.72)								
16	Indian roller	*Coracias benghalensis*	Coraciiformes	Coraciidae	Omnivore	Resident	Common	LC
7.3 Meropidae (no. of species: 1, RDi: 1.72)								
17	Green bee eater	*Merops orientalis*	Coraciiformes	Meropidae	Insectivore	Resident	Common	LC
8 Cuculiformes (no. of families: 1, no. of species: 3, RDi: 5.17) 8.1 Cuculidae (no. of species: 3, RDi: 5.17)								
18	Asian koel	*Eudynamys scolopaceus*	Cuculiformes	Cuculidae	Omnivore	Resident	Common	LC
19	Greater coucal (crow pheasant)	*Centropus sinensis*	Cuculiformes	Cuculidae	Carnivore	Resident	Common	LC
20	Jacobin cuckoo	*Clamator jacobinus*	Cuculiformes	Cuculidae	Carnivore	Summer migrant	Common	LC
9 Galliformes (no. of families: 1, no. of species: 3, RDi: 5.17) 9.1 Phasianidae (no. of species: 3, RDi: 5.17)								
21	Grey francolin	*Francolinus pondicerianus*	Galliformes	Phasianidae	Omnivore	Resident	Common	LC
22	Indian peafowl	*Pavo cristatus*	Galliformes	Phasianidae	Omnivore	Resident	Common	LC
23	Rain quail	*Coturnix coromandelica*	Galliformes	Phasianidae	Omnivore	Summer migrant	Common	LC
10 Passeriformes (no. of families: 17, no. of species: 24, RDi: 41.37) 10.1 Aegithinidae (no. of species: 1, RDi: 1.72)								
24	Common iora	*Aegithina tiphia*	Passeriformes	Aegithinidae	Omnivore	Resident	Common	LC
10.2 Alaudidae (no. of species: 1, RDi: 1.72)								
25	Ashy-crowned sparrow-lark	*Eremopterix griseus*	Passeriformes	Alaudidae	Omnivore	Resident	Very common	LC
10.3 Cisticolidae (no. of species: 1, RDi: 1.78)								
26	Common tailorbird	*Orthotomus sutorius*	Passeriformes	Cisticolidae	Omnivore	Resident	Common	LC
10.4 Corvidae (no. of species: 2, RDi: 3.44)								

