

Research Article

Community composition and status of avifaunal diversity in and around Ottu reservoir of Sirsa, Haryana, India

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Abstract

Assessments of avian communities' composition in different habitats give an emphasis in monitoring environmental perspective. Depending on specific habitat functioning, their population pattern helps to determine the ecological health of an area. Bird surveys were accomplished on a fortnightly basis from October 2019 to September 2020 using Scan sampling, Point count and Line transect methods for evaluation of species abundance and richness in and around Ottu Reservoir, district Sirsa, Haryana (India). A total of 114 species comprising 91 genera, 47 families and 18 orders were recorded, among which 76 species were resident, 30 winter migrants and 8 summer migrants. Out of reported 114 species of birds, one species was vulnerable, 6 Near-threatened as listed by IUCN. Three bird species were listed under Schedule-I and the remaining species under Schedule-IV of IWPA (1972); six species under appendices of CITES (2012). Species such as Rock dove *Columba livia*, Lesser Whistling-duck *Dendrocygna javanica* and Common Sandpiper *Actitis hypoleucos* with decreasing IUCN population trends were reported abundantly in the study area. Analysis of feeding guilds results revealed that Carnivores as predominated guild due to enriched food material. The presence of diverse plantation, aquatic body, serenity and agricultural fields serve the reservoir as potential habitat for residential and migratory species. Therefore, effective measures must be taken for the conservation of this area as a potential site for avian diversity.

Keywords: Avian communities, Ecological health, Passeriformes, Winter migrants, Ottu reservoir

INTRODUCTION

The avian population in different ecosystems has become an effective element in protecting biodiversity and determining appropriate conservation activities. Bird population estimation is important for understanding group structure, niche relationship, habitat preference and other behavioural aspects (Pawar *et al.*, 2019). Birds are a structural part of entire planet, key species in sustaining ecological equilibrium and are needed for human sustenance similar to other biotic components (State of India's Birds, 2020). They serve as pointer species of a particular region (Blair, 1999); bioindicator for understanding environmental issues (Newton and Anim, 1995); demolish insect pests, scavenge carrions, pollinate flowers, bio-fertilizers, disperse seeds (Niemi,

1985; Padmavathy *et al.*, 2010; Whelan *et al.*, 2015) and alter the environment in way beneficial for other species. Wetlands sustain distinct communities of plants and animals, considering this habitat as a 'Biodiversity hotspot' within an area or landscape (Gopal and Sah, 1993). These serve as crucial habitat for wetland-dependent and water-associated birds representing breeding, feeding and roosting sites, vital for their conservation and management (James *et al.*, 2001; Harisha and Hosetti, 2018; Vishwakarma *et al.*, 2020). Avian species distribution patterns are determined by their mobility, habitat suitability, food availability, geo-physiological structure of wetland (Akosim *et al.*, 2008).

India harbors 7,57,060 wetlands (with an area - 15.26 Mha) embracing 1,88,470 Inland (Natural and Man-

made) wetland; 13,033 Coastal (Natural and Man-made) wetland and 5,55,557 wetlands (<2.25 ha). The state of Haryana has a total of 11,970 wetlands that covers an area of about 42,478 ha, accounting 0.86% of the state geographic area (National Wetland Atlas, 2011). Due to favourable environmental conditions, approximately 450 avian species had reported spending time for their necessities in this state (Goyal *et al.*, 2014). Extensive work has been done by respective researchers (Gupta and Kaushik, 2013; Goyal *et al.*, 2014; Chopra and Jakhar, 2016; Rai *et al.*, 2017; Kumar and Sharma, 2018; Rai *et al.*, 2019; Kumar and Sahu, 2020) in this state on distribution, ecology, diversity and conservation status of birds. Different wetlands of any site function as balancing reservoir to sustain the native biodiversity. The presence of diverse plantations, widespread agricultural fields in and around Ottu Reservoir, located in village Ottu, district Sirsa, Haryana endows appropriate habitat for avifaunal diversity. The reservoir serves as foraging, roosting, breeding grounds for resident species and stopover or wintering grounds for migratory species. Depending upon various conditions such as climate, habitat use and resources stability of a reservoir determines the presence of aerial foraging avifauna (Basu *et al.*, 2018). The present study was conducted to fill the knowledge gap about the information on avifauna in Ottu Reservoir along with its ecological significance.

MATERIALS AND METHODS

Study area

The Ottu Reservoir is situated at district Sirsa, Haryana, with its geographical coordinates 29°29'39"N and 74°54'02"E, about 12 km west of Sirsa (Fig. 1 and 2). It is perennial lake that serves as a feeder for two Ghaggar canals (the northern and the southern canals) that carries water to adjoining areas and northern Rajasthan. It covers an area of about 950 acres with depth of approximately 15 feet (Goyal *et al.*, 2014). The flow of lake is restricted by Ottu weir situated at 29°29'21"N and 74°54'38"E near village Ottu (about 8 miles away from Sirsa) constructed in 1896-97 on Ghaggar-Hakra river of Haryana. The average annual rainfall of the district is approximately 325-400 mm, with mean temperatures ranging from 4°C in winter to 48°C in summer (Goyal *et al.*, 2016). The lake provides tremendous habitat due to diverse trees, bushes, aquatic vegetation, agricultural fields, floral species such as *Eucalyptus* spp. (Safeda), *Azadirachta indica* (Neem), *Ficus benghalensis* (Banyan), *Acacia nilotica* (Kikar), *Ziziphus jujube* (Jujube), *Dalbergia sissoo* (Shisham), *Ficus religiosa* (Peepal), *Acacia arabica* (Babool), *Eichhornia* (Water hyacinth) and attracts a large number of avian species considering as a suitable place for them.

