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COMMUNICATION

AN APPRAISAL OF AVIAN SPECIES DIVERSITY IN AND AROUND PURULIA TOWN, WEST BENGAL, INDIA

Swastik Mahato, Sudipta Mandal & Dipanwita Das

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An appraisal of avian species diversity in and around Purulia Town, West Bengal, India

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Abstract: Purulia, the westernmost district of West Bengal, India is least explored with respect to the biological diversity and relatively little information is available to date. The present study was conducted from February 2017 to January 2018 to document avifaunal diversity in Purulia Town and surroundings. Sampling was done through the line transect method with photographic documentation and subsequent identification following suitable keys. Species richness and seasonal abundance were calculated. Altogether, 115 species of birds belonging to 19 orders and 43 families were recorded during the study period. Passeriformes was the most dominant order represented by 46 species during the study. The Shannon-Wiener (H') value was highest for January (1.564). A large number of migratory birds visit Purulia every year mostly during winter and it is reflected in the present study. Diverse foraging habit among the birds was observed during the study period and omnivorous birds (29%) were found in highest number followed by invertivores (26%), carnivores (25%), granivores (8%), herbivores (7%), frugivores (3%), and nectarivores (2%). The present study is a preliminary effort to document the avifaunal diversity of Purulia and a more extensive systematic study should be carried out to investigate and protect the avifaunal diversity of this region.

Keywords: Bird, feeding guild, species diversity, species richness.

Bengali: পশ্চিমবঙ্গ রাজ্যের একেবারে পশ্চিমপ্রান্তে অবস্থিত পুরুলিয়া জেলার জীববৈচিত্র্য নিয়ে এখনও পর্যন্ত খুব কমই গবেষণা হয়েছে। তাই এই বিষয়ে তথ্যের অভাব রয়েছে। পুরুলিয়া শহর ও তার পার্শ্ববর্তী এলাকায় পাখির বৈচিত্র্য সম্বন্ধে তথ্য সংগ্রহের উদ্দেশ্যে ২০১৭ সালের ফেব্রুয়ারী মাস থেকে ২০১৮ সালের জানুয়ারী মাস পর্যন্ত একটি সমীক্ষা করা হয়। সমীক্ষাতে পাখি গণনার জন্য “line transect” পদ্ধতি অনুসরণ করা হয় এবং ক্যামেরার সাহায্যে ছবি তুলে পাখি সনাক্ত করণের উপযুক্ত বিধি মেনে পাখিগুলিকে সনাক্ত করা হয়। প্রজাতি প্রাচুর্য ও ঋতুগত তারতম্য হিসাব করা হয়। সমীক্ষার সময়কালে ১৯ টি বর্গ ও ৪৩ টি গোত্রের অন্তর্গত সর্বমোট ১১৫ টি প্রজাতির পাখি নথিভুক্ত করা হয়। Passeriformes বর্গের অধীনে সর্বোচ্চ ৪৬ টি প্রজাতির পাখি নথিভুক্ত করা হয়। জীববৈচিত্র্য নির্দেশক Shannon-Wiener (H') সূচক জানুয়ারী মাসে সর্বোচ্চ (1.564) ছিল। প্রত্যেক বছর শীতকালে প্রচুর পরিমাণে পাখি পুরুলিয়া জেলাতে আসে যা বর্তমান সমীক্ষাতেও প্রতিফলিত হয়েছে। নথিভুক্ত পাখিগুলির মধ্যে খাদ্যভাস এর বিভিন্নতা পরিলক্ষিত হয়েছে। এদের মধ্যে সর্বভুক প্রকৃতির পাখি ছিল সর্বাধিক (২৯%), তাছাড়াও অমেরুদণ্ডীভুক (২৬%), মাংসাশী (২৫%), দানাশস্যভুক (৮%), শাকাহারী (৭%), ফলাহারী (৩%) এবং পরাগভুক (২%) খাদ্যভাস যুক্ত পাখিও পাওয়া গেছে। বর্তমান সমীক্ষাটি পুরুলিয়া শহর ও পার্শ্ববর্তী এলাকার পাখির বৈচিত্র্য নথিভুক্ত করার একটি প্রাথমিক প্রচেষ্টা। এই অঞ্চলের পাখিসহ অন্যান্য জীববৈচিত্র্য সংরক্ষণের জন্য আরও বিস্তারিত ও সংগঠিত সমীক্ষা ও গবেষণার প্রয়োজন রয়েছে।

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Author contribution: SM—field work, photographic documentation, literature review and proof reading. SM—study design, plan of work, literature review, manuscript writing and proof reading. DD—literature review, statistical analysis, manuscript writing and proof reading.