27	House crow	*Corvus splendens*	Passeriformes	Corvidae	Omnivore	Resident	Very common	LC
28	Rufous treepie	*Dendrocitta vagabunda*	Passeriformes	Corvidae	Omnivore	Resident	Common	LC
10.5 Dicruridae (no. of species: 1, RDi: 1.72)								
29	Black drongo	*Dicrurus macrocercus*	Passeriformes	Dicruridae	Insectivore	Resident	Very common	LC
10.6 Estrildidae (no. of species: 1, RDi: 1.72)								
30	Indian silverbill	*Euodice malabarica*	Passeriformes	Estrildidae	Granivore	Resident	Common	LC
10.7 Hirudinidae (no. of species: 1, RDi: 1.72)								
31	Wire-tailed swallow	*Hirundo smithii*	Passeriformes	Hirundinidae	Insectivore	Resident	Common	LC
10.8 Laniidae (no. of species: 1, RDi: 1.72)								
32	Long-tailed shrike	*Lanius schach*	Passeriformes	Laniidae	Insectivore	Resident	Common	LC
10.9 Motacillidae (no. of species: 2, RDi: 3.44)								
33	Grey wagtail	*Motacilla cinerea*	Passeriformes	Motacillidae	Insectivore	Winter migrant	Common	LC
34	White wagtail	*Motacilla alba*	Passeriformes	Motacillidae	Insectivore	Winter migrant	Common	LC
10.10 Muscicapidae (no. of species: 3, RDi: 5.17)								
35	Black redstart	*Phoenicurus ochruros*	Passeriformes	Muscicapidae	Insectivore	Winter migrant	Common	LC
36	Indian robin	*Copsychus fulicatus*	Passeriformes	Muscicapidae	Insectivore	Resident	Common	LC
37	Oriental magpie robin	*Copsychus saularis*	Passeriformes	Muscicapidae	Insectivore	Resident	Common	LC
10.11 Nectariniidae (no. of species: 1, RDi: 1.72)								
38	Purple sunbird	*Cinnyris asiaticus*	Passeriformes	Nectariniidae	Nectarivore	Resident	Common	LC
10.12 Passeridae (no. of species: 1, RDi: 1.72)								
39	House sparrow	*Passer domesticus*	Passeriformes	Passeridae	Granivore	Resident	Common	LC
10.13 Ploceidae (no. of species: 1, RDi: 1.72)								
40	Baya weaver	*Ploceus philippinus*	Passeriformes	Ploceidae	Omnivore	Resident	Common	LC
10.14 Pycnonotidae (no. of species: 1, RDi: 1.78)								
41	Red vented bulbul	*Pycnonotus cafer*	Passeriformes	Pycnonotidae	Omnivore	Resident	Very common	LC
10.15 Sturnidae (no. of species: 4, RDi: 6.89)								
42	Bank Myna	*Acridotheres ginginianus*	Passeriformes	Sturnidae	Omnivore	Resident	Very common	LC
43	Brahminy Myna	*Sturnia pagodarum*	Passeriformes	Sturnidae	Omnivore	Resident	Very common	LC
44	Common Myna	*Acridotheres tristis*	Passeriformes	Sturnidae	Omnivore	Resident	Very common	LC
45	Rosy starling	*Pastor roseus*	Passeriformes	Sturnidae	Omnivore	Winter migrant	Very common	LC
10.16 Oriolidae (no. of species: 1, RDi: 1.72)								
46	Indian golden oriole	*Oriolus kundoo*	Passeriformes	Oriolidae	Omnivore	Resident	Common	LC
10.17 Zosteropidae (no. of species: 1, RDi: 1.72)								
47	Oriental white-eye	*Zosterops palpebrosus*	Passeriformes	Zosteropidae	Insectivore	Resident	Common	LC
11 Pelecaniformes (no. of families: 2, no. of species: 6, RDi: 10.34) 11.1 Ardeidae (no. of species: 3, RDi: 5.17)								
48	Cattle Egret	*Bubulcus ibis*	Pelecaniformes	Ardeidae	Carnivore	Resident	Common	LC
49	Great Egret	*Ardea alba*	Pelecaniformes	Ardeidae	Carnivore	Resident	Common	LC
50	Little egret	*Egretta garzetta*	Pelecaniformes	Ardeidae	Carnivore	Resident	Common	LC
11.2 Threskiornithidae (no. of species: 3, RDi: 5.17)								
51	Black headed ibis	*Threskiornis melanocephalus*	Pelecaniformes	Threskiornithidae	Carnivore	Resident	Common	NT
52	Glossy ibis	*Plegadis falcinellus*	Pelecaniformes	Threskiornithidae	Carnivore	Local migrant	Common	LC
53	Red naped ibis	*Pseudibis papillosa*	Pelecaniformes	Threskiornithidae	Carnivore	Resident	Common	LC
12 Piciformes (no. of families: 1, no. of species: 1, RDi: 1.72) 12.1 Megalaimidae (no. of species: 1, RDi: 1.72)								
54	Coppersmith barbet	*Psilopogon haemacephalus*	Piciformes	Megalaimidae	Frugivore	Resident	Common	LC
13 Psittaciformes (no. of families: 1, no. of species: 1, RDi: 1.72) 13.1 Psittaculidae (no. of species: 1, RDi: 1.72)								
55	Rose ringed parakeet	*Psittacula krameri*	Psittaciformes	Psittaculidae	Herbivore	Resident	Very common	LC
14 Pterocliformes (no. of families: 1, no. of species: 1, RDi: 1.72) 14.1 Pteroclidae (no. of species: 1, RDi: 1.72)								
56	Chestnut-bellied sandgrouse	*Pterocles exustus*	Pterocliformes	Pteroclidae	Omnivore	Resident	Common	LC
15 Strigiformes (no. of families: 2, no. of species: 2, RDi: 3.44) 15.1 Tytonidae (no. of species: 1, RDi: 1.72)								
57	Barn owl	*Tyto javanica*	Strigiformes	Tytonidae	Omnivore	Resident	Common	LC
15.2 Strigidae (no. of species: 1, RDi: 1.72)								
58	Spotted owlet	*Athene brama*	Strigiformes	Strigidae	Omnivore	Resident	Common	LC

Abbreviations: LC- Least Concern; NT- Near Threatened

Discussion

Our findings on bird diversity are consistent with the observations made by other scientists. These researchers came to the conclusion that passerine birds, with their diverse range of habitats and feeding habits (e.g., flowers, fruits, grains, insects, other invertebrates, nectar, nuts), represent the maximum diversity in an area (Beresford *et al*. 2005) [27]. In any ecosystem, the availability of food is a key factor in the area's richness and species variety. Our observations are in line with research on the residence status, local abundance, and foraging guilds of bird species in six distinct Telangana agricultural habitats (Narayana *et al*. 2015) [28].

In one study, it is found that migratory birds were more than half population. In Wetland habitat, it is found that those habitat attract migratory birds more in winter season (Vyas & Raval 2022) [29]. In another study, bird species from family Muscicapidae were found to be abundant than other families in Saurashtra University Campus (Trivedi & Vaghela 2020) [26]. In one study related to Aji-1 water reservoir in Rajkot, the reservoir and their surrounding wetland areas attract many migratory birds and provide favorable habitat and food resources. Migratory as well as residential aquatic birds of this site shows that there are factors like food resource distribution and abundance, physical environment, vegetation structure to support bird community and that way they form complex communities (Vala & Trivedi 2018) [27].

In the feeding guild, omnivorous species were having the maximum number, followed by carnivorous. Feeding guild analysis highlighted the interdependence and balance between physical and biological resources of the area (Singh *et al*. 2021) [31]. Avifaunal diversity has been decreasing due to the destruction of natural habitats and human disturbances. Due to unplanned management, agriculture and disposal of untreated public sewage water and other human and animal wastes in to the water bodies are continuously deteriorating their water quality and biotic resources (Pandey *et al*. 2021) [32].

Abundant population of human-associated species like Myna, House Sparrow and Rock Pigeon shows trends of progressive urbanization. Further, if the human disturbance increases in future, then there would be the danger of avian species homogenization (Palita *et al*. 2011) [33]. Some scientists stated that natural and farmland related habitats have higher bird species richness (Tu *et al*. 2020) [34]. The research area's abundance of Passeriformes is attributed to climatic factors, food availability, and nesting facilities.