Methodology

An ornithological survey was conducted periodically at selected study site from October 2019 to September 2020 in three respective phases viz., Morning, Noon and Evening phase. Data was recorded with the help of various methods such as Scan sampling (Altmann, 1974), Point and Line Transect (Gaston, 1975; Sutherland *et al.*, 2005) and presented in the form of checklist of avian species. Bird's observation was made with binoculars and Canon Power shot SX50HS digital cameras, and identification was done with the help of field guides i.e., Grimmett *et al.* (2015); Arlott (2015); Grimmett and Inskipp (2019); Kalsi *et al.* (2019) and authenticated avian database (IUCN Red list of Threatened Species, Merlin bird ID and Oriental Bird Club image database). A checklist of recorded bird species was prepared and classified based on a common name, scientific name, alternative name, order, family and genus using Praveen *et al.* (2016), Praveen *et al.* (2019) and IUCN (2020). The assessment of Residential/Migratory status was done based on the presence or absence method (Grimmett and Inskipp, 2003; Kumar *et al.*, 2016). The abundance status of species was calculated depending on the frequency of sightings and the definite criteria of Kumar and Gupta (2009), with some modifications. The criterion was quite different for both residential and migratory species. For residential species, abundance status was classified as Abundant (observed 16-21 times/21 visits), Common (11-15 times/21 visits), Fairly common (6-10 times/21 visits) and Rare (1-5 times/21 visits); whereas for migratory species the criteria varies for two selected seasons of one year field survey i.e., Winter (October-March) and Summer (April-September). In the winter season, the status is assigned as: Abundant (observed 9-11 times/11 visits), Common (6-8 times/11 visits), Fairly common (3-5 times/11 visits) and Rare (1-2 times/11 visits) and in Summer season: Abundant (observed 9-10 times/10 visits), Common (6-8 times/10 visits), Fairly common (3-5 times/10 visits) and Rare (1-2 times/10 visits). The IWPA (1972), CITES (2012), and IUCN (2020) were used to assess the conservation status and population trends (Increasing ↑, Decreasing ↓, Stable → and Unknown?) of the species. Feeding guilds were categorized into 8 guilds (Carnivore, Insectivore, Omnivore, Herbivore, Frugivore, Grainivore, Insect/Nectarivore and Piscivore) based on direct observation and literature (Ali and Ripley 1987; Grimmett *et al.*, 1999; Singh *et al.*, 2020). The relative diversity (RD_i) value of the families was calculated formula given by La Torre-Cuadros *et al.* (2007):

$$RD_i = \frac{\text{Number of bird species in a family}}{\text{Total number of bird species}} \times 100 \quad \dots \text{Eq. 1}$$

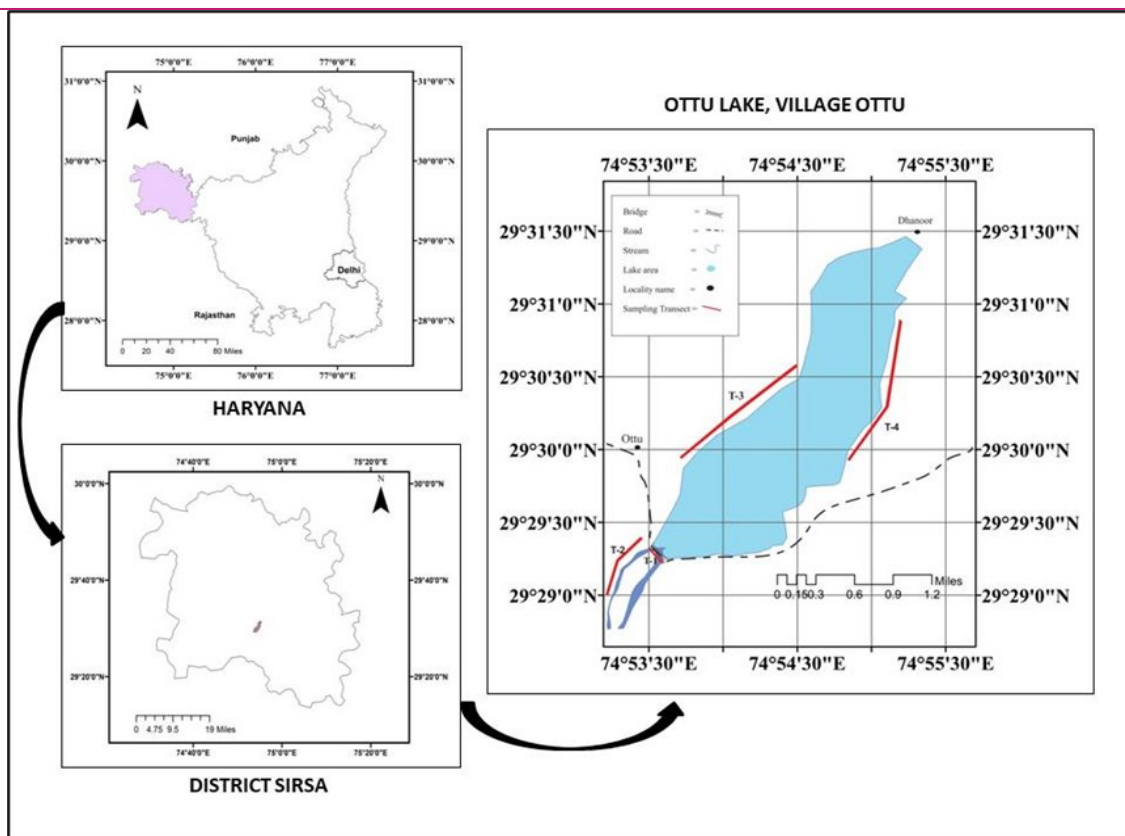


Fig. 1. Location and map of Ottu reservoir, Sirsa, Haryana, India.



Fig. 2. Pictorial view of Ottu reservoir, Sirsa, Haryana, India.

