



Science

STUDIES OF THE AVIFAUNA IN URBAN LIMITS OF AJMER, RAJASTHAN, INDIA

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Abstract

The urban sprawls are common in the present age. The urban biodiversity conservation is a challenge for the urban planners. The habitats formed within the green and blue spaces are home for the wide variety of floral and faunal diversity. In the series of the conservation actions, the present investigation was undertaken in the urban areas of the central Rajasthan, *i.e.*, Ajmer. It aimed to review and prepare comprehensive database through assessment of the avifaunal species of the municipal area of Ajmer. The seasonal surveys and periodic sampling observations were recorded for twenty-four months from February 2017 to January 2019. The urban area was classified into three regions namely, the Urban Green Patches (UGP), Urban Aquatic Area (UAA) and Human Settlement Area (HSA). The UGA & HSA harbored 104 species and 41 species respectively whereas the UAA harbored 95 species. The Relative Diversity Index of the various species was calculated. The present investigation recorded 167 species from 58 families. With the earlier studies with a reporting of 235 species from 62 families, there was addition of 13 new species and two families. Thus, the cumulative list of Ajmer District presented an account of 243 bird species from 64 families.

Keywords: Urban, Birds, Conservation, Aravalli, Ajmer, Rajasthan.

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1. Introduction

The urbanization process has given rise to the human dominated landscapes with complex ecological systems as the urban ecosystems which need to be explored and converted to the opportunity [1-7]. Such man-made ecosystems have certain areas of high biological diversity. These sites are the point of interest for the conservationists for the study of the urban biodiversity especially avifauna. The patterns of biodiversity determine the features of the urban ecosystems.

Rajasthan (India) owes diversity of the habitats which area also evident in the human settlements. The western low rainfall desert region, central hilly terrains, eastern high rainfall terrains of plains and plateau provide habitats for diverse avifauna. Over 500 avifaunal species are being recorded from the state of Rajasthan. The Aravalli Hills harbor over 300 avifaunal species, near about eighty percent of which are recorded from the central parts [3,5,6,8].

The study of the birds gives the better understanding of the past and present status of the biodiversity of the area. The environmental challenges could be better understood by the birds [9-11]. Further, monitoring the species abundance, habitat preference, and correlation between species abundance and habitat provides basic information for determining factors causing population fluctuation of bird species. Richness, abundance and community composition are often used by ecologists to understand the diversity of species in their natural occurrence [12]. The change in vegetation composition could impact the quality and quantity of habitat for birds in terms of food, water and cover which can further affect the diversity, abundance and distribution of birds [13]. In order to prioritize the future conservation of species, understanding the effect of habitat on bird community structure is important [14]. In the long run, the relative value of different habitats and conservation importance of sites can be assessed by investigating the diversity of birds present at those sites [15].

2. Material and Methods

Profile of Study Area

Rajasthan is situated in north – western part of India between the latitude $23^{\circ} 03'$ to $30^{\circ} 12'$ N and longitude $69^{\circ} 30'$ to $78^{\circ} 17'E$. It is the largest state of the Republic of India by area. Geographical features include the Thar Desert, Aravalli Mountain Ranges, Southern Malwa Plateau and Eastern plains. The Ajmer District is located nearly in the center of the Rajasthan and bordered with one of the world oldest mountain ranges *i.e.* Aravalli Hills (Fig. 1). The Ajmer Municipal area lies in the foothills of the Central Aravalli Hills with the highest peak Taragarh (870 feet) (Fig. 2). It experiences a mean annual rainfall of 573mm but scanty and often uncertain. Temperature ranges from $2^{\circ}C$ to $46^{\circ}C$. The summers are extremely hot in this part. However, there are many climate changes the Aravalli has witnessed in the recent past, particularly the rainfall, temperature fluctuation and shift of weathers.



Figure 1: Map of Rajasthan Highlighted with Ajmer District (In Inset Map of India)

