

# AVIAN DIVERSITY: A REVIEW

Priya Gaur<sup>1</sup>, Praveer Pandey<sup>2</sup> and S. Gaherwal<sup>1\*</sup>

<sup>1</sup>Government Holkar (Model, Autonomous) Science College, Indore (M.P.), INDIA,

<sup>2</sup>Government College, Mandleshwar (M.P.), INDIA

\*Corresponding author

## ABSTRACT

Bird species will be able to survive in the urban landscape or not, depends on their ability to adapt or the available resources. Birds and their melodious song increase the quality of life, especially for people living in urban areas. Nowadays city planners are making these habitats attractive, so that this may increase the faunal diversity. The current review aims to provide an analysis of avian fauna recorded. Wetland birds and terrestrial species are included from various water bodies and greenspaces of this area. This review highlights various aspects of avian diversity which were enlisted over these years and it will also form a base for further research.

**Keywords:** Indore, Avifaunal Diversity, Indices, Urban and Line transect.

## 1. INTRODUCTION

Avian diversity is also a bio-indicator of various habitats [1]. Current development in cities embodies one of the irreversible transformations for existing floral and faunal diversity [2]. Several factors like noise, light and water pollution etc. can indirectly affect bird capacity to survive and reproductive capacity in these areas [3]. Ornithologists have explored several ways of bird count techniques and have given simpler techniques for the researchers [4]. With all the guides and books, the data interpretation of avifaunal diversity is comprehensive [5].

Birds are a significant element of global biodiversity [2]). There are about 1,314 species from the Indian Subcontinent, out of which 450 species are reported from Central India [34]. In recent years, ornithologists have delved into various habitats and highlighted that birds are highly sensitive to obnoxious conditions. Estimation of avian diversity is an essential tool in the assessment of ecological health (Qualitative and Quantitative) of an ecosystem [13].

Since, land-use patterns have changed over the years, the emergence of pastures over the forest covers, farming croplands, botanical gardens, and highly urbanized human-dominated habitats. So, by calculating the avian diversity, one can estimate ecological health in both ways qualitatively and quantitatively. It's study functions as an ecological tool. As we know it performs several other functions in the ecosystem for example as a pollinating agent, seed dispersal, and disease regulation [2].

## 2. REVIEW

Balkhande [6] studied the avifaunal nesting pattern at Devi Ahilya Vishwavidyalaya, Indore (200 acre) by using line transect method and reported 34 bird species which belonged to 23 families in a period of one month. While studying nesting patterns of 6 different bird species were found breeding and nesting in the college campus. Species were White breasted water-hen, Red wattled lapwing, Red vented bulbul, Common swallow, Ashy Prinia and Ring dove. They have concluded that the campus was sustaining many bird species because of dense greenery and maintenance. Rapid urbanization is immensely altering the environment for birds and these effects were seen in the study conducted by [7] at Ralamandal Wildlife Sanctuary, Indore (M.P.). There were 2 species of great concern i.e. Egyptian vulture, which comes in Endangered category and Alexandrine parakeet, was found to be in Near threatened category.

Similarly, 51 species of Avian fauna were observed in the campus of Government Holkar Science College, Indore and only 1 species (Alexandrine parakeet) was found in Near threatened category of IUCN. Thus, areas like college campus are excellent places as they contain mature trees and dense foliage. In spite of the fact that campus has good ecological health, proper maintenance is required to increase the number of species dwelling in the area [8],[9]. According to the studies done by [10] sites of Indore city have a potential of sustaining a greater number of avian faunas shortly. Their study was the first-ever record of avian species in the Meghdoot garden, Nehru park and Lalbagh. Their findings support the scope of conservation of these spaces for increasing the number of species shortly. They have prepared a record of the Residential, IUCN and WPA status of the birds recorded in four sites of Indore city for one-year duration (2018). The results showed that there were five species as winter migrants, one as summer migrant, six as local migrants, and 46 as resident species.

According to WPA status, 5 species were Schedule I species, 1 schedule V, and 52 species as schedule IV species. Only one species, i.e. *Psittacula eupatria* was found to be in the near threatened category.

Wetland areas at some places potentially accord a large bird population. Despite this, an anthropogenic activity disrupts the ecology of a wetland. Total ninety-eight bird species were reported from a wetland site and its surrounding in Krishnagar City of West Bengal. Lesser adjutant stork, Black headed ibis and Indian vulture were currently present, which belonged to Vulnerable, near threatened and Critically endangered category of IUCN respectively. Furthermore, [11] alluded that ample food supply and safe zone were the basic requisite of migratory birds. Similarly, 3 near threatened species (Alexandrine parakeet, Malabar pied Hornbill and River tern), 2 vulnerable species (Great adjutant, lesser adjutant and Sarus crane), and White rumped vulture was found in Critically endangered category in Chuhiya Forest of Rewa district by [12].

Besides all the work done in Central India, maximum number of species was found by [13] in Tikamgarh district in Madhya Pradesh. Out of 170 species recorded, 9 bird species belonged to IUCN category. Painted stork, Alexandrine parakeet, River tern and Darter were present in Near threatened category, Woolly necked stork was the only species belonging to Vulnerable group, critically endangered category include Long billed vulture, White backed vulture and King vulture, and lastly Egyptian vulture was the only Endangered species in the area. Diseases, presence of predators and competition due to limited resources have led to decline in population of wetland birds over the years. Factors like siltation and soil erosion are prime reasons for swallowing of water bodies in cities [14]. However, they have noted migratory birds like Spot billed duck and Painted stork in large numbers during winter season [15].