RESULTS AND DISCUSSION

A total of 114 species belonging 18 orders, 47 families and 91 genera (Table 1) were recorded from Ottu Reservoir, district Sirsa, Haryana during 21 periodic visits from October 2019 to September 2020. Due to the outbreak of COVID-19, periodic field visits from 26 March 2020 to 30 April 2020 were missed. During the present study maximum number of recorded bird species belonged to Order Passeriformes (41 species in 20 families) followed by Charadriiformes (17 species in six families); Pelecaniformes (12 species in two families); Anseriformes (9 species in single family); Coraciiformes

(5 species in three families); Columbiformes (5 species in single family); Cuculiformes and Gruiformes (each with four species in single family); Piciformes (three species in two families); Bucerotiformes (two species in two families); Accipitriformes, Ciconiiformes, Psittaciformes and Suliformes (each with two species in single family) Galliformes, Phoenicopteriformes, Strigiformes, Podicipediformes (each with single species in single family) (Table 1). Goyal *et al.* (2014) also reported 64 migratory avian species comprising 44 genera, 27 families and 9 orders in Ottu Lake, Sirsa, Haryana. In accordance with previous records such as avifauna of Sultanpur National Park, Haryana (Chopra *et al.*, 2012);

Table 1. Checklist of Avifaunal Species with their RDI value recorded in and around Ottu reservoir, Haryana (India).

Sr. No.	Order/Family/Common name	Scientific name	Residential Status	Feeding guild	Abundance status	Global population trends	Conservation Status			Alternative name(s) followed by Praveen et al., 2016
							IUCN (2020)	CITES (2012)	IWPA (1972)	
1. ANSERIFORMES (No. of Species=9 and No. of Family=1)										
1.1. Anatidae (9), RDI value- 7.89										
1.	Indian Spot-Billed Duck	<i>Anas poecilorhyncha</i> J.R. Forster, 1781	R	H	C	↓	LC	-	IV	-
2.	Northern Shoveler	<i>Spatula clypeata</i> (Linnaeus, 1758)	WM	O	C	↓	LC	-	IV	-
3.	Eurasian Wigeon	<i>Mareca Penelope</i> (Linnaeus, 1758)	WM	H	FC	↓	LC	-	IV	-
4.	Gadwall	<i>Mareca strepera</i> (Linnaeus, 1758)	WM	H	FC	↑	LC	-	IV	-
5.	Common Pochard	<i>Aythya ferina</i> (Linnaeus, 1758)	WM	O	FC	↓	LC	-	IV	-
6.	Common Teal	<i>Anas crecca</i> Linnaeus, 1758	WM	O	R	?	LC	-	IV	Green-winged teal, Eurasian teal
7.	Garganey	<i>Spatula querquedula</i> (Linnaeus, 1758)	WM	H	FC	↓	LC	-	IV	-
8.	Lesser Whistling Duck	<i>Dendrocygna javanica</i> (Horsfield, 1821)	SM	O	A	↓	LC	-	IV	Lesser Whistling teal, Tree duck
9.	Comb Duck	<i>Sarkidiornis melanotos</i> (Pennant, 1769)	R	H	R	↓	LC	II	IV	Knob-billed duck, African comb duck
2. GALLIFORMES (No. of Species=1 and No. of Family=1)										
2.1. Phasianidae (1), RDI value- 0.88										
10.	Grey Francolin	<i>Francolinus pondicerianus</i> (J.F. Gmelin, 1789)	R	O	R	→	LC	-	IV	Grey Partridge
3. PHOENICOPTERIFORMES (No. of Species=1 and No. of Family=1)										
3.1. Phoenicopteridae (1), RDI value- 0.88										
11.	Greater Flamingo	<i>Phoenicopterus roseus</i> Pallas, 1811	R	O	R	↑	LC	-	IV	-
4. COLUMBIFORMES (No. of Species=5 and No. of Family=1)										
4.1. Columbidae (5), RDI value- 4.39										
12.	Rock Dove	<i>Columba livia</i> J.F. Gmelin, 1789	R	G	A	↓	LC	-	IV	Blue Rock Pigeon
13.	Yellow-Footed Green-Pigeon	<i>Treron phoenicopterus</i> (Latham, 1790)	R	F	C	↓	LC	-	IV	Yellow-legged Green pigeon
14.	Eurasian Collared Dove	<i>Streptopelia decaocto</i> (Fridvaldszky, 1838)	R	G	C	↑	LC	-	IV	Indian Ring Dove
15.	Laughing Dove	<i>Spilopelia senegalensis</i> (Linnaeus, 1766)	R	G	FC	→	LC	-	IV	Little brown Dove, Senegal Dove
16.	Spotted Dove	<i>Streptopelia chinensis</i> (Scopoli, 1786)	R	G	R	↑	LC	-	IV	-

Contd.....

Table 1. Contd.....