The Ardidae and Phalacrocoracidae families of birds primarily eat fish and other smaller aquatic invertebrates, whereas the carnivorous Accipitridae family of birds eats mammals, small birds, reptiles, fish, amphibians, crabs, and mollusks. Birds belonging to the Charadridae, Cuculidae, Strigidae, and Alcedinidae families eat invertebrates and small animals. The Dicruridae, Oriolidae, and Muscicapidae are among the families of birds that consume insects. The majority of the nectar that birds in the Nectarinidae family eat. The Corvidae and Sturnidae families of birds are omnivores, but the Passeridae, Columbidae, Megalaimidae, and Psittaculidae families of birds consume fruits, seeds, and buds. According to some scientists, birds in the Phasianidae family generally consume seeds, fruits, buds, roots, and leaves (Grimmett *et al*. 2013) [35].

Because of the habitat, food supply, and nesting sites in the research region, there are a lot of Passeriforme bird species. The Passeriformes is the largest order of birds and one of the most diverse groups of terrestrial animals (Gill & Donsker 2015) [36]. The majority of birds seen in the hamlet were inland species that were often found in close proximity to gardens, plantations, and human settlements (Grimmett *et al*. 2013) [35]. Numerous bird species are supported by the terrestrial ecosystem, which provides them with favorable climatic conditions, good habitat, and availability (Mehmood *et al*. 2018) [37]. The availability of various diets influences the diversity of birds in the study area, corroborating one study's finding that various foods benefit avian species, especially Passeriformes, either directly or indirectly (Tanveer *et al*. 2002) [38].

Because there is a wide diversity of vegetation in the Rajkot city, including a lot of wild plants, shrubs, and herbs that provide a habitat for insects. The research area has few freshwater habitats. One study asserts that birds occupy a range of ecological roles. Some birds are generalists, whereas others have very specialized needs when it comes to their surroundings or food sources (Sekercioglu 2006) [39]. Even within a single environment, like a forest, different bird species occupy different niches; some feed above the canopy, some below it, and some on the forest floor. Among the forest birds are nectarivores, frugivores, and insectivores.