Total seventeen species of avian fauna were recorded in their study of Sirpur Lake, Indore. Moreover, Sarus crane, darter, painted stork and oriental white ibis were found in the study of [16] in central India in Barna wetlands. In addition to these 270 species of birds were found in Jeypore Forest Reserve, in eastern Assam. This study revealed that almost 12 globally threatened species were thriving in the area annually, includes White cheeked partridge, Greater grey headed fish eagle, Brown hornbill, Great pied hornbill and Wedge billed wren babbler were belonging to Near threatened species. Slender billed babbler, Purple wood Pigeon, lesser adjutant stork and Swamp Francolin belonged to vulnerable category. White winged duck was the only species present in Endangered category from the reserve forest area. And lastly, long billed Vulture and Indian white backed vulture were critically endangered species so; the area is of great importance in terms of conservation of these rare birds [17].

Indore city harbours many species of bird diversity, workers studied avian diversity and its spatial variation at four different locations of Indore city viz. Meghdoot Garden, Nehru Park, Lalbagh and Pipliyapala Regional Park. One-year study was conducted January to December 2018 and 58 bird species belonging to 13 order and 34 families were recorded by the authors. The highest number of avian faunas were recorded in Pipliyapala Regional Park (58), followed by the second study site Lalbagh (41), then Meghdoot Garden (39) and the least number was 34 at Nehru Park. In this study Order Passeriformes was found to be dominant and family Columbidae was dominant having 8% contribution in the total diversity at Meghdoot Garden. Similarly, Muscicapidae was contributing 12% in Nehru Park and Lalbagh each and family Muscicapidae was 10% dominant in Regional Park. Their study highlights the need of Green spaces in urban cities [18].

Some rare birds in Central Indian Highlands of Madhya Pradesh which includes Malabar pied hornbill, Singing bush lark, Indian Short toed lark, Crested goshawk, Red spurfowl, Painted spurfowl, Red jungle fowl, Grey jungle fowl, Oriental turtle dove, Emerald dove, Indian cuckoo, Emerald dove, Common cuckoo etc [19]. Near threatened species like Painted stork and Oriental white ibis were observed in Pench Tiger Reserve in Madhya Pradesh of Central India by [20]. Avian species which are associated with agricultural lands are at more risk of decline as compared to avian fauna linked to other biome [21][22]. There is almost 40% reduction in population of birds in grasslands. Moreover, decrement of Aerial birds (Insectivores) has a high dependency on aerial insects (prey). Insect densities are hugely reduced by new agricultural practices and all the methods linked to it [23][24].

Areas with lesser intensive agricultural practices have higher species richness of the phylum Arthropod. In addition to this, cropland nearer to intensive agriculture areas can deliver necessary resources for a wide number of insects [25]. There is a gradual reduction of insectivorous birds in North America, and agricultural disturbances were found as one of the reasons behind these steep declines. Insect densities were reduced by rapid cropping intensities, improper wetland drainage and lastly accretion of agro chemical use. This led to abatement of breeding Tree swallows (*Tachycineta bicolor*). Passive aerial sampling was adopted for recording insect population and its biomass. Tree swallow nest boxes were monitored by RFID technology (Radio Frequency Identification) and their foraging behaviour was recorded. As, insect biomass was found greater on agricultural land, So, they have extravagant foraging rates as compared to grassland areas [26][27].

The number of individuals at each selected study site were Meghdoot Garden, Nehru Park, Lalbagh and Pipliyapala Regional Park. During this study, species richness (S) with respect to seasonal changes was recorded. Highest Species richness was recorded in Regional Park (S = 52) and lowest was observed in Nehru park (S = 30). The maximum numbers of individuals were observed in summer season (Pipliyapala Regional Park), followed by 452 in Lalbagh (summer) and

least were recorded in Nehru park (277) in Rainy season. They revealed that these study sites are of great importance in terms of sustenance of avian diversity in the city[28].

Birds play a vital role in controlling insect population[29]. They have also studied interaction between birds and the population density of insects (prey species). So, they calculated food of the avian fauna in both the ways i.e. qualitatively and quantitatively. Food density and also their production were estimated. In addition to this, they have also measured insect diversity living in the top of bushes and this all was done using twig sampling method and faecal pellets which were collected from the ground below the tree was counted. Dense foliage area such as heavy tree branches and deep holes in the upper part of the tree was not estimated. So, prey densities from these areas was not measured. Aquatic insect sampling was done by [30] to establish a relationship between aquatic insects and nesting bird (Rosy-finches). In all cardinal directions 4 emergence traps were used in the littoral zone. There were less Rosy-finches in fish containing lakes and more at fishless pond. Therefore, Mayfly (insect) density is a consequential factor for presence of few bird species. Therefore, intrusion of a non-native top predator into an ecosystem causes resource competition as well as altering food chain of that particular ecosystem.

As we know insects' population is controlled immensely by Insectivorous population of birds. They are mortality agents for insect pests and in addition to this they change the microhabitat of the prey. Birds suppress the insect population and prevent them growing to epidemic levels. These factors regulate and control outbreaks in insect population. They also help in seed dispersal of various shrubs and trees. Birds also spread wood rotting fungi and it leads to nutrient recycling in various ecosystems [31]. Exclusion experiments showed that larval Lepidoptera densities are importantly decreased by birds and that too in understory vegetation. Bird predation performs two vital functions, firstly as a population regulator and lastly, as natural selection agents [32].