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INTRODUCTION

About 10,721 species of birds are living in this planet (Billerman et al. 2020) distributed from the polar regions to the tropical forests and are even prominent in the highly populated metropolitan cities. Approximately, 75% and 45% of total bird species around the globe are adapted to forest habitats and human-modified habitats, respectively (BirdLife International 2018), where they play important role in pollination, seed dispersal, pest control, and act as an indicator of a healthy environment (Hadley et al. 2012; Ramachandra 2013). Birds play a crucial role in plant pollination; through their faeces, they carry seeds and initialize the distribution of plants to distant places; act as scavengers, which help in ecological decomposition. Birds are considered good ecological indicators as they exploit all trophic levels in a food chain acting as herbivore, carnivore, or omnivore. They respond to the qualitative and/or quantitative changes in the environment and usually indicate the secondary changes in their surroundings (Morrison 1986; Koskimies 1989). Population dynamics of bird species may indicate natural disasters like drought (Blake et al. 1994) or anthropogenic stress like the introduction of new species in the ecosystem and urbanization (Savidge 1984; O'Connell et al. 2000).

Habitat loss is one of the key factors responsible for the rapid decline of the avian species population (Prasad et al. 2014). Anthropogenic activities like agriculture, urbanization, and firewood collection have contributed to deforestation and the simultaneous habitat degradation of the bird communities that affect the variety and variability of bird population (Storch et al. 2003). Understanding the changes in the diversity and abundance of the birds linked with the degradation of the natural habitats and ecosystems could help in framing necessary conservation actions.

Avian species diversity and distribution are not consistent with the landscape (Bibby et al. 1992). The pattern of biodiversity changes with environmental factors, climatic conditions, topography and habitats (Rodríguez-Estrella 2007; Jankowski et al. 2009). Purulia is the westernmost district of West Bengal, India, and is topographically an undulated land which is the eastern part of Chotanagpur plateau. This district faces severe water scarcity in summer. Plants like *Palash Butea monosperma*, *Kusum Schleicheria oleosa*, *Mahua Madhuca longifolia*, *Neem Azadirachta indica*, *Kend Diospyros melanoxylon*, *Haritaki Terminalia chebula*, *Amla Phyllanthus emblica*, *Karange Pongamia pinnata*, *Bamboo Bambusa* spp. which can tolerate drought,

flourish in this district (Das 2016; Samanta et al. 2017). Purulia has been least explored concerning the biological diversity and relatively little published information is available to date (Das 2016; Samanta et al. 2017; Das 2018). In this circumstance, to enrich the knowledge on the biodiversity profile, an attempt was made to update the information about birds of Purulia Town and surroundings for the diversity and seasonal abundance. The main objective of the study was to determine bird species diversity and abundance to prepare a checklist of birds as well as to create awareness among the local people of Purulia to help maintain the ecological balance.

MATERIALS AND METHODS

Study Site

The present study was carried out to document the avifaunal diversity from February 2017 to January 2018 in and around Purulia Town (23.33 N; 86.36 E), Purulia, West Bengal, India. Five locations, namely, Ketika, Sidho-Kanho-Birsha University campus, Saheb Bandh, Surulia Deer Park, and Kansai river-side, situated in and around the town were selected for the study (Fig. 1). Ketika, situated about 2km from Purulia railway station, is a well-wooded residential area with trees, bushes, open lands with intermittent small ponds, and ditches. Sidho-Kanho-Birsha University campus is a vast open land with scattered bushes and trees. Saheb Bandh is a large man-made lake with some vegetation surrounding it. Surulia Deer Park is an urban forest with a mini zoo inside it. Kansai river-side was the area around the bank of river Kansai flowing by the south boundary of the town.

Data collection

Each study site was visited once a month. Line transect method was employed to record avifaunal richness and abundance (Hutto et al. 1986; Bibby et al. 1992; Buckland et al. 2004). The field surveys were conducted at 06.30–07.30 h, 12.00–13.00 h, and 16.30–17.30 h, and the values were averaged to obtain representative data of a particular count (Gibbons & Gregory 2006).