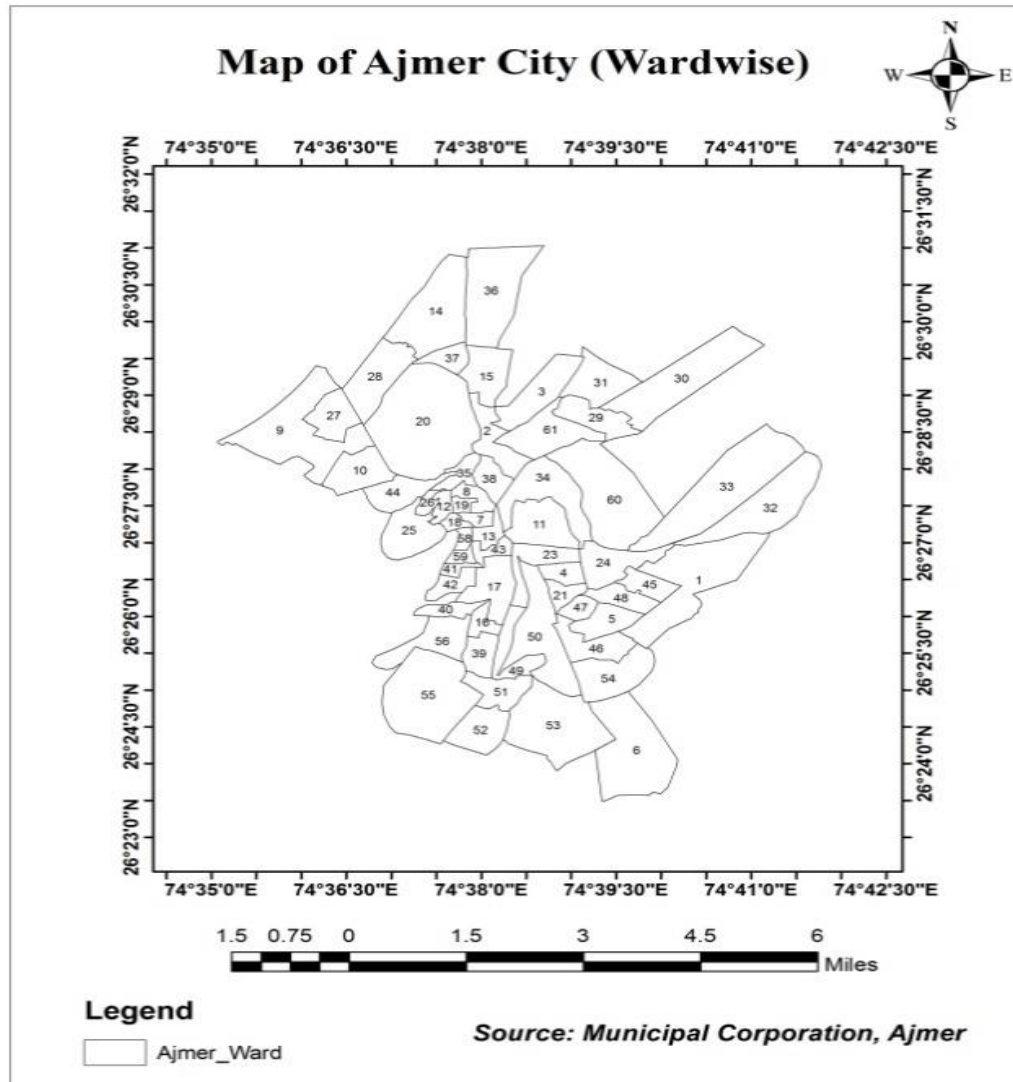


Figure 2: Map of Ajmer Municipal Area of Ajmer District, Rajasthan

For the ease of study, the habitats of the municipal area of Ajmer city in the present study was categorized under two broad groups (see 2, 3).

- 1) **Urban Aquatic Areas (UAA):** All perennial and seasonal water bodies within the municipal limits of Ajmer city were categorized under Urban Aquatic Areas (Anasagar Lake, Foy Sagar Lake, Chaurasiywas Talab, Paal Bichla Talab and Khanpura Talab).
- 2) **Urban Terrestrial Areas:** The terrestrial area within the municipal limits of Ajmer city which was further classified as:
 - **Human Settlement Areas (HSA):** Areas with direct human involvement and high anthropogenic pressure were included in this category (Constructed areas, buildings, roads etc.).
 - **Urban Green Patches (UGP):** This includes areas with less human intervention and lesser anthropogenic pressure (Institutional and Urban gardens, Agricultural fields, green patches of hillock of Aravalli).

Field Studies and Surveys

The field surveys and observations were taken for the period of two years February 2017 to January 2019. Recording of the bird species were also made from the calls. Regular surveys carried out by systematically walking on the fixed routes through the study area. Systematic observations of the species in different habitats of the municipal limits (Fig. 2) were recorded from 6:00 to 9:00 hrs and from 16:00 to 18:00 hrs. General observations were also made during other timings too. The nomenclature is after Manakadan & Pittie [16], and taxonomic arrangement is following Gill & Donsker [17]. The status of the species like resident, winter migrant, summer migrant and passage migrant were assigned as per the observations in each survey based on the presence/absence method along with analysis of the other parameters.

Data Collection and Analysis

Relative Diversity (RDi): The relative diversity (RDi) of families was calculated using the following formula [18]

$$RDi = \frac{\text{Number of bird species in a family}}{\text{Total number of species}} \times 100$$

Similarity Indices: Similarity indices between the intensive study sites were calculated using Jaccard Index and Sorenson Index [12].

