



## Avian diversity of public garden: Valley of wildflowers Ishwariya Hill Garden, Madhapar, Rajkot, Gujarat, India

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### Abstract

The present ecological study plays a significant role in conserving avifaunal diversity. The present work dealt with species community and diversity pattern of birds in Valley of Wildflowers, Ishwariya Hill Garden, Madhapar, Rajkot, Gujarat, India; from October – 2021 to September – 2023 (24 months or 2 years). I aim to prepare a checklist and see the avian diversity of selected sites. Based on preliminary surveys of the study area from July (2021) to September (2021) methodology was established and a map was created. Data records of birds were sighted at random under 72 visits; by approaching each macro and micro-habitat and peripheral boundaries by walk. Random sampling, point count, and Line transect method these 3 - methods are used for collecting data. A total of 130 species of birds, belonging to 99 genera, 48 families, and 18 orders were recorded from this study area during these 24 months. The numbers and percentages of terrestrial bird species (72, 55%) were a little higher than aquatic birds (58, 45%); as populations were a little high in aquatic birds (14326, 56%) than in terrestrial birds (11202, 44%) and total individuals are 25528. Most three dominant populations of the birds were of Great White Pelican (*Pelecanus onocrotalus*) (3221 individuals), Black Drongo (*Dicrurus macrocercus*) (1683 individuals) and Red-wattled Lapwing (*Vanellus indicus*) (1521 individuals) during this study period. Based on these good results and diverse avifauna we conclude that this area provides good resources and a good environment for the avifauna.

**Keywords:** Avian, diversity, valley of wild-flowers, checklist

### Introduction

The process of urbanization creates a new, unique ecosystem by altering the landscape, changing the soil, changing the climate, and reducing biodiversity (Pickett *et al.* (2011) [23].

Being scavengers, pollinators, predators, seed dispersers, prey, and ecosystem engineers, birds are essential to any ecosystem. A declining bird population indicates that we are upsetting the ecosystem, which is a sign that the environment is in danger. Therefore, preserving the ecosystem's equilibrium requires the conservation of the bird population.

As pollinators of flowers, dispersers of seeds, sources of the food chain, and agents of breaking seed dormancy, birds and their diversity are an important component of the natural environment (Nason, 1992) [19]. Birds are excellent environmental indicators because, during their migration and local movements, they serve as dispersers, moving spores and nutrients from one location to another (Niemi, 1985) [20]. The relationship between bird populations and vegetation was documented by Mac Arthur and Mac Arthur (1961). Emlen (1974) [9] mentioned the positive and negative changes in the bird population that occurred due to the natural environment's transformation. According to research by Skead (1966) [27], Maxwell and Kale (1977), and McCrimmon (1978) [17], the habitat is important for the organism's life cycle to be completed successfully.

Urbanization leads to increased populations of a limited number of bird species, positively affecting the abundance of certain species that have adapted to urban environments, particularly those that are omnivorous or require specific nesting sites (Kale *et al.*, 2012) [15].

### Avian Biodiversity

India is recognized for its extraordinary diversity, placing it among the most varied countries in the world, as noted by Gadgil and Rao (1998) [10]. The nation includes two significant global biodiversity hotspots and features seven unique bird regions that are not found elsewhere on the planet (Grimmet *et al.*, 1998).

According to Sibley and Monroe (1991) [25], there are 9,672 bird species documented worldwide. India's checklist documents a total of 1,263 bird species across 23 orders, 107 families, and 498 genera, with 61 species (4.8%) being endemic (Praveen *et al.* 2016) [24]. 479 species of birds in Gujarat have been reported by Singh (2001) [26]. In 2004, a checklist compiled by Parasharya *et al.* identified 526 species and subspecies of birds in Gujarat. Twelve years later, Ganpule (2016) [11] reported an increase, listing a total of 574 bird species in the region. More recently, Ganpule (2017) [12] updated this figure to 582 species. This study assessed the diversity of bird species in the public garden known as the Valley of Wild Flowers Ishwariya Hill Garden, located in Madhapar, Rajkot, Gujarat, India.

A comprehensive study of the avifauna in this selected region has not been conducted.

The primary aim of this study is to develop a comprehensive checklist to enhance our understanding of the avifaunal diversity within the study area.

The current research was undertaken to offer the latest insights into the avian diversity found in the public garden known as Ishwariya Hill Garden, located in Madhapar, Rajkot, Gujarat, India.