From the starting spot of any predetermined route, the bird species or their calls were recorded along either side of the transect. The starting point and the direction of transects were often random. The length of the route often varied due to topography, roads, water body that limited access. The opportunistic counts of birds during other times and other places were also included to

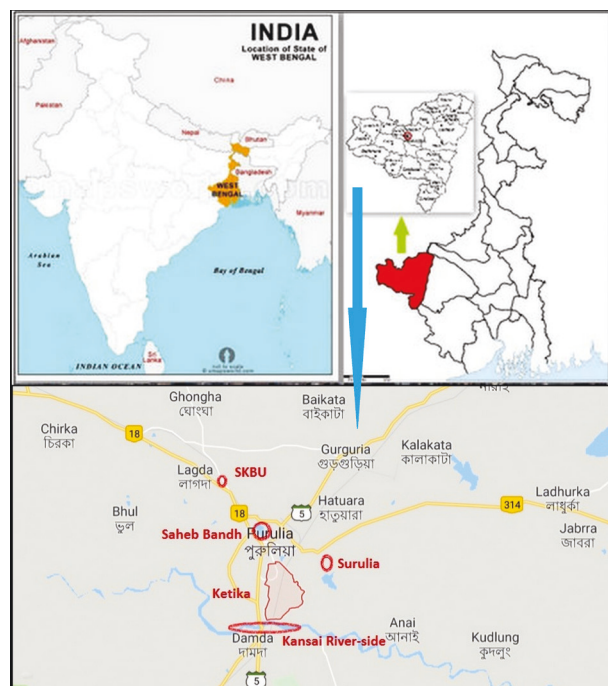


Figure 1. Study sites (marked by red circles) under present investigation in and around Purulia Town, West Bengal, India.

document a comprehensive checklist (Hossain & Aditya 2016).

Following visual observation or hearing a bird's call the presence of the birds was confirmed with the help of a binocular (Olympus 8 × 40 DPS1) and photographs were taken with digital cameras (Nikon Coolpix P520 and Canon 1200d, 55–250mm lens). Based on the visual observations and photographs, birds were identified following standard guidebooks (Ali 2002; Grimmett et al. 2011). Monthly data obtained from the one-year study was divided into four seasons: summer (March to May), monsoon (June to August), post-monsoon (September to November), and winter (December to February) to compare seasonal variations in avian species richness and abundance.

Species richness and diversity were calculated using Biodiversity Pro software (McAleece et al. 1997). The bird species diversity was calculated using the Shannon-Wiener diversity index [$H' = -\sum p_i \ln p_i$] and Shannon diversity index [$H_{\max} = \log_{10}(S)$]. Measurement of Shannon's evenness index was calculated using the following formula $J = H' / H_{\max}$ (p_i = proportion of total sample belonging to i^{th} species, S = total number of species in habitats (species richness) (Magurran 2004).

Migratory status and feeding habits of the enlisted birds was determined by personal observation as well as information available in the literature (Ali 2002;

Grimmett et al. 2011; Birdlife International 2018).

RESULTS

In the present study, 115 species of birds consisting of 19 orders and 43 families were recorded in and around Purulia Town (Table 1; Image 1a, b). Passeriformes was found to be the most dominant order represented by 46 species (Fig. 2). Among the families, Anatidae was represented by the highest of nine species (Table 1). The residential status of the recorded birds shows that 78 species of birds were a permanent resident of Purulia, 36 bird species were winter migrants, and only one species Jacobin Cuckoo *Clamator jacobinus* was a summer migrant (Table 1). Among the winter migrants, Red-Crested Pochard *Netta rufina*, Northern Shoveler *Anas clypeata*, Garganey *Spatula querquedula*, Eurasian Wigeon *Mareca penelope*, Northern Pintail *Anas acuta*, Gadwall *Mareca strepera*, and Ferruginous Duck *Aythya nyroca* took shelter in the Saheb Bandh, Purulia. Among the 115 species of birds, 43 species were partly or completely dependent on water bodies.

The species richness value was highest in the winter season (104) and in December (99); whereas, this was lowest in Monsoon (69) and in August (61) (Table 4). The overall avian diversity index (H') for the town and surroundings was 3.66. The biodiversity index was also calculated month-wise (Fig. 3) and it depicts that the Shannon-Wiener (H') value was highest for January (1.564) though the H' value does not differ significantly for the rest of the months. Shannon evenness (J') value was lowest in December (0.767) and highest for July (0.857).