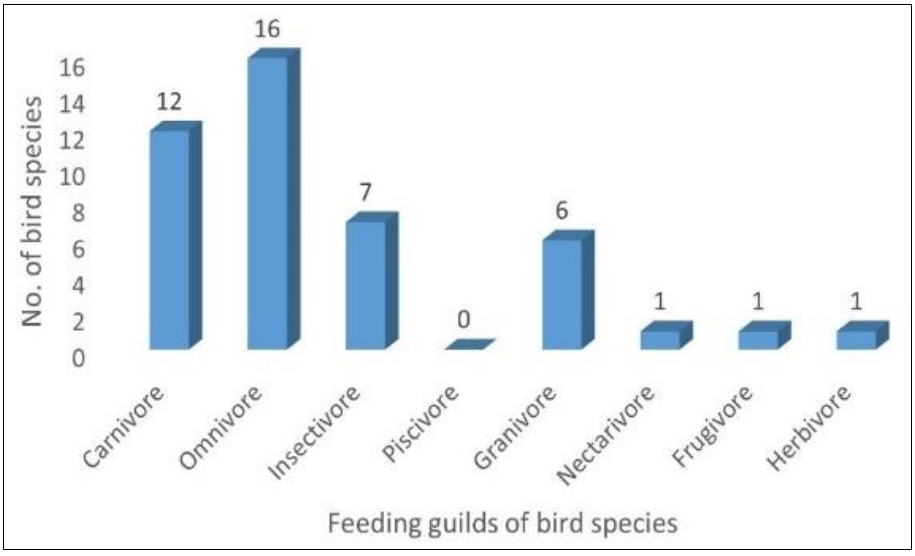

Fig 1: Feeding guilds of birds found in Garden habitat

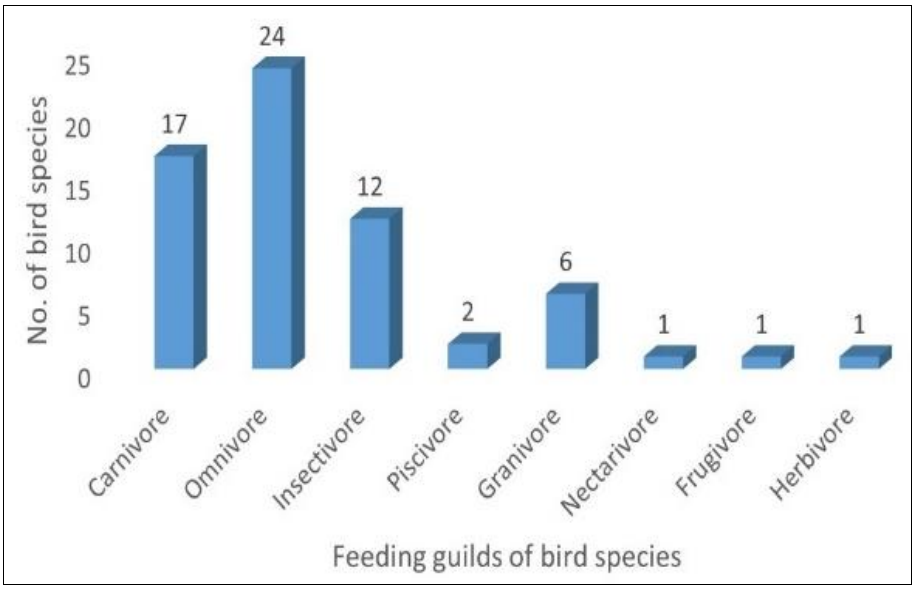

Fig 2: Feeding guilds of birds found in Wetland habitat

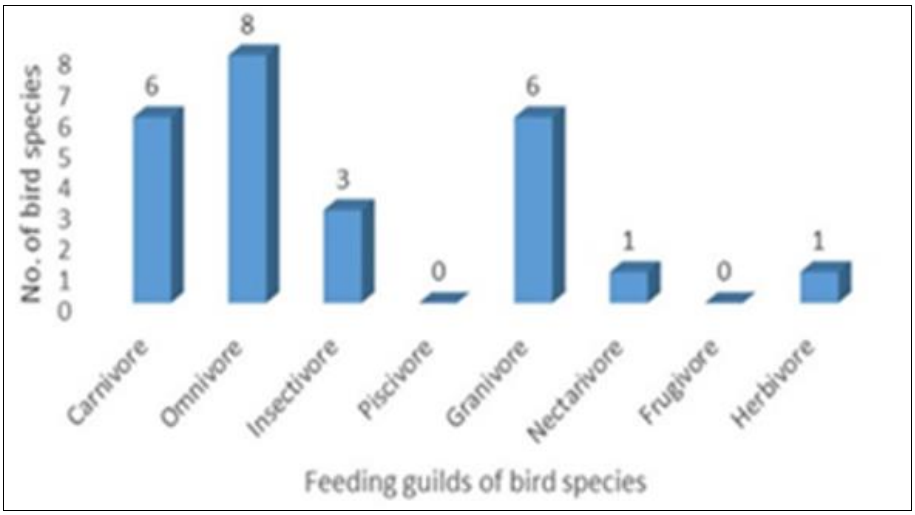

Fig 3: Feeding guilds of birds found in Human habitation

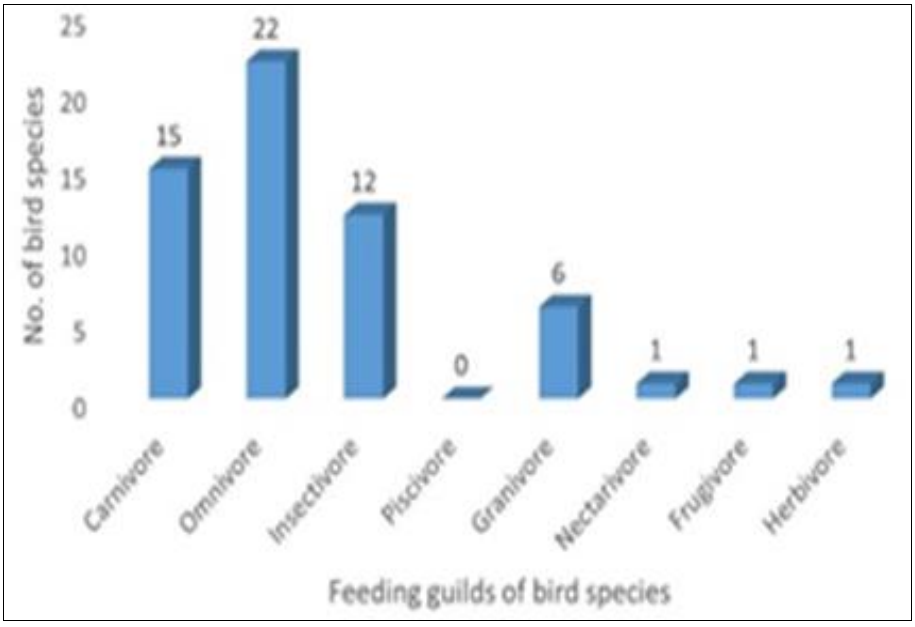

Fig 4: Feeding guilds of birds found in Grassland habitat

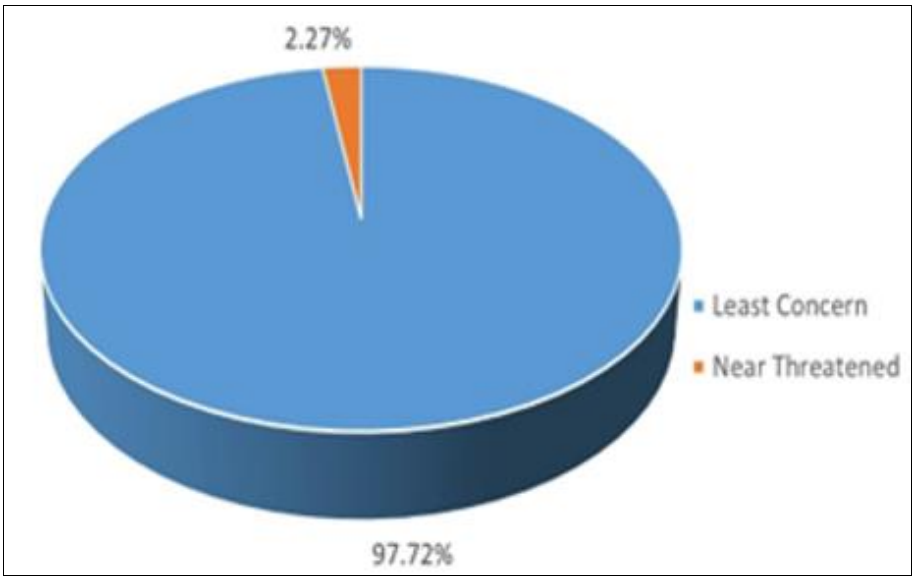

Fig 5: IUCN status of birds found in Garden habitat