## Study Area

### Location:

The present work is conducted at Valley of Wild-Flowers Ishwariya Hill Garden, Madhapar, Rajkot, Gujarat, India; from October - 2021 to September – 2023 (24 months). The Ishwariya Hill Garden is located at 22°21'14.52" N latitude and 70°45'33.03" E longitude; which is 10 kilometers away from Rajkot City and spread over 50% of land & 50% of water. The entire aquatic and landscape covering survey areas spread over a total of 237 acres (0.96 Square km). The area comprises characteristics habitat of large aquatic lands (spread over 50% of the total areas), grassland fragments, and scrubland having small hilly terrain, and trees and shrub patches.

Ishwariya Hill Garden was established on 8th Feb 2008 and governed by the Collector Office, Rajkot. The garden has several macro and microhabitats that provide ideal places for pilgrims, tourists, and nature lovers, picnic places for children, and sports grounds for Golf. The park has a huge

lake which covers almost one-half of the total area. International theme-based children's parks provide boating, a light Musical Fountain, a playground for children, and a Golf Course to attract people.

The landscape areas and habitat structures including an ecological overview of the Ishwariya Hill Garden are described below:

The area comprises small hilly rocky terrain and grassland patches. There is a lake on the western side of the garden spread over 50% of the total area. Several small islands of water bodies provide undisturbed roosting and resting sites for birds. The eastern side has a hilly rocky terrain covered by vegetative strata such as trees, shrubs, climbers, herbs, and small grassland patches. Here, anthropogenic activity is least as the area is prohibited for visitors in the morning but the evening anthropogenic pressure is high. In the middle moderate grassland patches are for a Golf course, boating in water bodies, a Canteen, and a playground for children.

Location is shown in (Fig.1A & B).



**Fig 1:** Illustrates the geographical position of the study site

- A. Rajkot City and location of study site in Gujarat State.
- B. Yellow marking denotes Survey Areas of Birds and T1 to T5 is samplings treks (*viz.* Ishwariya Hill Garden).

Vegetative areas and water reservoirs are the main characteristics of this study site which attracts many terrestrial as well as aquatic birds, insects, butterflies, etc.

## Materials & Methods

The work was carried out from October 2021 to September 2023 (24 months or 2 years); Total of 72 visits, at Valley of Wild Flowers Ishwariya Hill Garden, Madhapar, Rajkot, Gujarat, India; which spreads over 50% of land. The entire aquatic and landscape covering survey areas spread over a total of 237 acres (0.96 square km) as shown in Fig. 1B. To

survey the bird records the entire Ishwariya Hill Garden areas; every sampling day was scanned once between 06:00 to 12:00 hours using binocular (Olympus, 12 x 50) by me. Each macro and micro-habitat was surveyed by approaching peripheral boundaries by walking at random. Data records of bird encounters on sighting, the birds present in and around; including visible flying individuals, resting on trees, foraging, feeding on the ground, swimming over water reservoirs, resting and sunbathing on islands.

A total of 360 line transects (N=360; i.e. Trek 1 to 5 approximately 0.5 km to 1.5 km long), were surveyed (05 transects/visit; 3 visits/month) in total 72 visits, by morning 06:00 to 12:00 hours (6 hours/day i.e. total 432 hours spent by one manpower for data samplings); because these are the times when birds are most active during the whole research period. Birds were recorded using direct count which includes the point-count method & line-transects methods (Urfi *et al.*, 2005) [28], and areas search method.

The intensive birds watching were done during regular monthly surveys and data collection was made using binoculars (Olympus, 12 X 50) and Photographs (Cannon Power-shoot SX740 HS) captured by digital still camera for close examinations and identification Photoshop software was used.

Identification of birds and Systematic updates were done by using references like Ali and Ripley (1983) [3], Ali (2002,

2012) [1, 2], Parasharya *et al.* (2004) [22], Norman (2015) [21], Ganpule, (2016, 2017) [11, 12], taxonomic references such as "Indian Subcontinental Birds" by Grimmett *et al.* (2013) [13] and digital bird databases like Birdlife International and Birds of Gujarat were utilized.

Systematic procedures were adhered to following HBW and Birdlife International.

**Results & Discussion**

The present work reports the checklist of birds with their systematic from the public garden: Valley of Wild Flowers Ishwariya Hill Garden, Madhapar, Rajkot, Gujarat, India.