Feeding guilds included invertivorous, granivorous, nectarivorous, frugivorous, omnivorous, carnivorous, and herbivorous categories (Table 1, Fig. 4). Among the invertivorous birds, insectivorous and molluscivorous species specialized for feeding on only insects and mollusks (Table 1, Fig. 4) were considered. Omnivorous birds (29%) were found in the highest number followed by invertivores (26%), carnivores (25%), granivores (8%), herbivores (7%), frugivores (3%), and nectarivores (2%). Of all invertivores, insectivores represented 70% in number (Fig. 4).

DISCUSSION

As evident from the present study, Purulia Town and its surrounding places nurture a widely diversified

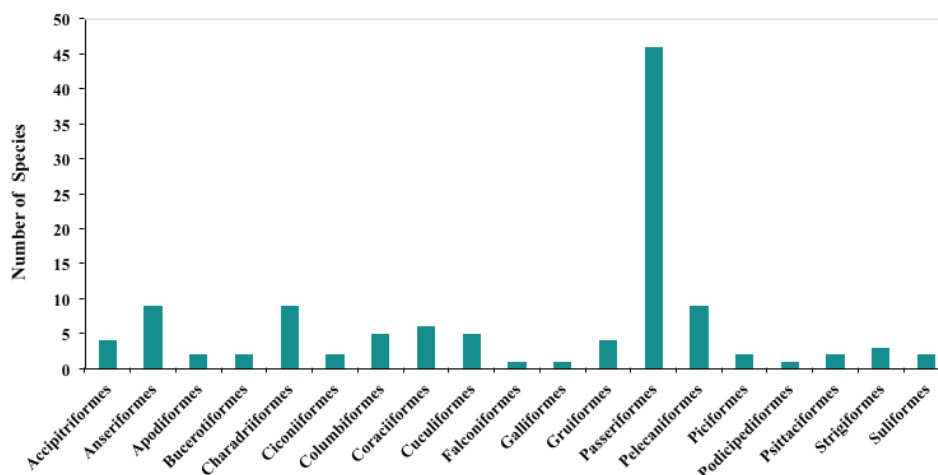


Figure 2. Family wise abundance (according to the number of species) of the birds observed during the present study.

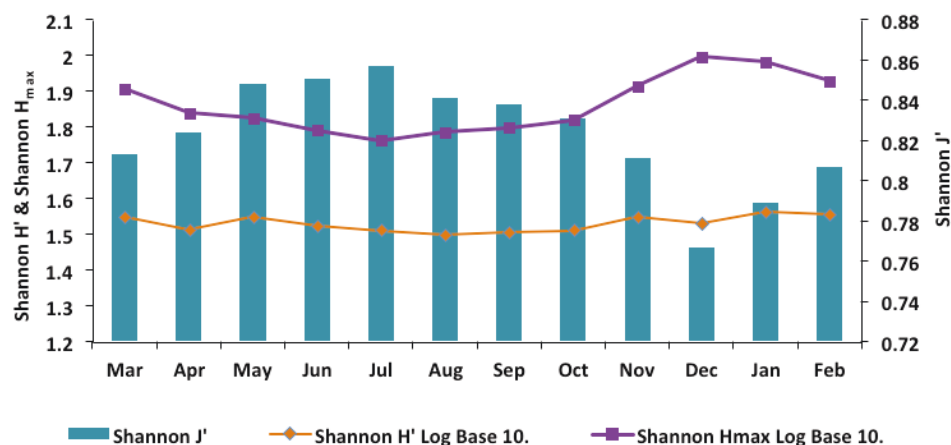


Figure 3. Month-wise Shannon-Wiener index and evenness value of the birds observed.

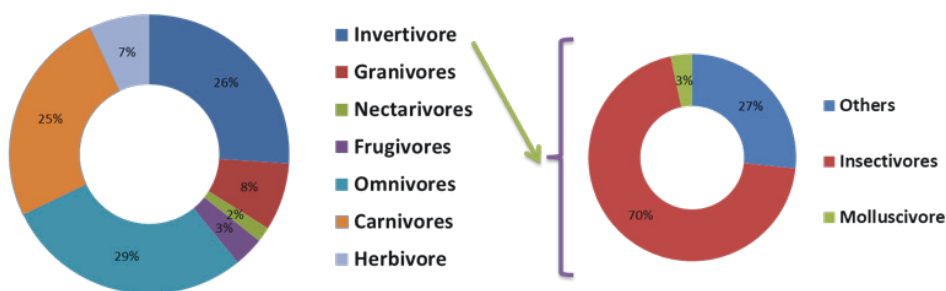


Figure 4. Feeding guild of the birds recorded in the present study.