5. CUCULIFORMES (No. of Species=4 and No. of Family=1)										
5.1. Cuculidae (4), RDI value- 3.51										
17.	Greater Coucal	<i>Centropus sinensis</i> (Stephens, 1815)	R	C	C	→	LC	-	IV	Crow Pheasant
18.	Asian Koel	<i>Eudynamis scolopacea</i> (Linnaeus, 1758)	SM	O	C	→	LC	-	IV	Common Koel
19.	Common Hawk-Cuckoo	<i>Hierococyx varius</i> (Vahl, 1797)	SM	In	R	→	LC	-	IV	Brainfever bird
20.	Jacobin Cuckoo	<i>Clamator jacobinus</i> (Boddaert, 1783)	SM	In	R	→	LC	-	IV	Pied Crested Cuckoo
6. GRUIFORMES (No. of Species=4 and No. of Family=1)										
6.1. Rallidae (4), RDI value- 3.51										
21.	Common Moorhen	<i>Gallinula chloropus</i> (Linnaeus, 1758)	R	O	C	→	LC	-	IV	Eurasian Moorhen, Indian Moorhen
22.	White-breasted Waterhen	<i>Amaurornis phoenicurus</i> (Pennant, 1769)	R	O	C	?	LC	-	IV	-
23.	Common Coot	<i>Fulica atra</i> Linnaeus, 1758	WM	O	A	↑	LC	-	IV	Eurasian Coot
24.	Purple Swamphen	<i>Porphyrio porphyrio</i> (Linnaeus, 1758)	R	O	R	?	LC	-	IV	Purple Moorhen
7. PELECANIFORMES (No. of Species=12 and No. of Families=2)										
7.1. Ardeidae (9), RDI value- 7.89										
25.	Cattle Egret	<i>Bubulcus ibis</i> (Linnaeus, 1758)	R	C	A	↑	LC	-	IV	-
26.	Great Egret	<i>Ardea alba</i> Linnaeus, 1758	R	C	FC	?	LC	-	IV	Large Egret
27.	Intermediate Egret	<i>Ardea intermedia</i> Wagler, 1829	R	C	FC	↓	LC	-	IV	Median Egret, Smaller Egret
28.	Little Egret	<i>Egretta garzetta</i> (Linnaeus, 1766)	R	C	A	↑	LC	-	IV	-
29.	Indian Pond Heron	<i>Ardeola grayii</i> (Sykes, 1832)	R	C	A	?	LC	-	IV	Paddybird
30.	Purple Heron	<i>Ardea purpurea</i> Linnaeus, 1766	R	C	R	↓	LC	-	IV	-
31.	Grey Heron	<i>Ardea cinerea</i> Linnaeus, 1758	R	C	A	?	LC	-	IV	-
32.	Green-backed Heron	<i>Butorides striata</i> (Linnaeus, 1758)	R	C	R	↓	LC	-	IV	Little Green Heron
33.	Black crowned Night Heron	<i>Nycticorax nycticorax</i> (Linnaeus, 1758)	R	C	R	↓	LC	-	IV	-

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Table 1. Contd.....

7.2. Threskiornithidae (3), RDI value- 2.63										
34.	Red-naped Ibis	<i>Pseudibis papillosa</i> (Temminck, 1824)	R	C	FC	↓	LC	-	IV	Indian Black Ibis
35.	Eurasian Spoonbill	<i>Platalea leucorodia</i> Linnaeus, 1758	R	C	R	?	LC	-	I	-
36.	Black-Headed Ibis	<i>Threskiornis melanocephalus</i> (Latham, 1790)	R	C	R	↓	LC	-	IV	White Ibis, Oriental White Ibis
8. CHARADRIIFORMES (No. of Species=17 and No. of Families=6)										
8.1. Recurvirostridae (2), RDI value- 1.75										
37.	Black-Winged Stilt	<i>Himantopus himantopus</i> (Linnaeus, 1758)	R	C	A	↑	LC	-	IV	-
38.	Pied Avocet	<i>Recurvirostra avosetta</i> Linnaeus, 1758	WM	C	R	?	LC	-	IV	Avocet
8.2. Scolopacidae (11), RDI value- 9.65										
39.	Common Sandpiper	<i>Actitis hypoleucos</i> (Linnaeus, 1758)	WM	In	A	↓	LC	-	IV	-
40.	Wood Sandpiper	<i>Tringa glareola</i> Linnaeus, 1758	WM	In	A	→	LC	-	IV	Spotted Sandpiper
41.	Green Sandpiper	<i>Tringa ochropus</i> Linnaeus, 1758	WM	In	C	↑	LC	-	IV	-
42.	Common Redshank	<i>Tringa totanus</i> (Linnaeus, 1758)	WM	In	A	?	LC	-	IV	-
43.	Common Greenshank	<i>Tringa nebularia</i> (Gunnerus, 1767)	WM	C	R	→	LC	-	IV	Greenshank
44.	Ruff	<i>Calidris pugnax</i> (Linnaeus, 1758)	WM	In	FC	↓	LC	-	IV	-
45.	Marsh Sandpiper	<i>Tringa stagnatilis</i> (Bechstein, 1803)	WM	In	R	↓	LC	-	IV	-
46.	Spotted Redshank	<i>Tringa erythropus</i> (Pallas, 1764)	WM	In	R	→	LC	-	IV	Dusky Redshank
47.	Common Snipe	<i>Gallinago gallinago</i> (Linnaeus, 1758)	WM	C	R	↓	LC	-	IV	Fantail Snipe
48.	Temminck's Stint	<i>Calidris temminckii</i> (Leisler, 1812)	WM	In	R	?	LC	-	IV	-
49.	Black-tailed Godwit	<i>Limosa limosa</i> (Linnaeus, 1758)	WM	In	R	↓	NT	-	IV	-
8.3. Charadriidae (1), RDI value- 0.88										
50.	Red-wattled Lapwing	<i>Vanellus indicus</i> (Boddaert, 1783)	R	C	A	?	LC	-	IV	-
8.4. Laridae (1), RDI value- 0.88										
51.	Whiskered Tern	<i>Chlidonias hybrida</i> (Pallas, 1811)	R	C	R	→	NT	-	IV	-