Jaccard Index:**Jaccard Index:**

$$C_j = j / (a + b - j)$$

Where

j = the number of species common to both sites

a = the number of species in site A and

b = the number of species in site b

Sorenson Index:**Sorenson Index:**

$$C_s = 2j / (a + b)$$

Where

j = the number of species common to both sites

a = the number of species in site A and

b = the number of species in site b

Observation and Results

Table 1: The Avi-Faunal Composition of Municipal Area of Ajmer District, Rajasthan (Family wise species occurrence at classified microhabitats)

S.No.	Common Name	Scientific Name	UAA	HSA	UGP
	Grebes	Podicipedidae			
1	Little Grebe	Tachybaptus ruficollis (Pallas, 1764)	+	-	-
	Pelicans	Pelecanidae			
2	Great White Pelican	Pelecanus onocrotalus (Linnaeus, 1758)	+	-	-
3	Dalmatian Pelican	Pelecanus crispus (Bruch, 1832)	+	-	-
	Cormorants/Shags	Phalacrocoracidae			
4	Little Cormorant	Phalacrocorax niger (Vieillot, 1817)	+	-	-
5	Indian Shag	Phalacrocorax fuscicollis (Stephens, 1826)	+	-	-
6	Great Cormorant	Phalacrocorax carbo (Linnaeus, 1758)	+	-	-
	Darters	Anhingidae			
7	Darter	Anhinga melanogaster (Pennant, 1769)	+	-	-
	Hérons, Egrets & Bitterns	Ardeidae			
8	Little Egret	Egretta garzetta (Linnaeus, 1766)	+	-	-
9	Grey Heron	Ardea cinerea (Linnaeus, 1758)	+	-	-
10	Purple Heron	Ardea purpurea (Linnaeus, 1766)	+	-	-
11	Large Egret	Casmerodius albus (Linnaeus, 1758)	+	-	-
12	Median Egret	Mesophoyx intermedia (Wagler, 1829)	+	+	-
13	Cattle Egret	Bubulcus ibis (Linnaeus, 1758)	+	+	+
14	Indian Pond-Heron	Ardeola grayii (Sykes, 1832)	+	+	+
15	Little Green Heron	Butorides striatus (Linnaeus, 1758)	+	-	-
16	Black-crowned Night-Heron	Nycticorax nycticorax (Linnaeus, 1758)	+	-	-
	Storks	Ciconiidae			
17	Painted Stork	Mycteria leucocephala (Pennant, 1769)	+	-	+
18	Asian Openbill-Stork	Anastomus oscitans (Boddaert, 1783)	+	-	-
	Ibises & Spoonbills	Threskiornithidae			
19	Glossy Ibis	Plegadis falcinellus (Linnaeus, 1766)	+	-	-
20	Oriental White Ibis	Threskiornis melanocephalus (Latham, 1790)	+	-	-
21	Black Ibis	Pseudibis papillosa (Temminck, 1824)	+	-	+
22	Eurasian Spoonbill	Platalea leucorodia (Linnaeus, 1758)	+	-	-
	Flamingos	Phoenicopteridae			
23	Greater Flamingo	Phoenicopterus ruber (Linnaeus, 1758)	+	-	-

	Swans, Geese & Ducks	Anatidae			
24	Greylag Goose	Anser anser (Linnaeus, 1758)	+	-	-
25	Bar-headed Goose	Anser indicus (Latham, 1790)	+	-	-
26	Brahminy Shelduck	Tadorna ferruginea (Pallas, 1764)	+	-	-
27	Comb Duck	Sarkidiornis melanotos (Pennant, 1769)	+	-	-
28	Gadwall	Anas strepera (Linnaeus, 1758)	+	-	-
29	Eurasian Wigeon	Anas penelope (Linnaeus, 1758)	+	-	-
30	Mallard	Anas platyrhynchos (Linnaeus, 1758)	+	-	-
31	Spot-billed Duck	Anas poecilorhyncha (J.R. Forester, 1781)	+	-	-
32	Northern Shoveller	Anas clypeata (Linnaeus, 1758)	+	-	-
33	Northern Pintail	Anas acuta (Linnaeus, 1758)	+	-	-
34	Garganey	Anas querquedula (Linnaeus, 1758)	+	-	-
35	Common Teal	Anas crecca (Linnaeus, 1758)	+	-	-
36	Red-crested Pochard	Rhodonessa rufina (Pallas, 1773)	+	-	-
37	Common Pochard	Aythya ferina (Linnaeus, 1758)	+	-	-
38	Ferruginous Pochard	Aythya nyroca (Guldenstadt, 1770)	+	-	-
	Hawks, Eagles, Buzzards, Old World Vultures, Kites, Harriers	Accipitridae			
39	Oriental Honey-Buzzard	Pernis ptilorhynchus (Temminck, 1821)	-	-	+
40	Black-shouldered Kite	Elanus caeruleus (Desfontaines, 1789)	-	-	+
41	Black Kite	Milvus migrans (Boddaert, 1783)	+	+	+
42	Egyptian Vulture	Neophron percnopterus (Linnaeus, 1758)	-	-	+
43	Short-toed Snake-Eagle	Circaetus gallicus (Gmelin, 1788)	-	-	+
44	Western Marsh-Harrier	Circus aeruginosus (Linnaeus, 1758)	+	-	+
45	Shikra	Accipiter badius (Gmelin, 1788)	-	+	+
46	Tawny Eagle	Aquila rapax (Temminck, 1828)	-	-	+
47	Steppe Eagle	Aquila nipalensis Hodgson, 1833	-	-	+
	Osprey	Pandionidae			
48	Osprey	Pandion haliaetus (Linnaeus, 1758)	+	-	-
	Falcons	Falconidae			
49	Common Kestrel	Falco tinnunculus (Linnaeus, 1758)	-	-	+
	Pheasants, Partridges, Quails	Phasianidae			
50	Grey Francolin	Francolinus pondicerianus (Gmelin, 1789)	-	+	+