Relation between codling moth larvae and bird population, showed that in cider- apple orchard and it was unsprayed. They also wended up with the fact that aging that birds are controlling codling moth population in the given area. Blue tits (*Parus caeruleus*) and Greater tits (*Parus caeruleus*) were the only bark hunting birds which were often observed in orchards. These two species use to make strange marks on the bark and they form a cavity in that portion of the tree and remains of the insect cocoon were found in that cavity[33]. Maximum population of birds was found in winter seasons in Central India. There is addition of migrating birds to the local population during these winter season. These migrants come from outside the subcontinent and also from within the subcontinent[34].

Highest Species richness was recorded at Regional Park ( $D = 2.3348$ ) and lowest was observed at Nehru park ( $D = 1.6160$ ). Due to absence of permanent water source, local dwelling species of an area move to other areas in summer season to protect themselves from scorching sunlight, as many trees with dense foliage shed their leaves during this season [35]. Nevertheless, there is a decline of resident species during rainy season. Especially, population of Indian pond heron decreases in rainy and winter season, particularly Green bee-eater were not observed in summer and rainy season [8]. Furthermore, similar study was done and highlighted that there is a maximum population of birds in spring season and during late winters[14]. Least bird population was recorded in late summer season and late rainy season. In addition to this, they also recorded local movement of resident bird species in one season and their movement in other seasons. This movement leads to fluctuations in number of bird species in that season.

Winter season provides ample amount of food sources and this increment in vegetation acts as a magnet for increase in migratory birds of an area. Similarly, [36] reported wetlands as a breeding ground for various aquatic birds and waders. Thus, there is a fluctuation in number of species dwelling all over the year. Interestingly, a minimum population of avian fauna was found in rainy season. Least avian diversity is observed in the months of May to July. Rain affects availability of food resources and it also affects nesting of few birds. In the month of September this population tends to increase as the resident and migratory birds come back to their native areas with ending of post monsoon season. Finally, maximum avian diversity is recorded in the months of December, January and February.

With the beginning of monsoon few water body overflows and it leaves no or less space for waders and other aquatic birds, so these bird species move to a shallower area till the end of rainy season. In spite of having good food resources these areas of wetland fail to thrive good number of bird species this is a plausible reason for low count of avian fauna especially the wading bird number [20]. Less avian fauna is found in summer and rainy season and highest avian diversity was observed in winter season, as there is ample of food resources available for birds of different guilds. Harsh climate condition urges these birds for local movement to other areas [12].

With the onset of winter season there is rapid growth in the shrubs and grasses besides the wetland area, it provides a hiding place for wetland birds and wader (shore birds). This change in the wetland habitat supports high number of aquatic birds during winters and it also attracts large number of migratory birds to thrive in this area. 17 species of avian fauna in Sirpur tank, and concluded that maximum populations of birds were observed in winter season [37]. There is an increase in the number of species as the weather changes from warmer to colder. They recorded a total number of 63 species of avian fauna; the maximum number was recorded in winter season. During summer season the wetland water evaporated and its area reduces, so waders get less availability of invertebrates as their food [16].

140 species of bird out of which resident birds were 118 in number, passage migrants were 1, 14 were winter migrants, breeding migrant's count was 4 and lastly, 3 species of local migrating birds were found dwelling in their area [38]. Similarly, 57 species of resident birds, 2 species of winter migrants, 2 species of passage migrants and 1 species of breeding migrants were observed [39]. 62 species of avian fauna were reported by them in total. Line Transect and Point count methods were adapted for the field survey for counting of bird population over the years. Besides this, a total of 76 species of birds were registered, out of which resident species number was 64 and 12 species were observed to be winter migrants [7].

Timed species count methods was adopted to fulfil this field study for a period of one year. On the other hand, 41 resident and 10 species of winter visitors were found in campus of Holkar Science College, total 51 species were recorded by time species count method of field survey by [7]. Due to absence of permanent water source, the numbers of resident species were low in number especially during summer season. Interestingly, Bar headed goose (*Anseri indicus*) was generally observed in Keoladeo National park, Bharatpur [40] but it is also present in the Sirpur Tank, Indore [41]. [11] reported 98 species of avian fauna in their survey and interestingly, 59 species were resident birds, winter migratory birds were 16 in number, 15 species were found having local migration and 8 species were summer migratory avian species. They adopted point count method for fulfilment of bird count, but transect method was adopted for survey in deep fields[42].

A total of 270 species of bird population, they adopted opportunistic, point count and line transect method for survey in reserve forest. They observed 30 migratory birds including twenty-five winter migratory birds and five species of summer migratory birds [17]. Total 113 species were observed by [43] there were sixty-four species of resident birds and forty-nine species were migrants including Winter and summer migrants. Species like Indian golden oriole, Orange headed thrush and Red throated flycatcher were summer visitors. Pied bush chat, Grey wagtail, White throated munia, and Brown bush chat were few winter migratory birds of their findings.