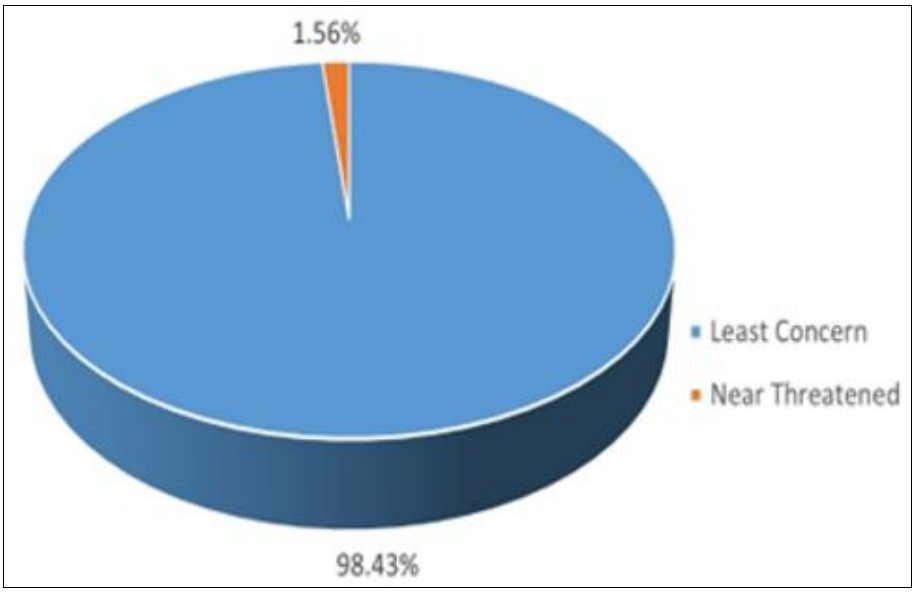

Fig 6: IUCN status of birds found in Wetland habitat

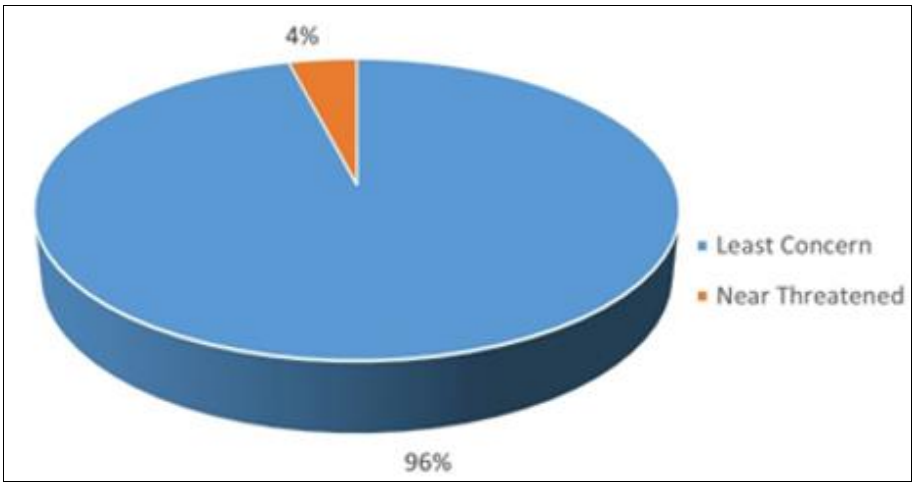

Fig 7: IUCN status of birds found in Human habitation

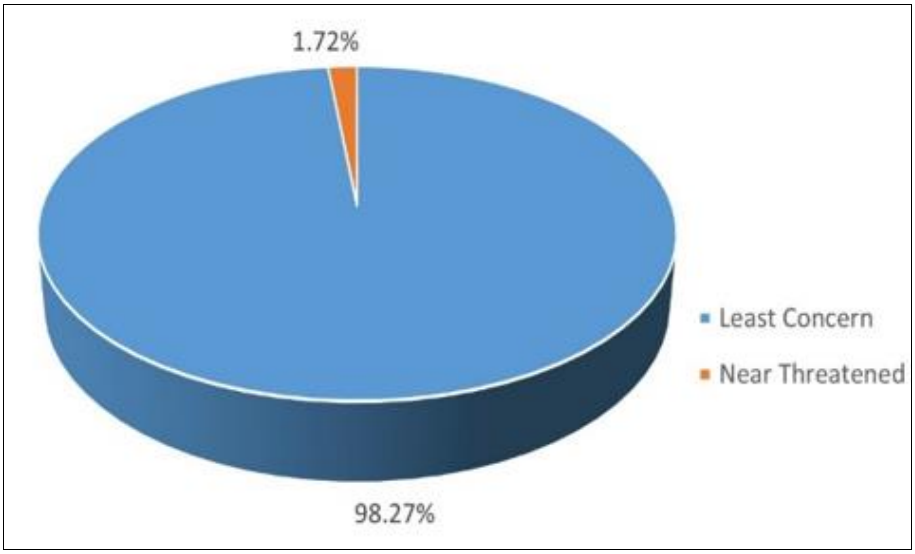

Fig 8: IUCN status of birds found in Grassland habitat

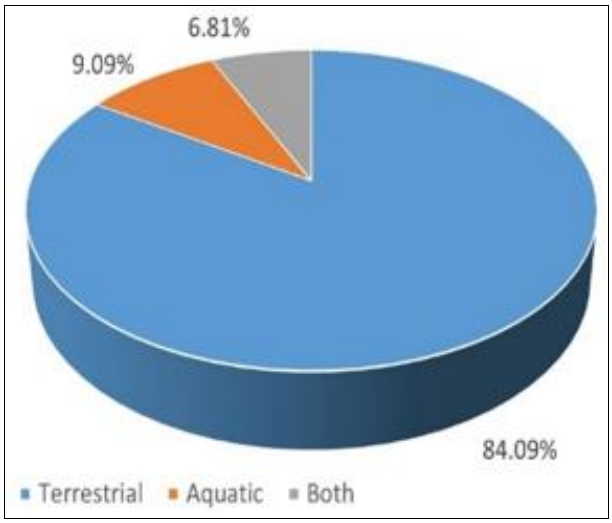

Fig 9: Habitat wise distribution of birds in Garden

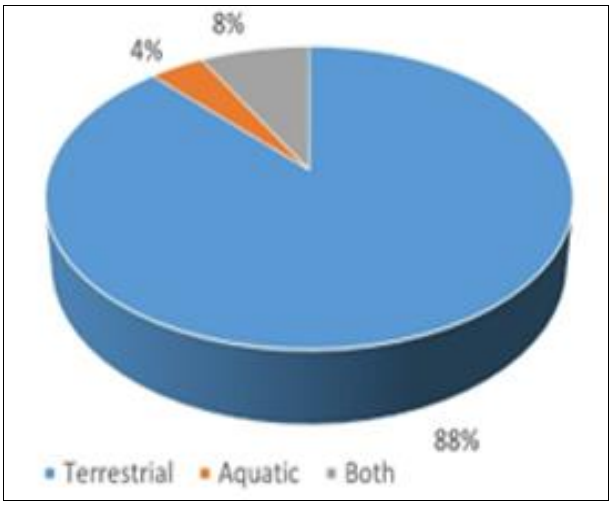

Fig 11: Habitat wise distribution of birds in Human Habitation