51	Rain Quail	Coturnix coromandelica (Gmelin, 1789)	-	-	+
52	Jungle Bush-Quail	Perdica asiatica (Latham, 1790)	-	-	+
53	Indian Peafowl	Pavo cristatus (Linnaeus, 1758)	-	+	+
	Rails, Crakes, Moorhens, Coots	Rallidae			
54	White-breasted Waterhen	Amaurornis phoenicurus (Pennant, 1769)	+	-	+
55	Purple Moorhen	Porphyrio porphyrio (Linnaeus, 1758)	+	-	-
56	Common Moorhen	Gallinula chloropus (Linnaeus, 1758)	+	-	-
57	Common Coot	Fulica atra (Linnaeus, 1758)	+	-	-
	Jacanas	Jacanidae			
58	Pheasant-tailed Jacana	Hydrophasianus chirurgus (Scopoli, 1786)	+	-	-
59	Bronze-winged Jacana	Metopidius indicus (Latham, 1790)	+	-	-
	Painted-Snipes	Rostratulidae			
60	Greater Painted-Snipe	Rostratula benghalensis (Linnaeus, 1758)	+	-	-
	Plovers, Dotterels, Lapwings	Charadriidae			
61	Little Ringed Plover	Charadrius dubius (Scopoli, 1786)	+	-	-
62	Kentish Plover	Charadrius alexandrinus (Linnaeus, 1758)	+	-	-
63	Yellow-wattled Lapwing	Vanellus malabaricus (Boddaert, 1783)	+	-	+
64	Red-wattled Lapwing	Vanellus indicus (Boddaert, 1783)	+	+	+
	Sandpipers, Stints, Snipes, Godwits & Curlews	Scolopacidae			
65	Common Snipe	Gallinago gallinago (Linnaeus, 1758)	+	-	-
66	Black-tailed Godwit	Limosa limosa (Linnaeus, 1758)	+	-	-
67	Spotted Redshank	Tringa erythropus (Pallas, 1764)	+	-	-
68	Common Redshank	Tringa totanus (Linnaeus, 1758)	+	-	-
69	Wood Sandpiper	Tringa glareola (Linnaeus, 1758)	+	-	-
70	Common Sandpiper	Actitis hypoleucos (Linnaeus, 1758)	+	-	+
71	Little Stint	Calidris minuta (Leisler, 1812)	+	-	+
72	Temminck's Stint	Calidris temminckii (Leisler, 1812)	+	-	-
73	Ruff	Philomachus pugnax (Linnaeus, 1758)	+	-	+
	Ibisbill, Avocets & Stilts	Recurvirostridae			
74	Black-winged Stilt	Himantopus himantopus (Linnaeus, 1758)	+	+	+
75	Pied Avocet	Recurvirostra avosetta (Linnaeus, 1758)	+	-	-

	Gulls, Terns & Noddies	Laridae			
76	Pallas's Gull	Larus ichthyaetus (Pallas, 1773)	+	-	-
77	Brown-headed Gull	Larus brunnicephalus (Jerdon, 1840)	+	-	-
78	Black-headed Gull	Larus ridibundus (Linnaeus, 1766)	+	-	-
79	Gull-billed Tern	Gelochelidon nilotica (Gmelin, 1789)	+	-	-
80	River Tern	Sterna aurantia (J.E. Gray, 1831)	+	-	-
81	Whiskered Tern	Chlidonias hybridus (Pallas, 1811)	+	-	-
	Sandgrouse	Pteroclididae			
82	Chestnut-bellied Sandgrouse	Pterocles exustus (Temminck, 1825)	-	-	+
83	Painted Sandgrouse	Pterocles indicus (Gmelin, 1789)	-	-	+
	Pigeons & Doves	Columbidae			
84	Blue Rock Pigeon	Columba livia (Gmelin, 1789)	+	+	+
85	Little Brown Dove	Streptopelia senegalensis (Linnaeus, 1766)	+	+	+
86	Red Collared-Dove	Streptopelia tranquebarica (Hermann, 1804)	-	-	+
87	Eurasian Collared-Dove	Streptopelia decaocto (Frisvaldszky, 1838)	+	+	+
88	Yellow-legged Green-Pigeon	Treron phoenicoptera (Latham, 1790)	-	-	+
	Parakeets & Hanging-Parrots	Psittacidae			
89	Alexandrine Parakeet	Psittacula eupatria (Linnaeus, 1766)	-	-	+
90	Rose-ringed Parakeet	Psittacula krameri (Scopoli, 1769)	+	+	+
91	Plum-headed Parakeet	Psittacula cyanocephala (Linnaeus, 1766)	-	-	+
	Cuckoos, Malkohas & Coucals	Cuculidae			
92	Asian Koel	Eudynamis scolopacea (Linnaeus, 1758)	-	+	+
93	Greater Coucal	Centropus sinensis (Stephens, 1815)	-	-	+
	Owls	Strigidae			
94	Spotted Owlet	Athene brama (Temminck, 1821)	-	+	+
	Nightjars	Caprimulgidae			
95	Common Indian Nightjar	Caprimulgus asiaticus (Latham, 1790)	-	-	+
	Swifts	Apodidae			
96	House Swift	Apus affinis (J.E. Gray, 1830)	-	-	+
	Kingfishers	Alcedinidae			
97	Small Blue Kingfisher	Alcedo atthis (Linnaeus, 1758)	+	-	-
98	White-breasted Kingfisher	Halcyon smyrnensis (Linnaeus, 1758)	+	+	+