Asurvey carried out in Indore city (Meghdoot garden, Nehru park, Lalbagh and Pipliyapala Regional Park) was conducted for a period of one year (2018) to study the temporal variation in terrestrial avifauna, the objective of their survey was to study the fluctuation in the number of species with the change of season [10]. Line transect method was used to make 10 faunistic surveys in each site in every season. The results showed that the highest number of birds were recorded in the summer season in Pipliyapala regional park (52) and in Lalbagh (39). On the other hand, least number of terrestrial avian diversity was recorded in Lalbagh (35) and Nehru Park (30) in rainy season. Thus, their study pinnacles the activity of bird watching and tourism in these spaces as it generates revenue, which was further used in the maintenance and development.

Total 126 species were observed out of which ninety-one species of resident birds, sixteen species of migratory birds, twelve species of local migratory and seven species of resident and migratory collectively both [44]. Breeding pattern of pied cuckoo was studied in college campus of Nagpur. Few species use same nests for many years like spotted owlet and Rose ringed parakeet, it does not abandon its nest [39].

For nesting, few large birds like Black kite and House crow favour large trees having compact foliage. Low trees and shrubs are generally selected for nest building by smaller birds (Pied myna and Oriental magpie robin). Natural cavities in trees are utilized by hole nesting birds like spotted owlet and Indian grey hornbill. Few birds use unnatural material for building their nests as there is an environmental stress in finding nesting material. Things like plastic straws and polythene rags were used for making of nests. Indigenous trees are more preferred by birds as compared to exotic species [45].

Twenty-eight birds' species were found breeding at Holkar Science College and Pipliyapala regional park, Indore. Breeding season for majority of the birds was March to May [7]. Passeriformes order with seventeen species were dominant in the breeding study for determination of breeding pattern five factors were taken into consideration, such as number of juveniles counted, avian fauna collecting nesting material, number of nests counted, mating of birds seen and birds collecting food for their chicks in their beak. Maximum seven nests of Cattle egrets were observed by them. Many workers highlighted the use of larger trees for building of nest especially aquatic birds like Grey heron, Indian pond heron, Egrets etc. While on the contrary small canopy plants and shrubs are occupied by smaller birds like Common Iora [46].

Association between breeding species richness (BSR) and urbanization, and concluded that with increase in urbanization there is reduction of breeding species richness [47]. Behavioural ecology of birds and concluded that birds generally prefer breeding in season having plenty of food. This postulated theory is known as "food availability breeding season" [48]. Author also categorized birds nesting into two categories like colonial bird nests and single (solitary) birds' nests. Birds like Hornbills, Barbets, Owls and Myna are single nesting birds and they build their nests in isolation. On the other hand, painted stork, Egrets, and aquatic birds prefer nests in colonies.

There is a negative correlation between the colony size and predation on eggs. With the decrease in colony size probability of predation of egg increases. This was studied in Passerine bird by [49]. But on the other hand, there are chances of death due to starvation with the increment in the bird colony size. Furthermore, mobbing of predator species is

easily achieved by birds of the colony and colonization also enhances foraging efficiency. Interestingly, diel variation was estimated in waterfowl [50]. They observed around 32 species of waterfowl during their study. This study took place in winter season in Sirpur tank, Indore. Their study revealed that Ducks and Geese were more active and dominating in the morning time. Their observation showed that the species which were observed in the morning were maximum in number. On the other hand, less species was seen in afternoon and evening. These species belonged to nine families and six orders. They also highlighted absence of few species like Indian cormorant, intermediate egret and Northern pintail in the evening but were present in morning and noon. In addition to these species which were present in the morning only are Great cormorant, African darter, Great egret, Grey heron, yellow wattled lapwing, Purple swamp hen, Ruddy shelduck, Gadwall and Western swamp hen. They also concluded that the highest number of birds were found in the evening.

Similar study on diel variation was done in summer season at Sirpur tank, Indore. They reported total twenty-five species of waterfowl. These species belonged to ten families and seven orders. Maximum activity of birds was found in the morning and followed by evening, and least birds were counted in the noon. The bird count was 2680 in the morning, 537 in the noon and 1947 in the evening time. Teals and ducks were maximum in number (activity) in the morning and only waders (shore birds) were present in the evening. But there was complete absence of waterfowl in the night. Anatidae family was maximum in the morning hours and at noon also. On the other hand, Recurvirostridae was dominating in the evening hours. Crane occupied the lowest rank in the noon and evening and Grebe were least in the morning [50].

Green spaces are a major attraction for local public but few visitors litter. Some people including children enter these parks illegally for collection of crabs near the shore of wetland and Illegal cutting of sandalwood is also reported. There is no proper disposal of garbage and when this heap of garbage accumulates, it is burnt, but it can be toxic also. Illegal sporadic fires spoil nearby shrubs and grasses. Nests of birds like Ashy Prinia are destroyed by these activities [7].

Generally, water bodies get shallower in the summers and water area gets reduced for wetland and wading birds, but less rainfall makes these areas prone to eutrophication and it creates anoxic conditions for the fauna of that wetland. Therefore, it reduces migratory birds residing in that area. Hunting of migratory birds was also recorded [14]. Unsuitable sites are selected by few birds for building of nests and this degrades their nesting efficiency. This misplacement of habitat forces them to use the available risky sites for their building of nests[52]. These odd places include abandoned buildings, tube light stands, street lights, railway stations, transmission towers, under construction skyscrapers, chimneys, government statues, electric poles, cavities in bridges, sewage canals, etc. [46], [53], [54], [55], [56], [57].