Table 1. Contd

8.5. Jacanidae (1), RDi value- 0.88										
52.	Pheasant-Tailed Jacana	<i>Hydrophasianus chirurgus</i> (Scopoli, 1786)	SM	O	R	↓	LC	-	IV	-
8.6. Burhinidae (1), RDi value- 0.88										
53.	Indian Thick-Knee	<i>Burhinus indicus</i> (Salvadori, 1865)	R	O	R	↓	LC	-	IV	-
9. ACCIPITRIFORMES (No. of Species=2 and No. of Families=1)										
9.1. Accipitridae (2), RDi value- 1.75										
54.	Shikra	<i>Accipiter badius</i> (J.F. Gmelin, 1788)	R	C	R	→	LC	II	I	-
55.	Black Kite	<i>Milvus migrans</i> (Boddaert, 1783)	R	C	R	?	LC	II	I	Pariah Kite
10. STRIGIFORMES (No. of Species=1 and No. of Families=1)										
10.1. Strigidae (1), RDi value- 0.88										
56.	Spotted Owlet	<i>Athene brama</i> (Temminck, 1821)	R	C	R	→	LC	II	IV	-
11. BUCEROTIFORMES (No. of Species=2 and No. of Families=2)										
11.1. Bucerotidae (1), RDi value- 0.88										
57.	Indian Grey Hornbill	<i>Ocyroceros birostris</i> (Scopoli, 1786)	R	O	FC	→	LC	-	IV	Common Grey Hornbill
11.2. Upupidae (1), RDi value- 0.88										
58.	Common Hoopoe	<i>Upupa epops</i> Linnaeus, 1758	R	In	R	↓	LC	-	IV	Eurasian Hoopoe
12. CORACIIFORMES (No. of Species=5 and No. of Families=3)										
12.1. Meropidae (2), RDi value- 1.75										
59.	Green Bee-Eater	<i>Merops orientalis</i> Latham, 1801	SM	In	A	↑	LC	-	IV	Small Green Bee-Eater, Little Green Bee-Eater
60.	Blue-Cheeked Bee-Eater	<i>Merops persicus</i> Pallas, 1773	SM	In	R	↑	LC	-	IV	-
12.2. Alcedinidae (2), RDi value- 1.75										
61.	White-Breasted Kingfisher	<i>Halcyon smyrnensis</i> (Linnaeus, 1758)	R	C	C	↓	LC	-	IV	White-throated Kingfisher
62.	Pied Kingfisher	<i>Ceryle rudis</i> (Linnaeus, 1758)	R	P	R	?	LC	-	IV	Lesser Pied Kingfisher
12.3. Coraciidae (1), RDi value- 0.88										
63.	Indian Roller	<i>Coracias benghalensis</i> (Linnaeus, 1758)	R	C	R	↑	LC	-	IV	-
13. PSITTACIFORMES (No. of Species=2 and No. of Families=1)										
13.1. Psittaculidae (2), RDi value- 1.75										
64.	Rose-Ringed Parakeet	<i>Psittacula krameri</i> (Scopoli, 1769)	R	F	A	↑	LC	-	IV	-
65.	Alexandrine Parakeet	<i>Psittacula eupatria</i> (Linnaeus, 1766)	R	F	C	↓	NT	II	IV	Large Indian Parakeet

Table 1. Contd.....

14. PASSERIFORMES (No. of Species=41 and No. of Families=20)										
14.1. Motacillidae (4), RDI value- 3.51										
66.	White-Browed Wagtail	<i>Motacilla maderaspatensis</i> J.F. Gmelin, 1789	R	In	C	→	LC	-	IV	Large Pied Wagtail
67.	White Wagtail	<i>Motacilla alba</i> Linnaeus, 1758	WM	In	C	→	LC	-	IV	Pied Wagtail
68.	Western Yellow Wagtail	<i>Motacilla flava</i> Linnaeus, 1758	WM	In	C	↓	LC	-	IV	-
69.	Grey Wagtail	<i>Motacilla cinerea</i> Tunstall, 1771	WM	In	R	→	LC	-	IV	-
14.2. Hirundinidae (2), RDI value- 1.75										
70.	Streak-Throated Swallow	<i>Petrochelidon fluvicola</i> (Blyth, 1855)	R	In	C	↑	LC	-	IV	Indian Cliff Swallow
71.	Wire-Tailed Swallow	<i>Hirundo smithii</i> Leach, 1818	R	In	C	↑	LC	-	IV	-
14.3. Estrilidae (2), RDI value- 1.75										
72.	Scaly-Breasted Munia	<i>Lonchura punctulata</i> (Linnaeus, 1758)	R	G	R	→	LC	-	IV	Spotted Munia
73.	Indian Silverbill	<i>Euodice malabarica</i> (Linnaeus, 1758)	R	G	R	→	LC	-	IV	White-throated Munia
14.4. Leiothrichidae (2), RDI value- 1.75										
74.	Jungle Babbler	<i>Turdoides striata</i> (Dumont, 1823)	R	O	A	→	LC	-	IV	-
75.	Striated Babbler	<i>Argya earlei</i> (Blyth, 1844)	R	O	R	↓	LC	-	IV	-
14.5. Muscicapidae (4), RDI value- 3.51										
76.	Indian Robin	<i>Saxicoloides fulicatus</i> (Linnaeus, 1766)	R	In	C	→	LC	-	IV	Indian Black Robin
77.	Bluethroat	<i>Luscinia svecica</i> (Linnaeus, 1758)	WM	In	FC	→	LC	-	IV	-
78.	Oriental Magpie Robin	<i>Copsychus saularis</i> (Linnaeus, 1758)	R	In	R	→	LC	-	IV	-
79.	Siberian Stonechat	<i>Saxicola maurus</i> (Pallas, 1773)	WM	In	R	→	LC	-	IV	Collared stonechat, Eastern Stonechat
14.6. Corvidae (2), RDI value- 1.75										
80.	House Crow	<i>Corvus splendens</i> Vieillot, 1817	R	O	C	→	LC	-	V	-
81.	Rufous Treepie	<i>Dendrocitta vagabunda</i> (Latham, 1790)	R	O	R	↓	LC	-	IV	Indian Treepie
14.7. Sylviidae (1), RDI value- 0.88										
82.	Lesser Whitethroat	<i>Sylvia curruca</i> (Linnaeus, 1758)	WM	O	R	→	LC	-	IV	-

Table 1. Contd.....