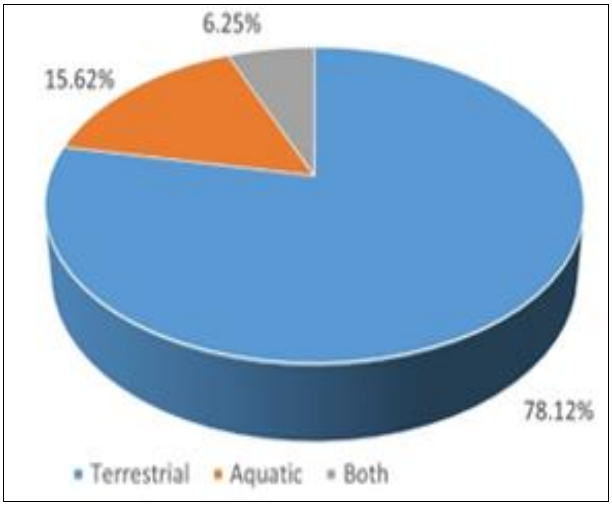

Fig 10: Habitat wise distribution of birds in Wetland

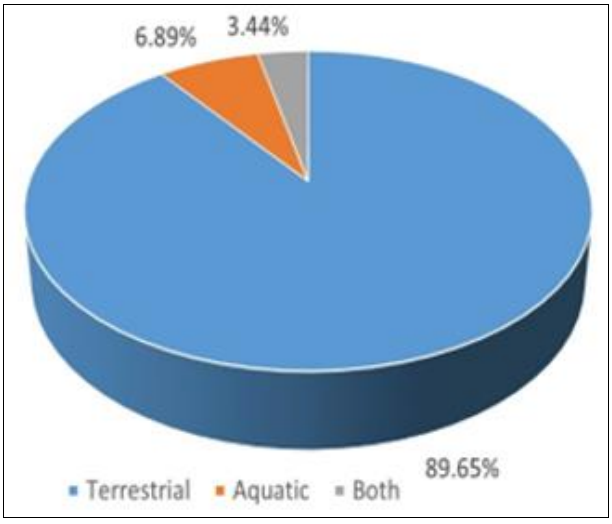

Fig 12: Habitat wise distribution of birds in Grassland habitat

Plate A: Asian koel (*Eudynamys scolopaceus*)

Plate B: Flock of birds (Red-vented bulbul (*Pycnonotus cafer*), Common myna (*Acridotheres tristis*), Brahminy myna (*Sturniapagodarum*), Rosy starling (*Pastor roseus*)

Plate C: Black headed ibis (*Threskiornis melanocephalus*)