Rapid invasion of exotic trees into the natural habitats reduces the area of dense foliage of indigenous trees. Thus, there are fewer options for birds for nesting and roosting [45]. Eggs of aquatic birds were collected by local people; [58] reported that it is directly affecting the richness of that place. To combat such problems proper fencing of the areas should be done to avoid unnecessary intrusion of such local people.

Poaching of waterfowl was also reported; they also concluded that these activities are performed by local people for recreation. They also highlighted other anthropogenic activities like immersion of idols, grazing of stray cattle and illegal fishing [59]. Similarly, practices like sand mining, continuous construction work besides river and cutting of trees for creating of space has been recited by [44]. Use of dynamite for fishing was also observed in the area. Hunting and poaching by local population are still a threat to avian diversity.

Excess of tourism also exerts pressure on the bird diversity. In summer season there is shallow water in the water body; this because habitat break up and destruction. Apart from this, Nilgai and wild cattle also disrupts birds which make their nests on the ground [43]. Dogs were seen trampling and chasing the chicks of few birds especially during breeding season.

The Shannon Weiner Index of four study sites of Indore City while adopting the point count and line transect method. They prepared Seasonal checklists for one year and then evaluated the index. Their findings revealed that the Highest Species Diversity with  $H' = 3.2585$  was recorded in Pipliyapala Regional park in Summer Season. Lowest Species Diversity with  $H' = 2.7656$  in Rainy season at Nehru Park [60]. They have observed several indigenous tree species in their study area to study the nesting preferences for several avian species. They have stressed upon creation of more green spaces for promotion of this avifaunal diversity.

Other statistical tools were used to estimate species richness was highest at station 4 ( $S=6.14$ ), Shannon Weiner Index was  $H' = 2.554$  (Highest) at Station 4 [16]. They also constructed Jaccard's similarity cluster on the basis of observance of the bird population of the area, Margalef's species richness and Simpson's Index were estimated. Shannon Weiner biodiversity index ( $H = 3.39$ ), Simpson's biodiversity index ( $D = 0.04$ ), reverse Simpson biodiversity ( $1-D = 0.96$ ) and Shannon Species Evenness ( $E_H = 0.95$ ) [61]. They also used ANOVA for finding the difference (Test) among the avian diversity and species richness among all the sites. Helmeted Guinea fowl was having maximum abundance of 4.90 percent.

The method to calculate relative diversity (percent occurrence). Family Accipitridae was having highest diversity (RD Index Value = 7.14) [11]. Multivariate analysis of variance (MANOVA) for estimating land use data. Variables used include trees, water, green herbaceous coverage, pasture land, humane use and the crop covering area. Other is response variables which include concentration of insecticides and second one is explanatory variables which have site type (agricultural land and grassland) [26]. Furthermore, sixty-two species were recorded; and these species belonged to 38

families. They calculated percent occurrence of various families and in their result, family Sturnidae was maximum having value of 11.8 percent [39]. Similarly, forty one percent of Passeriformes order was recorded in the study [43] in Sultanpur National Park. Here we have compiled a complete checklist of birds of Indore city observed till date (Table 1).