I recorded a total of 25528 Individuals belonging to a total of 130 species of birds, belonging to 99 genera, 48 families, and 18 orders were recorded from Valley of Wild Flowers Ishwariya Hill Garden, Madhapar, Rajkot from October 2021 to September 2023 (24 months or 2 years). The numbers and percentages of terrestrial bird species (72, 55%) were a little higher than aquatic birds (58, 45%); as populations were a little high in aquatic birds (14326, 56%) than in terrestrial birds (11202, 44%). (Chart)

Most three dominant populations of the birds were of Great White Pelican (*Pelecanus onocrotalus*) (3221 individuals), Black Drongo (*Dicrurus macrocercus*) (1683 individuals) and Red-wattled Lapwing (*Vanellus indicus*) (1521 individuals) during this study period.

**Table 1:** Checklist of Avian Diversity in Valley of Wild-flowers, Ishwariya Hill Garden, Madhapar, Rajkot, Gujarat

Sr. No	Common Name	Scientific Name	Status MS
<b>Order: Anseriformes</b>			
<b>Family: Anatidae</b>			
1	Lesser Whistling-duck	<i>Dendrocygna javanica</i>	CR
2	Garganey	<i>Anas querquedula</i>	CWV
3	Gadwall	<i>Anas strepera</i>	CWV
4	Ruddy Shelduck	<i>Tadorna ferruginea</i>	CUWV
5	Eurasian Wigeon	<i>Anas penelope</i>	CWV
6	Northern Pintail	<i>Anas acuta</i>	CWV
7	Northern Shoveler	<i>Anas clypeata</i>	VCWV
8	Indian Spot-billed Duck	<i>Anas poecilorhyncha</i>	CR
9	Common Teal	<i>Anas crecca</i>	CWV
<b>Order: Galliformes</b>			
<b>Family: Phasianidae</b>			
10	Grey Francolin	<i>Francolinus pondicerianus</i>	CR
<b>Order: Phoenicopteriformes</b>			
<b>Family: Phoenicopteridae</b>			
11	Greater Flamingo	<i>Phoenicopeterus roseus</i>	CR
<b>Order: Podicipediformes</b>			
<b>Family: Podicipedidae</b>			
12	Little Grebe	<i>Tachybaptus ruficollis</i>	CR
13	Great Crested Grebe	<i>Podiceps cristatus</i>	UCR
<b>Order: Columbiformes</b>			
<b>Family: Columbidae</b>			
14	Common Pigeon	<i>Columba livia</i>	VCR
15	Yellow-footed Green Pigeon	<i>Treron phoenicopterus</i>	CUR&LM
16	Red Collared Dove	<i>Streptopelia tranquebarica</i>	CR
17	Eurasian Collared Dove	<i>Streptopelia decaocto</i>	CR
18	Laughing Dove	<i>Spilopelia senegalensis</i>	CR
<b>Order: Cuculiformes</b>			
<b>Family: Cuculidae</b>			
19	Asian Koel	<i>Eudynamis scolopaceus</i>	CR
20	Greater Coucal	<i>Centropus sinensis</i>	CR
<b>Order: Gruiformes</b>			
<b>Family: Rallidae</b>			
21	White-breasted Waterhen	<i>Amaurornis phoenicurus</i>	CR
22	Purple Swanphen	<i>Porphyrio porphyrio</i>	CR