14.8. Laniidae (2), RDi value- 1.75										
83.	Bay Backed Shrike	<i>Lanius vittatus</i> Valenciennes, 1826	R	In	R	→	LC	-	IV	-
84.	Long Tailed Shrike	<i>Lanius schach</i> Linnaeus, 1758	R	In	R	?	LC	-	IV	Rufous-backed Shrike
14.9. Cisticolidae (4), RDi value- 3.51										
85.	Plain Prinia	<i>Prinia inornata</i> Sykes, 1832	R	In	FC	→	LC	-	IV	Plain Wren Warbler
86.	Common Tailorbird	<i>Orthotomus sutorius</i> (Pennant, 1769)	R	In/N	R	→	LC	-	IV	-
87.	Yellow-Bellied Prinia	<i>Prinia flaviventris</i> (Delessert, 1840)	R	In	R	↓	LC	-	IV	Yellow-bellied Wren Warbler
88.	Ashy Prinia	<i>Prinia socialis</i> Sykes, 1832	R	In	R	→	LC	-	IV	Ashy Wren Warbler
14.10. Nectariniidae (1), RDi value- 0.88										
89.	Purple Sunbird	<i>Cinnyris asiaticus</i> (Latham, 1790)	R	In/N	C	→	LC	-	IV	-
14.11. Zosteropidae (1), RDi value- 0.88										
90.	Indian White-Eye	<i>Zosterops palpebrosus</i> (Temminck, 1824)	R	In/N	R	↓	LC	-	IV	-
14.12. Pycnonotidae (2), RDi value- 1.75										
91.	Red Vented Bulbul	<i>Pycnonotus cafer</i> (Linnaeus, 1766)	R	O	C	↑	LC	-	IV	-
92.	White-Eared Bulbul	<i>Pycnonotus leucotis</i> (Gould, 1836)	R	O	R	↓	LC	-	IV	-
14.13. Passeridae (2), RDi value- 1.75										
93.	House Sparrow	<i>Passer domesticus</i> (Linnaeus, 1758)	R	O	FC	↓	LC	-	IV	-
94.	Sind Sparrow	<i>Passer pyrrhonotus</i> Blyth, 1845	R	O	R	→	LC	-	IV	Sind Jungle Sparrow
14.14. Sturnidae (6), RDi value- 5.26										
95.	Common Starling	<i>Sturnus vulgaris</i> Linnaeus, 1758	WM	O	R	↓	LC	-	IV	European Starling
96.	Brahminy Starling	<i>Sturnia pagodarum</i> (J.F. Gmelin, 1789)	R	O	R	?	LC	-	IV	Black-headed Munia, Brahminy Munia
97.	Asian Pied Starling	<i>Gracupica contra</i> (Linnaeus, 1758)	R	O	R	↑	LC	-	IV	Pied Myna
98.	Rosy Starling	<i>Pastor roseus</i> (Linnaeus, 1758)	WM	O	R	?	LC	-	IV	Rosy Pastor
99.	Common Myna	<i>Acridotheres tristis</i> (Linnaeus, 1766)	R	O	FC	↑	LC	-	IV	Indian Myna
100.	Bank Myna	<i>Acridotheres ginginianus</i> (Latham, 1790)	R	O	R	↑	LC	-	IV	-
14.15. Dicruridae (1), RDi value- 0.88										
101.	Black Drongo	<i>Dicrurus macrocerus</i> Vieillot, 1817	R	In	C	?	LC	-	IV	-

Table 1. Contd.....

14.16. Phylloscopidae (1), RDI value- 0.88						
102.	Common Chiffchaff	<i>Phylloscopus collybita</i> (Vieillot, 1817)	WM	In	FC	↑ LC - IV -
14.17. Ploceidae (1), RDI value- 0.88						
103.	Baya Weaver	<i>Ploceus philippinus</i> (Linnaeus, 1766)	R	O	R	→ LC - IV - Indian Baya
14.18. Pellorneidae (1), RDI value- 0.88						
104.	Rufous-Vented Grass Bbler	<i>Laticilla burnesii</i> (Blyth, 1844)	R	O	R	↓ NT - IV -
14.19. Oriolidae (1), RDI value- 0.88						
105.	Indian Golden Oriole	<i>Oriolus kundoo</i> Sykes, 1832	SM	O	FC	? LC - IV -
14.20. Vangidae (1), RDI value- 0.88						
106.	Common Woodshrike	<i>Tephrodornis pondicerianus</i> (J.F. Gmelin, 1789)	R	In	R	→ LC - IV -
15. CICONIIFORMES (No. of Species=2 and No. of Family=1)						
15.1. Ciconiidae (2), RDI value- 1.75						
107.	Asian Woollyneck	<i>Ciconia episcopus</i> (Boddaert, 1783)	R	C	FC	↓ VU - IV - Woolly-necked Stork, White-necked Stork
108.	Painted Stork	<i>Mycteria leucocephala</i> (Pennant, 1769)	R	C	R	↓ NT I - IV -
16. PICIFORMES (No. of Species=3 and No. of Families=2)						
16.1. Megalaimidae (2), RDI value- 1.75						
109.	Coppersmith Barbet	<i>Psilopogon haemacephalus</i> (Statius Muller, 1776)	R	F	R	↑ LC - IV - Crimson-breasted Barbet
110.	Brown Headed Barbet	<i>Psilopogon zeylanicus</i> (J.F. Gmelin, 1788)	R	F	R	→ LC - IV - Large Green Barbet
16.2. Picidae (1), RDI value- 0.88						
111.	Eurasian Wryneck	<i>Jynx torquilla</i> Linnaeus, 1758	WM	In	R	↓ LC - IV - Wryneck, Northern Wryneck
17. PODICIPEDIFORMES (No. of Species=1 and No. of Family=1)						
17.1. Podicipedidae (1), RDI value- 0.88						
112.	Little Grebe	<i>Tachybaptus ruficollis</i> (Pallas, 1764)	R	C	R	? LC - IV - Dabchick
18. SULIFORMES (No. of Species=2 and No. of Family=1)						
18.1. Phalacrocoracidae (2), RDI value- 1.75						
113.	Little Cormorant	<i>Microcarbo niger</i> (Vieillot, 1817)	R	C	A	? LC - IV -
114.	Great Cormorant	<i>Phalacrocorax carbo</i> (Linnaeus, 1758)	WM	C	R	↑ LC - IV - Large Cormorant