**Table 1: Complete checklist of avian fauna of Indore with their respective Orders and Families.**

S.No.	Scientific Name	English Name	Family	Order
1	<i>Aythyaferina</i>	Common Pochard	Anatidae	Anseriformes
2	<i>Rynchops albicollis</i>	Indian Skimmer	Anatidae	Anseriformes
3	<i>Tadorna ferruginea</i>	Ruddy Shelduck	Anatidae	Anseriformes
4	<i>Mycteria leucocephala</i>	Painted Stork	Anatidae	Anseriformes
5	<i>Mareca penelope</i>	Eurasian Wigeon	Anatidae	Anseriformes
6	<i>Mareca strepera</i>	Gadwall	Anatidae	Anseriformes
7	<i>Ardeola grayii</i>	Indian Pond Heron	Phasianidae	Galliformes
8	<i>Ardea alba</i>	Great Egret	Phasianidae	Galliformes
9	<i>Ardea cinerea</i>	Grey Heron	Phasianidae	Galliformes
10	<i>Ardea purpurea</i>	Purple Heron	Phasianidae	Galliformes
11	<i>Dendrocygna javanica</i>	Lesser Whistling Duck	Columbidae	Columbiformes
12	<i>Clamator jacobinus</i>	Pied Cuckoo	Columbidae	Columbiformes
13	<i>Sternula albifrons</i>	Little Tern	Columbidae	Columbiformes
14	<i>Streptopelia decaocto</i>	Eurasian Collared Dove	Columbidae	Columbiformes
15	<i>Anas poecilorhyncha</i>	Indian Spot-billed Duck	Columbidae	Columbiformes
16	<i>Porphyriopolioccephalus</i>	Grey-headed Swamphe	Columbidae	Columbiformes
17	<i>Himantopus himantopus</i>	Black-winged Stilt	Cuculidae	Cuculiformes
18	<i>Metopidius indicus</i>	Bronze-winged Jacana	Cuculidae	Cuculiformes
19	<i>Hydrophasianus chirurgus</i>	Pheasant-tailed Jacana	Cuculidae	Cuculiformes
20	<i>Chlidoniashybrida</i>	Whiskered Tern	Cuculidae	Cuculiformes
21	<i>Coracias benghalensis</i>	Indian Roller	Cuculidae	Cuculiformes
22	<i>Calidristemminckii</i>	Temminck's Stint	Caprimulgidae	Caprimulgiiformes
23	<i>Vanellus indicus</i>	Red-wattled Lapwing	Apodidae	Caprimulgiiformes
24	<i>Anser indicus</i>	Bar-headed Goose	Apodidae	Caprimulgiiformes
25	<i>Plegadis falcinellus</i>	Glossy Ibis	Charadriidae	Charadriiformes
26	<i>Nettapus coromandelianus</i>	Cotton Teal	Charadriidae	Charadriiformes
27	<i>Ceryle rudis</i>	Pied Kingfisher	Charadriidae	Charadriiformes
28	<i>Tringa glareola</i>	Wood Sandpiper	Scolopacidae	Charadriiformes
29	<i>Tringa ochropus</i>	Green Sandpiper	Scolopacidae	Charadriiformes
30	<i>Recurvirostra avosetta</i>	Pied Avocet	Glareolidae	Charadriiformes
31	<i>Alcedo atthis</i>	Common Kingfisher	Laridae	Charadriiformes
32	<i>Oenanthe fusca</i>	Brown Rock Chat	Laridae	Charadriiformes
33	<i>Pernis ptilorhynchus</i>	Oriental Honey Buzzard	Phaethontidae	Phaethontiformes
34	<i>Passer domesticus</i>	House Sparrow	Oceanitidae	Procellariiformes
35	<i>Calidris minuta</i>	Little Stint	Procellariidae	Procellariiformes
36	<i>Sturniapa godardum</i>	Brahminy Starling	Sulidae	Suliformes
37	<i>Idunacaligata</i>	Booted Warbler	Ardeidae	Pelecaniformes
38	<i>Dinopium benghalense</i>	Black-rumped Flameback	Ardeidae	Pelecaniformes
39	<i>Aquila fasciata</i>	Bonelli's Eagle	Ardeidae	Pelecaniformes
40	<i>Tachybaptus ruficollis</i>	Little Grebe	Accipitridae	Accipitriformes
41	<i>Egretta garzetta</i>	Little Egret	Accipitridae	Accipitriformes
42	<i>Ardeotis nigriceps</i>	Great Indian Bustard	Accipitridae	Accipitriformes
43	<i>Acridotheres tristis</i>	Common Myna	Accipitridae	Accipitriformes
44	<i>Gracupica contra</i>	Asian Pied Starling	Accipitridae	Accipitriformes
45	<i>Ardea intermedia</i>	Intermediate Egret	Accipitridae	Accipitriformes

46	<i>Anhinga melanogaster</i>	Oriental Darter	Accipitridae	Accipitriformes
47	<i>Rhipidura albogularis</i>	Spot-breasted Fantail	Accipitridae	Accipitriformes
48	<i>Microcarboniger</i>	Little Cormorant	Accipitridae	Accipitriformes
49	<i>Phoenicurus ochruros</i>	Black Redstart	Accipitridae	Accipitriformes
50	<i>Terpsiphone paradisi</i>	Indian Paradise-flycatcher	Accipitridae	Accipitriformes
51	<i>Monticola solitarius</i>	Blue Rock Thrush	Accipitridae	Accipitriformes
52	<i>Prinia hodgsonii</i>	Grey-breasted Prinia	Accipitridae	Accipitriformes
53	<i>Phalacrocorax carbo</i>	Great Cormorant	Accipitridae	Accipitriformes
54	<i>Copsychus fulicatus</i>	Indian Robin	Accipitridae	Accipitriformes
55	<i>Phalacrocorax fuscicollis</i>	Indian Cormorant	Accipitridae	Accipitriformes
56	<i>Oriolus oriolus</i>	Eurasian Golden Oriole	Strigidae	Strigiformes
57	<i>Oriolus xanthornus</i>	Black-hooded Oriole	Strigidae	Strigiformes
58	<i>Aythya fuligula</i>	Tufted Duck	Strigidae	Strigiformes
59	<i>Aythya nyroca</i>	Ferruginous Duck	Strigidae	Strigiformes
60	<i>Sterna aurantia</i>	River Tern	Strigidae	Strigiformes
61	<i>Nettarufina</i>	Red-crested Pochard	Strigidae	Strigiformes
62	<i>Milvus migrans</i>	Black Kite	Bucerotidae	Bucerotiformes
63	<i>Prinia socialis</i>	Ashy Prinia	Bucerotidae	Bucerotiformes
64	<i>Vanellus malabaricus</i>	Yellow-wattled Lapwing	Alcedinidae	Coraciiformes
65	<i>Elanus caeruleus</i>	Black-winged Kite	Meropidae	Coraciiformes
66	<i>Accipiter badius</i>	Shikra	Megalaimidae	Piciformes
67	<i>Pseudibispapillosa</i>	Red-naped Ibis	Megalaimidae	Piciformes
68	<i>Butastur teesa</i>	White-eyed Buzzard	Picidae	Piciformes
69	<i>Accipiter nisus</i>	Eurasian Sparrowhawk	Picidae	Piciformes
70	<i>Chlidonias leucopterus</i>	White-winged Tern	Picidae	Piciformes
71	<i>Bubulcus ibis</i>	Cattle Egret	Falconidae	Falconiformes
72	<i>Antigone antigone</i>	Sarus Crane	Psittaculidae	Psittaciformes
73	<i>Gallinula chloropus</i>	Common Moorhen	Psittaculidae	Psittaciformes
74	<i>Fulica atra</i>	Common Coot	Psittaculidae	Psittaciformes
75	<i>Hirundo smithii</i>	Wire-tailed Swallow	Pittidae	Passeriformes
76	<i>Taccocualeschenaultii</i>	Sirkeer Malkoha	Campephagidae	Passeriformes
77	<i>Centropus sinensis</i>	Greater Coucal	Campephagidae	Passeriformes
78	<i>Eudynamis scolopaceus</i>	Asian Koel	Campephagidae	Passeriformes
79	<i>Francolinus pondicerianus</i>	Grey Francolin	Oriolidae	Passeriformes
80	<i>Psittacula eupatria</i>	Alexandrine Parakeet	Vangidae	Passeriformes
81	<i>Athene brama</i>	Spotted Owlet	Aegithinidae	Passeriformes
82	<i>Oriolus kundoo</i>	Indian Golden Oriole	Rhipiduridae	Passeriformes
83	<i>Pavo cristatus</i>	Indian Peafowl	Dicruridae	Passeriformes
84	<i>Columba livia</i>	Rock Pigeon	Dicruridae	Passeriformes
85	<i>Streptopelia chinensis</i>	Spotted Dove	Dicruridae	Passeriformes
86	<i>Dendrocygna bicolor</i>	Fulvous Whistling Duck	Dicruridae	Passeriformes
87	<i>Lanius schach</i>	Long-tailed Shrike	Monarchidae	Passeriformes
88	<i>Lalage melaschistos</i>	Black-winged Cuckooshrike	Laniidae	Passeriformes
89	<i>Perdicula argoondah</i>	Rock Bush Quail	Laniidae	Passeriformes
90	<i>Francolinus pictus</i>	Painted Francolin	Laniidae	Passeriformes
91	<i>Streptopelia senegalensis</i>	Laughing Dove	Corvidae	Passeriformes
92	<i>Psittacula cyanocephala</i>	Plum-headed Parakeet	Corvidae	Passeriformes
93	<i>Psittacula krameri</i>	Rose-ringed Parakeet	Corvidae	Passeriformes
94	<i>Yungipicus nanus</i>	Brown-capped Pygmy Woodpecker	Stenostiridae	Passeriformes
95	<i>Coracina macei</i>	Large Cuckooshrike	Paridae	Passeriformes