Plate D: Brahminy myna (*Sturnia pagodarum*)

Plate E: Common myna (*Acridotheres tristis*)

Plate F. Flock of birds (Rose ringed parakeet (*Psittacula krameri*), Rufous treepie (*Dendrocitta vagabunda*), Rosy starling (*Pastorroseus*), Eurasian collared dove (*Streptopelia decaocto*)

Plate G: Black drongo (*Dicrurus macrocercus*)

Plate H: Flock of Blue rock pigeons (*Columba livia*)

Plate I: Flock of Cattle egrets (*Bubulcus ibis*)

Plate J: Common coot (*Fulica atra*)

Conclusion

According to the current study, 44 species from 40 genera, 27 families, and 13 orders are supported by Garden habitat. The Wetland habitat sustains 64 species from 58 genera, 39 families, and 18 orders. There are 25 species that are supported by Human habitation, representing 24 genera, 17 families, and 6 orders. The Grassland habitat is home to 56 species from 15 orders, 36 families, and 53 genera. The district supports over half of the total bird species of Gujarat and almost 25% of bird species in India. It includes important resident as well as migratory species. Being an important area for avifaunal diversity, sites in and around Rajkot should receive immediate attention for conservation (Neel *et al*. 2022) [40].

Rajkot is home to a wide variety of birdlife. Birds are drawn to the area due of its superior ecology. The quantity of different bird species found in a given location is determined by the quality of the habitat. Food, shelter, and breeding habitat provide a safe haven for many species in the research region. However, industrialization and habitat degradation are two human activities that pose a threat to the bird richness of the research area. Thus, maintaining the ecological balance depends on conserving birds. The information gathered from various locations can be very helpful in assessing the condition of birds and their preservation in various environments in the future.

Acknowledgement

The authors extend their sincere thanks to the Dr. Paresh Poriya, Assistant Professor, Zoology Department, Bahauddin Science College, Junagadh & Dr. Abhijeet Purohit, Retired Managaer Bioengineering, Excel Crop Care Limited, Bhavnagar for their immense support, constructive criticism, invaluable suggestions and guidance during study.

Conflict of Interest

The authors declare that there is no conflict of interest.

References

1. Shekhawat DS, Bhatnagar C. Guild, status, and diversity of avian fauna in the Jhunjhunu district, Rajasthan, India. J Asia-Pac Biodivers. 2014 Sep 30;7(3):262-267. DOI: 10.1016/j.japb.2014.06.001.
2. Kumar P, Sahu S. Composition, diversity and foraging guilds of avifauna in agricultural landscapes in Panipat, Haryana, India. J Threat Taxa. 2020 Jan 26;12(1):15140-53. Available from: https://orcid.org/0000-0002-4940-9507.
3. Kumar P, Sahu S. Avian diversity in agricultural landscapes of district Panipat, Haryana, India. Asian J Conserv Biol. 2019;8(2):188-198.
4. Pragasan LA, Madesh M. Species diversity and abundance of birds on Bharathiar University Campus, Tamil Nadu, India. J Threat Taxa. 2018 May 26;10(6):11725-31. Available from: http://orcid.org/0000-0002-8543-4267.
5. Boyce MS, Johnson CJ, Merrill EH, Nielsen SE, Solberg EJ, Van Moorter B. Can habitat selection predict abundance? J Anim Ecol. 2016 Jan;85(1):11-20. DOI: 10.1111/1365-2656.12359.
6. Young AC, Cox WA, McCarty JP, Wolfenbarger LL. Post fledging habitat selection and survival of Henslow's Sparrow: management implications for a critical life stage. Avian Conserv Ecol. 2019;14(2):10.
7. Bailey BA, King DI. Habitat selection and habitat quality for wintering wood thrushes in a coffee growing region in Honduras. Glob Ecol Conserv. 2019 Oct 1;20:e00728. DOI: 10.1016/j.gecco.2019.e00728.
8. Rahman F, Ismail A. Waterbirds: An important bio-indicator of ecosystem. Pertanika J Scholarly Res Rev. 2018, 4(1).
9. Koshelev OI, Koshelev VO, Fedushko MP, Zhukov OV. The bird communities diversity and indicator groups of natural and anthropogenic landscapes of the South and South-east of Ukraine. Agrology. 2019;2:229-240. DOI: 10.32819/019032.
10. Shabanam Saiyad K. A study on the house crow *Corvus splendens* population, their distribution and food in Junagadh and Rajkot cities, Gujarat.
11. Chavda A, Soni VC, Radadia B, Saiyad S. Tree species selection for roosting by House sparrow (*Passer domesticus*) in Rajkot, Gujarat. Life Sci Int Res J. 2015;2(2):314-318.
12. Raval VB, Soni VC. Vertebrate community responses to the changing landscape in Saurashtra University campus Rajkot. Int J Recent Sci Res. 2015;6(5):3906-3909.
13. Jadav RD. Ecological status and importance of grasslands (vidis) in conservation of avian. [Doctoral dissertation]. Rajkot: Saurashtra University.
14. Wikipedia: the free encyclopedia. Rajkot [Internet]. St. Petersburg (FL): Wikimedia Foundation, Inc.; 2001 [modified 2024 Nov 12; cited 2024 Nov 25]. Available from:https://en.wikipedia.org/w/index.php?title=Rajkot&oldid=1256936657.
15. Volpato GH, Lopes EV, Mendonça LB, Boçon R, Bisheimer MV, Serafini PP, *et al*. The use of the point count method for bird survey in the Atlantic forest. Zoologia (Curitiba). 2009;26:74-8.
16. Hutto RL, Pletschet SM, Hendricks P. A fixed-radius