RDI value: Relative Diversity Index Value; **Residential status:** R- Resident, SM- Summer Migrant, WM- Winter Migrant; **Abundance status:** A- Abundant, C - Common, FC - Fairly Common, R - Rare; **Feeding guild:** In- Insectivore, O-Omnivore, C-Carnivore, H-Herbivore, P-Piscivore, G-Grainivore, In/N- Insecti/Nectarivore, F-Frugivore; **Conservation Status:** IUCN- International Union for Conservation of Nature and Natural Resources, CITES- Convention on International Trade in Endangered Species of Wild Fauna and Flora, WPA- Wildlife Protection Act; NT-Near-threatened, LC-Least Concern, VU-Vulnerable, I- Schedule I of IWPA (highly preferred species), IV- Schedule IV of IWPA (moderately preferred species); **Population trends:** ↑- Increasing, ↓- Decreasing, →- Stable, ?- Unknown.

Kalesar National Park, Haryana (Rai *et al.*, 2017b); Gibe Sheleko National Park, South-western Ethiopia (Desta *et al.*, 2020); Sheikh Badin National Park, Khyber (Ullah *et al.*, 2021), order Passeriformes was the most prevalent taxa of avifauna in different areas. Due to their ability to use a wide range of habitats and consume varied food items such as grains, nuts, floral buds, fruits, nectar and invertebrates, passerines species encompasses high diversity in an area (Beresford *et al.*, 2005). Analysis of RDi (Relative diversity) results revealed Scolopacidae as a highly diverse family possessing 11 species and the greatest RDi value, i.e., 9.65, in contrast to other families. The presence of food in large quantities plays a crucial role in revealing the existence of specific species in an area. The result of feeding guild of observed species revealed Carnivores (35 species) as highly dominated guild followed by Insectivores (32 species); Omnivores (26 species); Grainivores (6 species); Herbivores (6 species); Frugivores (5 species); Insecti/Nectarivores (3 species) and Piscivores (one species). The maximum number of carnivorous bird species represents that the lake provides enormous food assets in terms of amphibians, crustaceans, fishes, reptiles and another non-insect invertebrate as well as vertebrates species (Kumar and Gupta, 2013; Jamwal *et al.*, 2017; Kumar and Sharma, 2018; Sohil and Sharma, 2020). Out of recorded 114 species, 76 species were Resident; 30 Winter migrants and 8 summer migrants (Table 1). Some of the migratory species were Eurasian wigeon *Mareca Penelope*; Marsh Sandpiper *Tringa stagnatilis*; Spotted Redshank *Tringa erythropus*; Common Snipe *Gallinago gallinago*; Rosy Starling *Pastor roseus*; Black Tailed Godwit *Limosa limosa*; Grey Wagtail *Motacilla cinerea*; Lesser Whitethroat *Sylvia curruca*; Great Cormorant *Phalacrocorax carbo*; Common Hawk cuckoo *Hierococcyx varius*; Pheasant-tailed Jacana *Hydrophasianus chirurgus*. Earlier record in Ottu Lake, Sirsa, Haryana documented 64 migratory species constituting 57 winter migrants and 7 summer migrant (Goyal *et al.* 2014). Studies such as Rai *et al.* (2017a) on Basai wetland; Chopra *et al.* (2017) on Bhindawas bird sanctuary; Rai *et al.* (2019) on Basai wetland; Vishwakarama *et al.* (2020) on Kopra reservoir revealed the presence of a maximum number of migratory birds in winter season in accordance with other respective seasons. Kumar *et al.* (2016) also recorded highest number of winter migratory species from Rural ponds of Kurukshetra, Haryana, being the presence of their study site on Central Asian Flyway. Being located on CAF (Central Asian Flyway) selected study site Ottu Reservoir, Sirsa also serves as most preferred wintering area for migrant avifaunal diversity that breeds in Palaearctic region of biogeographic realms. On the basis of IUCN Red list Criteria, 107 species were observed as Least concern (LC); six were Near

threatened (NT) and the single species as Vulnerable (VU). Species such as Black-Tailed Godwit *Limosa limosa*; Black-Headed Ibis *Threskiornis melanocephalus*; Alexandrine Parakeet *Psittacula eupatria*; Whiskered Tern *Chlidonias hybrida*; Rufous-Vented Grass-Babbler *Laticilla burnesii*; Painted Stork *Mycteria leuco-*

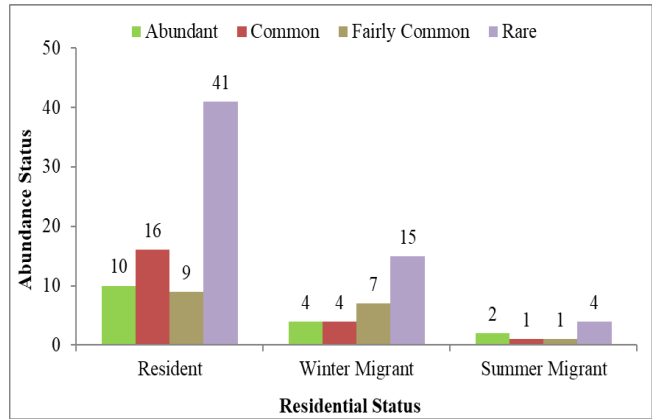


Fig. 3. Comparison of residential status and abundance status of species recorded in and around Ottu reservoir, District Sirsa, Haryana (India).