99	Lesser Pied Kingfisher	<i>Ceryle rudis</i> (Linnaeus, 1758)	+	-	-
	Bee-eaters	Meropidae			
100	Small Bee-eater	<i>Merops orientalis</i> (Latham, 1801)	+	+	+
101	Blue-cheeked Bee-eater	<i>Merops persicus</i> (Pallas, 1773)	-	-	+
102	Blue-tailed Bee-eater	<i>Merops philippinus</i> (Linnaeus, 1766)	-	-	+
	Rollers	Coraciidae			
103	European Roller	<i>Coracias garrulus</i> (Linnaeus, 1758)	-	-	+
104	Indian Roller	<i>Coracias benghalensis</i> (Linnaeus, 1758)	+	-	+
	Hoopoes	Upupidae			
105	Common Hoopoe	<i>Upupa epops</i> (Linnaeus, 1758)	-	+	+
	Hornbills	Bucerotidae			
106	Indian Grey Hornbill	<i>Ocyrceros birostris</i> (Scopoli, 1786)	-	+	+
	Barbets	Capitonidae			
107	Coppersmith Barbet	<i>Megalaima haemacephala</i> (P.L.S. Müller, 1776)	-	+	+
	Woodpeckers	Picidae			
108	Eurasian Wryneck	<i>Jynx torquilla</i> (Linnaeus, 1758)	-	-	+
109	Lesser Golden-backed Woodpecker	<i>Dinopium benghalense</i> (Linnaeus, 1758)	-	+	+
	Larks	Alaudidae			
110	Singing Bush-Lark	<i>Mirafra cantillans</i> (Blyth, 1845)	-	-	+
111	Common Crested Lark	<i>Galerida cristata</i> (Linnaeus, 1758)	-	-	+
	Swallows & Martins	Hirundinidae			
112	Dusky Crag-Martin	<i>Hirundo concolor</i> (Sykes, 1833)	-	+	+
113	Wire-tailed Swallow	<i>Hirundo smithii</i> (Leach, 1818)	+	+	+
114	Red-rumped Swallow	<i>Hirundo daurica</i> (Linnaeus, 1771)	-	-	+
115	Streak-throated Swallow	<i>Hirundo fluvicola</i> (Blyth, 1855)	-	-	+
	Wagtails & Pipits	Motacillidae			
116	Large Pied Wagtail	<i>Motacilla maderaspatensis</i> (Gmelin, 1789)	+	-	-
117	Citrine Wagtail	<i>Motacilla citreola</i> (Pallas, 1776)	+	-	-
118	Yellow Wagtail	<i>Motacilla flava</i> (Linnaeus, 1758)	+	-	-
119	Paddyfield Pipit	<i>Anthus rufulus</i> (Vieillot, 1818)	+	-	+
	Cuckoo-Shrikes, Flycatcher-Shrikes, Trillers, Minivets, Woodshrikes	Campephagidae			
120	Small Minivet	<i>Pericrocotus cinnamomeus</i> (Linnaeus, 1766)	-	-	+
121	Common Woodshrike	<i>Tephrodornis pondicerianus</i> (Gmelin, 1789)	-	+	+