23	Common Moorhen	<i>Gallinula chloropus</i>	CR
24	Eurasian Coot	<i>Fulica atra</i>	CR
<b>Order: Ciconiiformes</b>			
<b>Family: Ciconiidae</b>			
25	Asian Openbill	<i>Anastomus oscitans</i>	CR
26	Painted Stork	<i>Mycteria leucocephala</i>	ULCR
<b>Order: Pelecaniformes</b>			
<b>Family: Ardeidae</b>			
27	Grey Heron	<i>Ardea cinerea</i>	CR&WV
28	Purple Heron	<i>Ardea purpurea</i>	CR
29	Indian Pond Heron	<i>Ardeola grayii</i>	CR
30	Black-crowned Night Heron	<i>Nycticorax nycticorax</i>	CR
31	Cattle Egret	<i>Bubulcus ibis</i>	CR
32	Great Egret	<i>Casmerodius albus</i>	CR
33	Little Egret	<i>Egretta garzetta</i>	CR
34	Intermediate Egret	<i>Ardea intermedia</i>	CR
<b>Family: Pelecanidae</b>			
35	Great White Pelican	<i>Pelecanus onocrotalus</i>	CWV
36	Dalmatian Pelican	<i>Pelecanus crispus</i>	CUWV
<b>Family: Threskiornithidae</b>			
37	Glossy Ibis	<i>Plegadis falcinellus</i>	CUR&M
38	Black-headed Ibis	<i>Threskiornis melanocephalus</i>	CR
39	Red-naped Ibis	<i>Pseudibis papillosa</i>	CR
40	Eurasian Spoonbill	<i>Platalea leucorodia</i>	CR&LM
<b>Order: Suliformes</b>			
<b>Family: Anhingidae</b>			
41	Oriental Darter	<i>Anhinga melanogaster</i>	UR
<b>Family: Phalacrocoracidae</b>			
42	Great Cormorant	<i>Phalacrocorax carbo</i>	CR
43	Little Cormorant	<i>Phalacrocorax niger</i>	CR
44	Indian Cormorant	<i>Phalacrocorax fuscicollis</i>	CR
<b>Order: Charadriiformes</b>			
<b>Family: Burhinidae</b>			
45	Indian Thick-Knee	<i>Burhinus indicus</i>	CR
<b>Family: Charadriidae</b>			
46	Little Ringed Plover	<i>Charadrius dubius</i>	CR
47	Red-wattled Lapwing	<i>Vanellus indicus</i>	VCR
48	Yellow-wattled Lapwing	<i>Vanellus malabaricus</i>	CR
<b>Family: Jacanidae</b>			
49	Pheasant-tailed Jacana	<i>Hydrophasianus chirurgus</i>	CR
<b>Family: Laridae</b>			
50	Caspian Tern	<i>Hydroprogne caspia</i>	CR
51	River Tern	<i>Sterna aurantia</i>	CR
52	Common Tern	<i>Sterna hirundo</i>	UPM&WV
53	Whiskered Tern	<i>Chlidonias hybrida</i>	CWV
54	Black-headed Gull	<i>Chroicocephalus ridibundus</i>	CWV
55	Pallas's Gull	<i>Ichthyaetus ichthyaetus</i>	CWV
<b>Family: Recurvirostridae</b>			
56	Black-winged Stilt	<i>Himantopus himantopus</i>	CR
<b>Family: Scolopacidae</b>			
57	Ruff	<i>Philomachus pugnax</i>	VCWV
58	Marsh Sandpiper	<i>Tringa stagnatilis</i>	CWV
59	Wood Sandpiper	<i>Tringa glareola</i>	CWV
60	Common Sandpiper	<i>Actitis hypoleucos</i>	CWV
61	Green Sandpiper	<i>Tringa ochropus</i>	CWV
62	Sanderling	<i>Calidris alba</i>	CWV
63	Little Stint	<i>Calidris minuta</i>	CWV
64	Temminck's stint	<i>Calidris temminckii</i>	CWV
65	Common Snipe	<i>Gallinago gallinago</i>	CWV
66	Black-tailed Godwit	<i>Limosa limosa</i>	CWV
67	Common Greenshank	<i>Tringa nebularia</i>	CWV
<b>Order: Accipitriformes</b>			
<b>Family: Accipitridae</b>			
68	Shikra	<i>Accipiter badius</i>	CR
69	Black Kite	<i>Milvus migrans</i>	CR
70	Black-winged Kite	<i>Elanus caeruleus</i>	CR
71	Eurasian Marsh Harrier	<i>Circus aeruginosus</i>	CWV