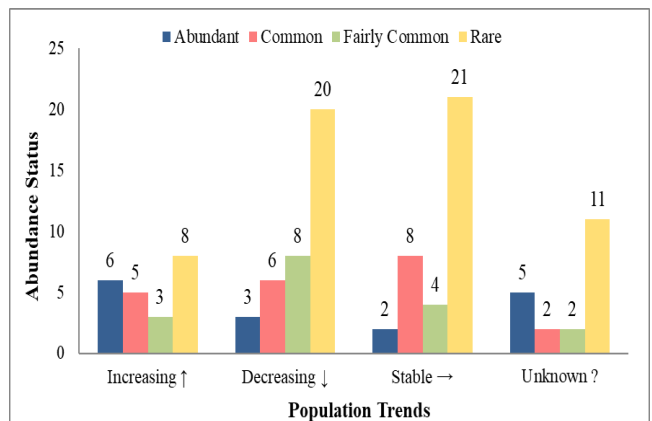


Fig. 4. Relationship between population trends and abundance status of species documented in and around Ottu reservoir, District Sirsa, Haryana (India).

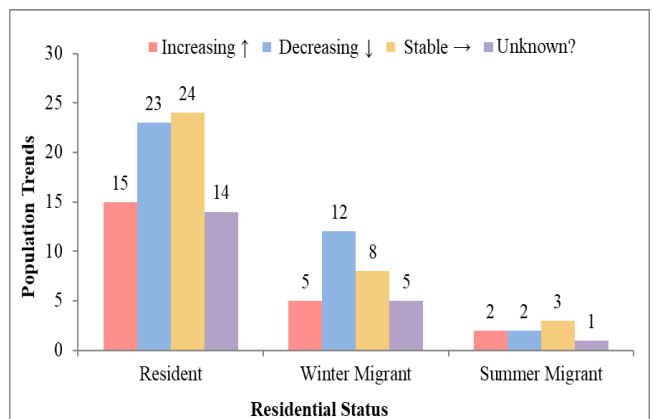


Fig. 5. Relationship between residential status and population trends of species recorded in and around Ottu reservoir, District Sirsa, Haryana (India).

cephala were Near-Threatened (NT) whereas Asian Woollyneck *Ciconia episcopus* was Vulnerable (VU). Three species such as Shikra *Accipiter badius*, Black kite *Milvus migrans* and Eurasian Spoonbill *Platalea leucorodia* were documented under Schedule-I and the remaining 111 species under Schedule-IV of Wildlife Protection Act (IWPA,1972). Six species from the reported avian species fall under various categories of CITES (2012) presenting Appendix-II (i.e. includes five species) and Appendix-I (i.e. include single species), respectively. In the present study, Rufous-Vented Grass-Babbler *Laticilla burnesii* was also recorded by us during one year study period in the study area as well as by others in district sirsa claiming its last sighting in October 2003 (Prayag Arora- Desai, 2019). Data on the abundance status of reported (residential and migratory) species figured out that 16 species were abundant, 21 were common, 17 were fairly common and 60 were rare in the area. The abundance status of a species in a region is determined by the composition of the vegetation that forms a major component of the habitat (Block and Brennan, 1993). A comparison of residential status of observed species with abundance status revealed that of 76 resident species, 10 species were abundant, 16 commons, 9 fairly common and 41 rare; among 30 winter migrants: 4 species were abundant, 4 common, 7 fairly common and 15 rare and Of 8 Summer migrants: 2 species abundant, 1 common, 1 fairly common and 4 rare (Fig. 3). Depending on the abundance status, appropriate conservation planning is essential for maintaining these rare species' diversity in the study area. The population trends consigned in accordance with IUCN Red List (IUCN, 2020) revealed that among recorded avian fauna, increasing trends were by 22 species; decreasing by 37 species; stable by 35 species and unknown by 20 species. A comparison between local abundance status and population trends (Fig. 4) described three species namely Rock dove *Columba livia*, Lesser Whistling-duck *Dendrocygna javanica* and Common Sandpiper *Actitis hypoleucos* with decreasing global population trends of IUCN, were present abundantly in the reservoir, due to presence of suitable food resources and appropriate environmental conditions. Similarly, analysis of global IUCN population trends with respect to the residential status of bird's results out that among 76 residents species: 15 species shows increasing trend (↑), 23 species decreasing trend (↓), 24 species stable trend (→) and 14 species unknown trend (?); whereas of 30 winter migrants: 5 species with an increasing trend (↑), 12 species decreasing trend (↓), 8 species stable trend (→) and 5 species unknown trend (?) and of 8 summer migrants: 2 species shows increasing trend (↑), 2 species decreasing trend (↓), 3 species stable trend (→) and single species with unknown status (Fig. 5). Concerning conservation, species with decreasing IUCN population

trends need to be prioritized for extensive monitoring and other threatened species. A proper management plan should be made at objective and secondary levels, emphasizing wetland protection and sustainable use, as the lake is home to a huge number of bird species.

Conclusion

The present study provides information about the ecological characteristics of Ottu reservoir, which serves as heaven for 114 avian species (18 orders, 47 families and 91 genera), sustaining serenity, contiguity of river, diverse habitat, vast aquatic area, agricultural fields, nutrient-rich water and other environmental conditions. Recorded data of 114 bird species at the reservoir can be used as baseline data for assessing future perspectives and proper management plans for wetland protection and its sustainable use. Long-term monitoring of avifaunal composition in this area will act as excellent means to determine the effects of anthropogenic pressures and implement conservation strategies of the Ottu reservoir, Sirsa (Haryana).

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Conflict of interest

The authors declare that they have no conflict of interest.

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