	Bulbuls & Finchbills	Pycnonotidae			
122	White-eared Bulbul	<i>Pycnonotus leucotis</i> (Gould, 1836)	-	-	+
123	Red-vented Bulbul	<i>Pycnonotus cafer</i> (Linnaeus, 1766)	+	+	+
	Shrikes	Laniidae			
124	Bay-backed Shrike	<i>Lanius vittatus</i> (Valenciennes, 1826)	-	-	+
125	Rufous-backed Shrike	<i>Lanius schach</i> (Linnaeus, 1758)	-	-	+
126	Southern Grey Shrike	<i>Lanius meridionalis</i> (Temminck, 1820)	-	+	+
	Thrushes, Shortwings, Robins, Forktails, Wheaders	Turdinae			
127	Bluethroat	<i>Luscinia svecica</i> (Linnaeus, 1758)	+	-	-
128	Oriental Magpie-Robin	<i>Copsychus saularis</i> (Linnaeus, 1758)	-	-	+
129	Indian Robin	<i>Saxicoloides fulicata</i> (Linnaeus, 1776)	-	+	+
130	Black Redstart	<i>Phoenicurus ochruros</i> (Gmelin, 1774)	-	-	+
131	Common Stonechat	<i>Saxicola torquata</i> (Linnaeus, 1766)	-	-	+
132	Pied Bushchat	<i>Saxicola caprata</i> (Linnaeus, 1766)	-	-	+
133	Desert Wheatear	<i>Oenanthe deserti</i> (Temminck, 1825)	-	-	+
134	Isabelline Wheatear	<i>Oenanthe isabellina</i> (Temminck, 1829)	-	-	+
135	Indian Chat	<i>Cercomela fusca</i> (Blyth, 1851)	-	+	+
	Babblers, Laughingthrushes, Babaxes, Barwings, Yuhinas	Timaliinae			
136	Yellow-eyed Babbler	<i>Chrysomma sinense</i> (Gmelin, 1789)	+	-	-
137	Common Babbler	<i>Turdoides caudatus</i> (Dumont, 1823)	-	-	+
138	Large Grey Babbler	<i>Turdoides malcolmi</i> (Sykes, 1832)	-	+	+
139	Jungle Babbler	<i>Turdoides striatus</i> (Dumont, 1823)	-	-	+
	Goldcrest, Prinias, Tesias, Warblers	Sylviinae			
140	Ashy Prinia	<i>Prinia socialis</i> (Sykes, 1832)	-	+	+
141	Rufous-fronted Prinia	<i>Prinia buchanani</i> (Blyth, 1844)	-	-	+
142	Plain Prinia	<i>Prinia inornata</i> (Sykes, 1832)	-	-	+
143	Common Chiffchaff	<i>Phylloscopus collybita</i> (Vieillot, 1817)	-	+	+
144	Common Lesser Whitethroat	<i>Sylvia curruca</i> (Linnaeus, 1758)	-	+	+
	Flycatchers	Muscicapinae			
145	Red-throated Flycatcher	<i>Ficedula parva</i> (Bechstein, 1792)	-	-	+
146	Grey-headed Flycatcher	<i>Culicicapa ceylonensis</i> (Swainson, 1820)	-	-	+
	Monarch-Flycatchers & Paradise-Flycatchers	Monarchinae			

147	Asian Paradise-Flycatcher	Terpsiphone paradisi (Linnaeus, 1758)	-	-	+
	Fantail-Flycatchers	Rhipidurinae			
148	White-browed Fantail-Flycatcher	Rhipidura aureola (Lesson, 1830)	-	-	+
	Tits	Paridae			
149	Great Tit	Parus major (Linnaeus, 1758)	-	-	+
	Sunbirds & Spiderhunters	Nectariniidae			
150	Purple Sunbird	Nectarinia asiatica (Latham, 1790)	-	+	+
	White-eyes	Zosteropidae			
151	Oriental White-eye	Zosterops palpebrosus (Temminck, 1824)	-	-	+
	Buntings	Emberizinae			
152	Crested Bunting	Melophus lathamii (Gray, 1831)	-	-	+
	Finches	Fringillidae			
153	Common Rosefinch	Carpodacus erythrinus (Pallas, 1770)	+	-	+
	Munias (Estrildid Finches)	Estrildidae			
154	White-throated Munia	Lonchura malabarica (Linnaeus, 1758)	-	-	+
155	Spotted Munia	Lonchura punctulata (Linnaeus, 1758)	-	-	+
	Sparrows & Snowfinches	Passerinae			
156	House Sparrow	Passer domesticus (Linnaeus, 1758)	+	+	+
157	Yellow-throated Sparrow	Petronia xanthocollis (Burton, 1838)	-	-	+
	Weavers	Ploceinae			
158	Baya Weaver	Ploceus philippinus (Linnaeus, 1766)	+	-	+
	Starlings & Mynas	Sturnidae			
159	Brahminy Starling	Sturnus pagodarum (Gmelin, 1789)	-	+	+
160	Rosy Starling	Sturnus roseus (Linnaeus, 1758)	+	-	+
161	Asian Pied Starling	Sturnus contra (Linnaeus, 1758)	+	+	+
162	Common Myna	Acridotheres tristis (Linnaeus, 1766)	+	+	+
163	Bank Myna	Acridotheres ginginianus (Latham, 1790)	+	+	+
	Orioles	Oriolidae			
164	Eurasian Golden Oriole	Oriolus oriolus (Linnaeus, 1758)	-	-	+
	Drongos	Dicruridae			
165	Black Drongo	Dicrurus macrocercus (Vieillot, 1817)	+	+	+
	Crows, Jays, Treepies, Magpies	Corvidae			
166	Indian Treepie	Dendrocitta vagabunda (Latham, 1790)	-	+	+
167	House Crow	Corvus splendens (Vieillot, 1817)	+	+	+