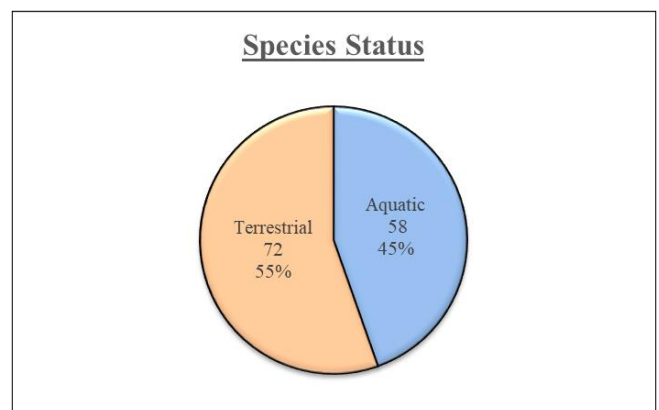
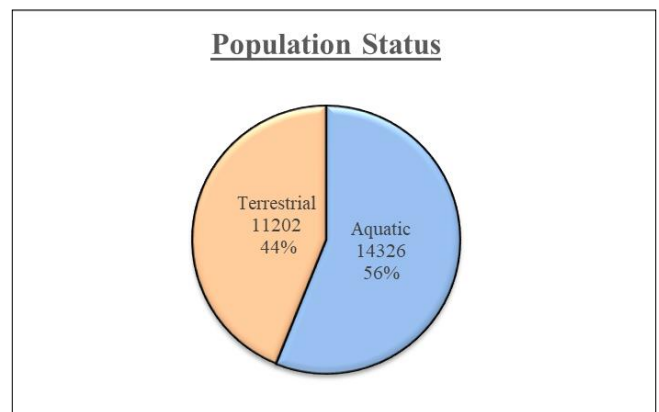
72	Oriental Honey-buzzard	<i>Pernis ptilorhynchus</i>	CR&WV
<b>Family: Pandionidae</b>			
73	Osprey	<i>Pandion haliaetus</i>	CWV
<b>Order: Strigiformes</b>			
<b>Family: Strigidae</b>			
74	Spotted Owllet	<i>Athene brama</i>	CR
<b>Order: Bucerotiformes</b>			
<b>Family: Upupidae</b>			
75	Common Hoopoe	<i>Upupa epops</i>	CWV
<b>Order: Piciformes</b>			
<b>Family: Megalaimidae</b>			
76	Coppersmith Barbet	<i>Megalaima haemacephala</i>	CR
<b>Family: Picidae</b>			
77	Yellow-crowned Woodpecker	<i>Leiopicus mahrattensis</i>	CR
78	Eurasian Wryneck	<i>Jynx torquilla</i>	CUWV
<b>Order: Coraciiformes</b>			
<b>Family: Alcedinidae</b>			
79	Pied Kingfisher	<i>Ceryle rudis</i>	CR
80	White-throated Kingfisher	<i>Halcyon smyrnensis</i>	VCR
81	Common Kingfisher	<i>Alcedo atthis</i>	CR
<b>Family: Meropidae</b>			
82	Green Bee-eater	<i>Merops orientalis</i>	CR
<b>Order: Psittaciformes</b>			
<b>Family: Psittacidae</b>			
83	Rose-ringed Parakeet	<i>Psittacula krameri</i>	VCR
<b>Order: Passeriformes</b>			
<b>Family: Acrocephalidae</b>			
84	Clamorous Reed Warbler	<i>Acrocephalus stentoreus</i>	CR&M
<b>Family: Aegithinidae</b>			
85	Common Iora	<i>Aegithina tiphia</i>	CR
<b>Family: Alaudidae</b>			
86	Indian Bushlark	<i>Mirafra erythroptera</i>	CR
87	Ashy-crowned Sparrow Lark	<i>Eremopterix griseus</i>	VCR
88	Sykes's Lark	<i>Galerida deva</i>	UR
89	Greater Short-toed Lark	<i>Calandrella brachydactyla</i>	CWV
<b>Family: Campephagidae</b>			
90	Small Minivet	<i>Pericrocotus cinnamomeus</i>	CR
<b>Family: Cisticolidae</b>			
91	Plain Prinia	<i>Prinia inornata</i>	CR
92	Ashy Prinia	<i>Prinia socialis</i>	CR
93	Grey-breasted Prinia	<i>Prinia hodgsonii</i>	CR
94	Common Tailorbird	<i>Orthotomus sutorius</i>	CR
<b>Family: Corvidae</b>			
95	Rufous Treepie	<i>Dendrocitta vagabunda</i>	CR
<b>Family: Dicruridae</b>			
96	Black Drongo	<i>Dicrurus macrocercus</i>	VCR
<b>Family: Estrildidae</b>			
97	Indian Silverbill	<i>Euodice malabarica</i>	CR
98	Scaly-breasted Munia	<i>Lonchura punctulata</i>	CR
<b>Family: Hirundinidae</b>			
99	Wire-tailed Swallow	<i>Hirundo smithii</i>	CR
100	Dusky Crag Martin	<i>Ptyonoprogne concolor</i>	CR
101	Red-rumped Swallow	<i>Cecropis daurica</i>	CR
102	Barn Swallow	<i>Hirundo rustica</i>	CWM
<b>Family: Laniidae</b>			
103	Bay-backed Shrike	<i>Lanius vittatus</i>	CR
104	Long-tailed Shrike	<i>Lanius schach</i>	CR
<b>Family: Leiotrichidae</b>			
105	Common Babbler	<i>Turdoides caudata</i>	VCR
106	Large Grey Babbler	<i>Turdoides malcolmi</i>	VCR
<b>Family: Monarchidae</b>			
107	Asian Paradise-flycatcher	<i>Terpsiphone paradisi</i>	CR&M
<b>Family: Motacillidae</b>			
108	Western Yellow Wagtail	<i>Motacilla flava</i>	CWV
109	Grey Wagtail	<i>Motacilla cinerea</i>	UWV
110	Citrine Wagtail	<i>Motacilla citreola</i>	CWV
111	White Wagtail	<i>Motacilla alba</i>	CWV