96	<i>Actitis hypoleucos</i>	Common Sandpiper	Alaudidae	Passeriformes
97	<i>Dendrocitta vagabunda</i>	Rufous Treepie	Cisticolidae	Passeriformes
98	<i>Dicrurus macrocercus</i>	Black Drongo	Cisticolidae	Passeriformes
99	<i>Dicrurus caerulescens</i>	White-bellied Drongo	Cisticolidae	Passeriformes
100	<i>Dicrurus leucophaeus</i>	Ashy Drongo	Cisticolidae	Passeriformes
101	<i>Cinnyris asiaticus</i>	Purple Sunbird	Acrocephalidae	Passeriformes
102	<i>Ploceus philippinus</i>	Baya Weaver	Acrocephalidae	Passeriformes
103	<i>Dicaeum agile</i>	Thick-billed Flowerpecker	Acrocephalidae	Passeriformes
104	<i>Zosterops palpebrosus</i>	Indian White-eye	Acrocephalidae	Passeriformes
105	<i>Gymnorisxanthocollis</i>	Yellow-throated Sparrow	Acrocephalidae	Passeriformes
106	<i>Emberizalathami</i>	Crested Bunting	Acrocephalidae	Passeriformes
107	<i>Dicaeum erythrorhynchos</i>	Pale-billed Flowerpecker	Acrocephalidae	Passeriformes
108	<i>Euodice malabarica</i>	Indian Silverbill	Acrocephalidae	Passeriformes
109	<i>Machlolophus xanthogenys</i>	Himalayan Black-lored Tit	Locustellidae	Passeriformes
110	<i>Limosalimosa</i>	Black-tailed Godwit	Locustellidae	Passeriformes
111	<i>Circaetus gallicus</i>	Short-toed Snake Eagle	Hirundinidae	Passeriformes
112	<i>Neophron percnopterus</i>	Egyptian Vulture	Hirundinidae	Passeriformes
113	<i>Falco tinnunculus</i>	Common Kestrel	Hirundinidae	Passeriformes
114	<i>Apus affinis</i>	Indian House Swift	Pycnonotidae	Passeriformes
115	<i>Paruscinereus</i>	Cinereous Tit	Pycnonotidae	Passeriformes
116	<i>Tephrodornis pondicerianus</i>	Common Woodshrike	Phylloscopidae	Passeriformes
117	<i>Phylloscopus trochiloides</i>	Greenish Warbler	Phylloscopidae	Passeriformes
118	<i>Corvus splendens</i>	House Crow	Phylloscopidae	Passeriformes
119	<i>Phylloscopus collybita</i>	Common Chiffchaff	Phylloscopidae	Passeriformes
120	<i>Copsychus saularis</i>	Oriental Magpie Robin	Cettiidae	Passeriformes
121	<i>Cyornis tickelliae</i>	Tickell's Blue Flycatcher	Cettiidae	Passeriformes
122	<i>Culicicapaceylonensis</i>	Grey-headed Canary-flycatcher	Cettiidae	Passeriformes
123	<i>Corvus macrorhynchos</i>	Large-billed Crow	Sylviidae	Passeriformes
124	<i>Pycnonotus cafer</i>	Red-vented Bulbul	Zosteropidae	Passeriformes
125	<i>Halcyon smymensis</i>	White-throated Kingfisher	Timaliidae	Passeriformes
126	<i>Spatula clypeata</i>	Northern Shoveler	Timaliidae	Passeriformes
127	<i>Spatula querquedula</i>	Garganey	Timaliidae	Passeriformes
128	<i>Spelaorniscaudatus</i>	Rufous-throated Wren Babbler	Timaliidae	Passeriformes
129	<i>Gallirex cinerea</i>	Watercock	Pellorneidae	Passeriformes
130	<i>Saxicola maurus</i>	Siberian Stonechat	Pellorneidae	Passeriformes
131	<i>Merops orientalis</i>	Green Bee-eater	Leiothrichidae	Passeriformes
132	<i>Ocyeros birostris</i>	Indian Grey Hornbill	Leiothrichidae	Passeriformes
133	<i>Threskiornismelanocephalus</i>	Black-headed Ibis	Tichodromidae	Passeriformes
134	<i>Phylloscopus humei</i>	Hume's Warbler	Sturnidae	Passeriformes
135	<i>Sylvia curruca</i>	Lesser Whitethroat	Sturnidae	Passeriformes
136	<i>Orthotomus sutorius</i>	Common Tailorbird	Sturnidae	Passeriformes
137	<i>Prinia sylvatica</i>	Jungle Prinia	Sturnidae	Passeriformes
138	<i>Phylloscopus griseolus</i>	Sulphur-bellied Warbler	Sturnidae	Passeriformes
139	<i>Circus aeruginosus</i>	Western Marsh Harrier	Turdidae	Passeriformes
140	<i>Motacilla flava</i>	Western Yellow Wagtail	Muscicapidae	Passeriformes
141	<i>Motacilla alba</i>	White Wagtail	Muscicapidae	Passeriformes
142	<i>Motacilla maderaspatensis</i>	White-browed Wagtail	Muscicapidae	Passeriformes
143	<i>Cecropisdaurica</i>	Red-rumped Swallow	Muscicapidae	Passeriformes
144	<i>Ptyonoprogne concolor</i>	Dusky Crag Martin	Muscicapidae	Passeriformes
145	<i>Amandava amandava</i>	Red Munia	Muscicapidae	Passeriformes
146	<i>Leiopicusmahrattensis</i>	Yellow-fronted Woodpecker	Muscicapidae	Passeriformes