Table legends

UAA: Urban Aquatic Areas; HSA: Human Settlement Areas; UGP: Urban Green Patches
 (+) represents presence of species and (-) represents absence of species

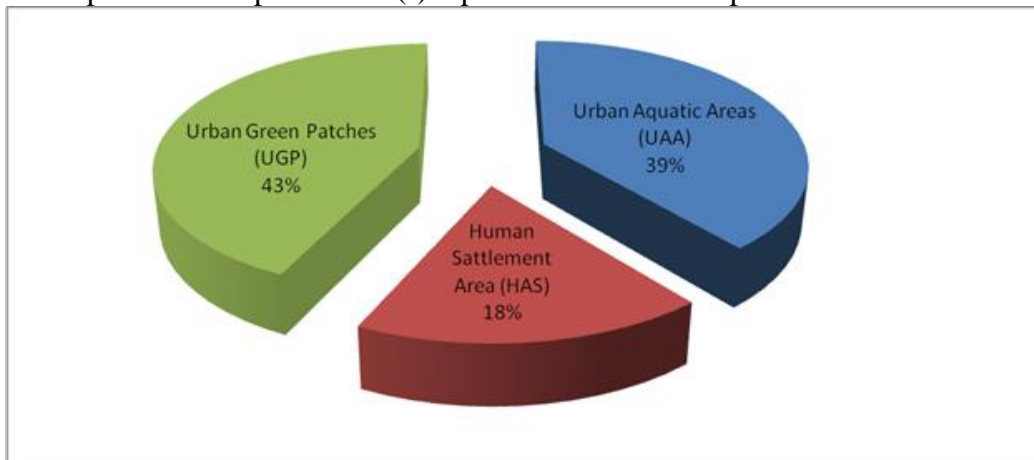


Figure 3: Observed Species at different Microhabitats of Municipal Area of Ajmer District, Rajasthan

Table 2: Relative diversity (RDi) of avian families at Municipal area of Ajmer District, Rajasthan and number of species at various sites

S. No.	Family Commonly Known as	Family Name	Overall Rdi	No of Species in UAA	No of Species in HSA	No of Species in UGP
1	Grebes	Podicipedidae	0.6	1	0	0
2	Pelicans	Pelecanidae	1.19	2	0	0
3	Cormorants/Shags	Phalacrocoracidae	1.79	3	0	0
4	Darters	Anhingidae	0.6	1	0	0
5	Hérons, Egrets & Bitterns	Ardeidae	5.36	9	3	2
6	Storks	Ciconiidae	1.19	2	0	1
7	Ibises & Spoonbills	Threskiornithidae	2.38	4	0	0
8	Flamingos	Phoenicopteridae	0.6	1	0	0
9	Swans, Geese & Ducks	Anatidae	8.93	15	0	0
10	Hawks, Eagles, Buzzards, Old World Vultures, Kites, Harriers	Accipitridae	5.36	2	2	9
11	Osprey	Pandionidae	0.6	1	0	0
12	Falcons	Falconidae	0.6	0	0	1
13	Pheasants, Partridges, Quails	Phasianidae	2.38	0	2	4
14	Rails, Crakes, Moorhens, Coots	Rallidae	2.38	4	0	1
15	Jacanas	Jacanidae	1.19	2	0	0
16	Painted-Snipes	Rostratulidae	0.6	1	0	0
17	Sandpipers, Stints, Snipes, Godwits & Curlews	Scolopacidae	5.36	4	1	2
18	Plovers, Dotterels, Lapwings	Charadriidae	2.38	9	0	3
19	Ibisbill, Avocets & Stilts	Recurvirostridae	1.19	2	1	1
20	Gulls, Terns & Noddies	Laridae	3.57	6	0	0