point count method for nonbreeding and breeding season use. The Auk. 1986 Jul 1;103(3):593-602.
17. Grimmett R, Inskipp T. Birds of Northern India. London: Christopher Helm; c2019.
18. Grimmett R, Inskipp C, Inskipp T. Birds of Indian Subcontinent. 2nd ed. New Delhi: Oxford University Press; c2015.
19. Ali S. The Book of Indian Birds. 13th ed. Bombay: Bombay Natural History Society, Oxford University Press Inc; c2002.
20. IUCN (International Union for Conservation of Nature). Red List of Threatened Species [Internet]. 2021 [cited 2024 Nov 25]. Available from: http://www.iucnredlist.org.
21. Praveen J, Jayapal R, Inskipp T, Warakagoda D, Thompson PM, Anderson RC, *et al*. Checklist of the birds of the Indian subcontinent. [Internet]. v3.0; c2019 [cited 2024 Nov 25]. Available from: http://www.indianbirds.in/indian-subcontinent.
22. Grimmett R, Inskipp T. Birds of Northern India. London: Bloomsbury Publishing; c2003.
23. Prasad G. The Birds of Gujarat: Status and Distribution. Flamingo Interim Issue. 2016;VIII 3-XII 4:2-40.
24. Grimmett R, Inskipp C, Inskipp T. Pocket Guide to the Birds of the Indian Subcontinent. New Delhi: Oxford University Press; c1999. p. 384.
25. Priya S, Singh D, Delu V, Yodha K. Avifaunal Diversity at the Farmlands of CCSHAU, Hisar, Haryana, India. Appl Ecol Environ Sci. 2022;10(7):424-431. DOI: 10.12691/aees-10-7-1.
26. Trivedi V, Vaghela S. Avifauna of Saurashtra University Campus, Rajkot, Gujarat, India. J Threat Taxa. 2020 Sep 26;12(13):16764-16774.
27. Beresford P, Barker FK, Ryan P, Crowe TM. African endemics span the tree of songbirds (Passeri): molecular systematics of several evolutionary 'enigmas'. Proc R Soc B Biol Sci. 2005 Apr 22;272(1565):849-858.
28. Narayana BL, Rao VV, Pandiyan J. Avifaunal diversity in different croplands of Nalgonda district, Telangana, Southern India. Int J Curr Res. 2015;7(7):17677-82.
29. Vyas MA, Raval JV. A comparative study of avian diversity at three selected sites of Porbandar, Gujarat, India. Asian J Biol Life Sci. 2022 Sep;11(3):663.
30. Vala Dolatsang S, Trivedi V. Status of aquatic birds at Aji-1 water reservoir, Rajkot, Gujarat, India. J Global Biosci. 2018;7(2):5375-5384.
31. Singh J, Hooda S, Phogat A, Malik V. Avian Diversity and Habitat Use of Sultanpur National Park, Haryana, India. Asian J Conserv Biol. 2021 Jul 1, 10(1). DOI: 10.53562/ajcb.RKPR3560.
32. Pandey P, Jain R, Gaherwal S. A review on diversity of birds. Int J Zool Stud. 2021;6(5):15-18.
33. Palita SK, Ponkshe AV, Dhar U. Habitat enrichment and its impact on avian diversity: a study at GBPIHED, Kosi-Katarmal, Uttarakhand, India. Curr Sci. 2011 Jun 10;1681-1689.
34. Tu HM, Fan MW, Ko JC. Different habitat types affect bird richness and evenness. Sci Rep. 2020 Jan 27;10(1):1221.
35. Grimmett R, Inskipp C, Inskipp T. Birds of the Indian Subcontinent. New Delhi: Oxford University Press, India, 2013. p. 1-528.
36. Gill F, Donsker D, editors. IOC World Bird List [Internet]. v5.1; 2015 [cited 2017 Dec 11]. Available from: www.worldbirdnames.org. DOI: 10.14344/IOC.ML.5.1.
37. Mehmood S, Khan BN, Raza H, Ahmad R, Muhammad A, Ali Z, *et al*. Assessment of seasonal distribution and threats to avian fauna of Lahore Safari Zoo. Pak J Zool. 2018 Apr 1;50(2):533-538.
38. Tanveer A, Shahzad M, Chaudhry AA. Avian fauna of Punjab University, Lahore, Pakistan. Punjab Univ J Zool. 2002, 17.
39. Sekercioglu CH. Old World Flycatchers to Old World Warblers. In: del Hoyo J, Elliott A, Christie DA, editors. Handbook of the Birds of the World. 11th ed. Barcelona: Lynx Editions; c2006. p. 48. 40.
40. Sureja N, Radadia H, Trivedi B, Varagiya D, Gadhavi M. The checklist of birds of Rajkot district, Gujarat, India with a note on probable local extinction. J Threat Taxa. 2022 Aug 26;14(8):21508-21528. DOI: 10.11609/jott.6458.14.8.21508-21528.