147	<i>Ficedula albicilla</i>	Taiga Flycatcher	Muscicapidae	Passeriformes
148	<i>Psilopogon haemacephalus</i>	Coppersmith Barbet	Muscicapidae	Passeriformes
149	<i>Hirundo rustica</i>	Barn Swallow	Muscicapidae	Passeriformes
150	<i>Lanius vittatus</i>	Bay-backed Shrike	Muscicapidae	Passeriformes
151	<i>Nycticorax nycticorax</i>	Black-crowned Night Heron	Muscicapidae	Passeriformes
152	<i>Pericrocotus cinnamomeus</i>	Small Minivet	Dicaeidae	Passeriformes
153	<i>Pericrocotus ethologus</i>	Long-tailed Minivet	Dicaeidae	Passeriformes
154	<i>Aegithina tiphia</i>	Common Iora	Nectariniidae	Passeriformes
155	<i>Chroicocephalus ridibundus</i>	Black-headed Gull	Nectariniidae	Passeriformes
156	<i>Charadrius dubius</i>	Little Ringed Plover	Chloropseidae	Passeriformes
157	<i>Argya striata</i>	Jungle Babbler	Ploceidae	Passeriformes
158	<i>Platalealeucorodia</i>	Eurasian Spoonbill	Ploceidae	Passeriformes
159	<i>Argya malcolmi</i>	Large Grey Babbler	Estrildidae	Passeriformes
160	<i>Dumetia hyperythra</i>	Tawny-bellied Babbler	Passeridae	Passeriformes
161	<i>Amauormis phoenicurus</i>	White-breasted Waterhen	Motacillidae	Passeriformes
162	<i>Anas acuta</i>	Northern Pintail	Motacillidae	Passeriformes
163	<i>Anas platyrhynchos</i>	Mallard	Motacillidae	Passeriformes
164	<i>Rhipidura albicollis</i>	White-throated Fantail	Fringillidae	Passeriformes
165	<i>Prinia inornata</i>	Plain Prinia	Fringillidae	Passeriformes
166	<i>Leptocoma zeylonica</i>	Purple-rumped Sunbird	Fringillidae	Passeriformes
167	<i>Leptocoma minima</i>	Crimson-backed Sunbird	Fringillidae	Passeriformes
168	<i>Ficedula parva</i>	Red-breasted Flycatcher	Emberizidae	Passeriformes

### 3. CONCLUSION

The above literature we can conclude that several authors have contributed a checklist of avian fauna. The above review showed that the above-mentioned literature is rich in studies regarding avian diversity and its various parameters. There is a vast scope in these studies as many aspects are still untouched.

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