112	White-browed Wagtail	<i>Motacilla maderaspatensis</i>	CR
113	Paddyfield Pipit	<i>Anthus rufulus</i>	CR
114	Tawny Pipit	<i>Anthus campestris</i>	CWV
<b>Family: Muscicapidae</b>			
115	Common Stonechat	<i>Saxicola torquatus</i>	CWV
116	Pied Bushchat	<i>Saxicola caprata</i>	CWV
117	Black Redstart	<i>Phoenicurus ochruros</i>	CWV
118	Bluethroat	<i>Luscinia svecica</i>	CWV
119	Indian Robin	<i>Saxicoloides fulicatus</i>	CR
120	Oriental Magpie Robin	<i>Copsychus saularis</i>	CR
121	Red-breasted Flycatcher	<i>Ficedula parva</i>	CWV
<b>Family: Nectariniidae</b>			
122	Purple Sunbird	<i>Cinnyris asiaticus</i>	CR
<b>Family: Oriolidae</b>			
123	Indian Golden Oriole	<i>Oriolus kundoo</i>	CR
<b>Family: Passeridae</b>			
124	House Sparrow	<i>Passer domesticus</i>	CR
<b>Family: Ploceidae</b>			
125	Baya Weaver	<i>Ploceus philippinus</i>	CR
<b>Family: Pycnonotidae</b>			
126	Red-vented Bulbul	<i>Pycnonotus cafer</i>	VCR
<b>Family: Sturnidae</b>			
127	Bank Myna	<i>Acridotheres ginginianus</i>	VCR
128	Common Myna	<i>Acridotheres tristis</i>	VCR
129	Brahminy Starling	<i>Sturnia pagodarum</i>	VCR
130	Rosy Starling	<i>Pastor roseus</i>	VCWV

<b>CR</b> - Common Resident
<b>CR&amp;LM</b> - Common Resident & Local Migrant
<b>CR&amp;M</b> - Common Resident & Migrant
<b>CR&amp;WV</b> - Common Resident & Winter Visitor
<b>CUR&amp;LM</b> - Common to Uncommon Resident & Local Migrant
<b>CUR&amp;M</b> - Common to Uncommon Resident & Migrant
<b>CUWV</b> - Common to Uncommon Winter Visitor
<b>CWM</b> - Common Winter Migrant
<b>CWV</b> - Common Winter Visitor
<b>UCR</b> - Uncommon to Common Resident
<b>ULCR</b> - Uncommon to Local Common Resident
<b>UPM&amp;WV</b> - Uncommon Passage Migrant & Winter Visitor
<b>UR</b> - Uncommon Resident
<b>UWV</b> - Uncommon Winter visitor
<b>VCR</b> - Very Common Resident
<b>VCWV</b> - Very Common Winter Visitor

**Table 2:** Table showing No. of families & No. of Species recorded

Sr. No.	Order	Family	Species
1	Anseriformes	1	9
2	Galliformes	1	1
3	Phoenicopteriformes	1	1
4	Podicipediformes	1	2
5	Columbiformes	1	5
6	Cuculiformes	1	2
7	Gruiformes	1	4
8	Ciconiiformes	1	2
9	Pelecaniformes	3	14
10	Suliformes	2	4
11	Charadriiformes	6	23
12	Accipitriformes	2	6
13	Strigiformes	1	1
14	Bucerotiformes	1	1
15	Piciformes	2	3
16	Coraciiformes	2	4
17	Psittaciformes	1	1
18	Passeriformes	20	47
<b>Total</b>		<b>48</b>	<b>130</b>



**Chart 1:** Pie-chart showing Population status (%) and Species status (%) of the 8 Aquatic & Terrestrial Bird species

**Conclusion**

Overall species richness and diversity of birds were significant during this period as per results & checklist. In conclusion, diversity reveals that Ishwariya Hill Garden provides a multi-habitat complex to shelter and enough food resources for a recorded avifaunal community.

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