21	Sandgrouse	Pteroclididae	1.19	0	0	2
22	Pigeons & Doves	Columbidae	2.98	3	3	5
23	Parakeets & Hanging-Parrots	Psittacidae	1.79	1	1	3
24	Cuckoos, Malkohas & Coucals	Cuculidae	1.19	0	1	2
25	Owls	Strigidae	0.6	0	1	1
26	Nightjars	Caprimulgidae	0.6	0	0	1
27	Swifts	Apodidae	0.6	0	0	1
28	Kingfishers	Alcedinidae	1.79	3	1	1
29	Bee-eaters	Meropidae	1.79	1	1	3
30	Rollers	Coraciidae	1.19	1	0	2
31	Hoopoes	Upupidae	0.6	0	1	1
32	Hornbills	Bucerotidae	0.6	0	1	1
33	Barbets	Capitonidae	0.6	0	1	1
34	Woodpeckers	Picidae	1.19	0	1	2
35	Larks	Alaudidae	1.19	0	0	2
36	Swallows & Martins	Hirundinidae	2.38	1	2	4
37	Wagtails & Pipits	Motacillidae	2.38	4	0	1
38	Cuckoo-Shrikes, Flycatcher-Shrikes, Trillers, Minivets, Woodshrikes	Campephagidae	1.19	0	1	2
39	Bulbuls & Finchbills	Pycnonotidae	1.19	1	1	2
40	Shrikes	Laniidae	1.79	0	1	3
41	Thrushes, Shortwings, Robins, Forktails, Wheaters	Turdinae	5.36	1	2	8
42	Babblers, Laughingthrushes, Babaxes, Barwings, Yuhinas	Timaliinae	2.38	1	1	3
43	Goldcrest, Prinias, Tesias, Warblers	Sylviinae	2.98	0	3	5
44	Flycatchers	Muscicapinae	1.19	0	0	2
45	Monarch-Flycatchers & Paradise-Flycatchers	Monarchinae	0.6	0	0	1
46	Fantail-Flycatchers	Rhipidurinae	0.6	0	0	1
47	Tits	Paridae	0.6	0	0	1
48	Sunbirds & Spiderhunters	Nectariniidae	0.6	0	1	1
49	White-eyes	Zosteropidae	0.6	0	0	1
50	Buntings	Emberizinae	0.6	0	0	1
51	Finches	Fringillidae	0.6	1	0	1
52	Munias (Estrildid Finches)	Estrildidae	1.19	0	0	2
53	Sparrows & Snowfinches	Passerinae	1.19	1	1	2
54	Weavers	Ploceinae	0.6	1	0	1
55	Starlings & Mynas	Sturnidae	3.57	4	4	5
56	Orioles	Oriolidae	0.6	0	0	1
57	Drongos	Dicruridae	0.6	1	1	1
58	Crows, Jays, Treepies, Magpies	Corvidae	1.19	1	2	2
			100	95	41	104

Table 3: Similarity indices (Jaccard Index and Sorenson Index) between the various study sites

		Jaccard Index		
		UAA	HAS	UGP
Sorenson Index	UAA		0.1709	0.1976
	HSA	0.2919		0.3809
	UGP	0.3300	0.5517	

3. Results and Discussions

In the investigation period of twenty-four months, a total of 167 species of birds belonging to 58 families were recorded in the study area (Table 1). The three different study sites i.e. Urban Aquatic Area (UAA) had 39% of the total species observed; Human Settlement Area (HSA) had 18% and Urban Green Patches (UGP) had 43% of the total species observed (Fig. 3). The Relative Diversity of different families was calculated to determine the dominance of species occurrence at a particular study site (Table 2). The highest relative diversity was recorded as of Anatidae family with 15 species and 8.93 RDi followed by Ardeidae, Accipitridae, Scolopacidae and Turdinae families with 9 species each and 5.36 RDi respectively representing the dominance of species occurrence belonging to these families at study area (Table 2). The calculation for the similarity indices among different study sites revealed that Urban Green Patches and Human Settlement Areas had more similar habitat structure as the Jaccard index and Sorenson Index values are higher i.e. 0.3809 and 0.5517 respectively. While on the other hand Urban Aquatic Areas and Human Settlement Areas had very less similarity in habitat characteristics hence the values of Jaccard index and Sorenson Index are lower as 0.1709 and 0.2919 respectively (Table 3).

Overall, 95 species belonging to 34 families were present in the Urban Aquatic Area (UAA). The Anatidae family with 15 species dominated the Urban Aquatic Area followed by the Scolopacidae with 9 species. The urban terrestrial area which was further classified for simplification into Human Settlement Area (HAS) and Urban Green Patches (UGP). The Human Settlement Area was represented by 41 species belonging to 27 families. This Area had a lesser number of species and was dominated by Sturnidae family (4 species) followed by Ardeidae, Columbidae, and Sylviinae (3 species each). The Urban Green Patches had 47 families (104 species) and Accipitridae family dominated the area (9 species) followed by Turdinae family (8 species).

4. Conclusion

The present study concluded that the Municipal area of Ajmer district represents near about 68% of the avifaunal diversity observed in different habitats of the Ajmer District as a whole [2,3,5-8]. The study area includes the foothills of the oldest mountain range the Aravalli that provides an excellent habitat for various floral and faunal components hence the diversity is rich at the study area. The Urban Aquatic Areas (Anasagar Lake, Foy Sagar Lake, Chaurasiywas Talab, Paal Bichla Talab and Khanpura Talab) represented by the 96 species belonging to the 34 families. The Anasagar Lake, which is located in the central part of Ajmer Municipal area supports the 40 species [19], whereas another study conducted after two years by same authors documented 42 species from the same locality [20]. In the continuation another worker documented 48 species of birds from the Anasagar Lake and 42 species from the Foy Sagar Lake [21].

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