avian group with its arid environment, wild flora, the fragmented agricultural field, plantation, and gardens that provides a complex landscape. The study area is moderately rich with its avifauna with 115 species, and when compared with previous observations in different parts of India it has been found that the species richness at Purulia (Table 2) was lower than the values reported for Burdwan (144) (Hossain & Aditya 2016), and the surrounding area of western Kachchh (252) (Gajera

et al. 2013). But the avian diversity was higher than that reported for Kolkata surroundings (48 species) (Sengupta et al. 2014). Shannon diversity index (H') for the present study (3.66) was found to be higher than the Silent Valley (3.3) and moist deciduous forest of Mukkali (3.45) (Jayson & Mathew 2000), which indicates that Purulia Town possesses a rich avian diversity.

The present species richness value is greater than the richness values for Purulia Saheb bandh (24 species)

Table 1. Checklist of birds found in Purulia Town and surroundings with their seasonal occurrence, residential status, species abundance (P_i value), and feeding habits.

	Scientific name	Common name	Seasonal occurrence [#]	Status ^a	P_i value*	Feeding habit ^s
ORDER 1 : Accipitriformes						
Family: Accipitridae						
1	<i>Accipiter badius</i> (Gmelin, 1788)	Shikra	ALL	R	0.00173	C
2	<i>Milvus migrans</i> (Boddaert, 1783)	Black Kite	ALL	R	0.00479	C
3	<i>Pernis ptilorhynchus</i> (Temminck, 1821)	Oriental Honey Buzzard	S, W	R	0.00005	C
4	<i>Circus aeruginosus</i> (Linnaeus, 1758)	Western Marsh Harrier	W	WM	0.00002	C
ORDER 2 : Anseriformes						
Family: Anatidae						
5	<i>Dendrocygna javanica</i> (Horsfield, 1821)	Lesser Whistling Duck	ALL	R	0.12926	G
6	<i>Netta rufina</i> (Pallas, 1773)	Red-Crested Pochard	S, PM, W	WM	0.01085	G
7	<i>Nettapus coromandelianus</i> (Gmelin, 1789)	Cotton Pygmy Goose	ALL	WM	0.00191	H
8	<i>Anas clypeata</i> (Linnaeus, 1758)	Northern Shoveler	S, PM, W	WM	0.00511	O
9	<i>Spatula querquedula</i> (Linnaeus, 1758)	Garganey	S, W		0.00041	O
10	<i>Mareca penelope</i> (Linnaeus, 1758)	Eurasian Wigeon	PM	WM	0.00002	H
11	<i>Anas acuta</i> (Linnaeus, 1758)	Northern Pintail	S, PM, W	WM	0.00702	H
12	<i>Mareca strepera</i> (Linnaeus, 1758)	Gadwall	S, PM, W	WM	0.00629	H
13	<i>Aythya nyroca</i> (Güldenstädt, 1770)	Ferruginous Duck	W		0.00010	O
ORDER 3: Apodiformes						
Family: Apodidae						
14	<i>Cypsiurus balasiensis</i> (J.E. Gray, 1829)	Asian Palm Swift	ALL	R	0.01229	I
15	<i>Apus affinis</i> (JE Gray, 1830)	Little Swift	ALL	R	0.01775	I
ORDER 4 : Bucerotiformes						
Family: Upupidae						
16	<i>Upupa epops</i> (Linnaeus, 1758)	Common Hoopoe	ALL	R	0.00049	I
Family: Bucerotidae						
17	<i>Ocyrceros birostris</i> (Scopoli, 1786)	Indian Grey Hornbill	W	R	0.00002	F
ORDER 5 : Charadriiformes						
Family: Charadriidae						
18	<i>Charadrius dubius</i> (Scopoli, 1786)	Little Ringed Plover	M, PM, W	R	0.00215	IV
19	<i>Vanellus indicus</i> (Boddaert, 1783)	Red-wattled Lapwing	S, W	R	0.00044	IV
20	<i>Vanellus malabaricus</i> (Boddaert, 1783)	Yellow-wattled Lapwing	ALL	R	0.00367	IV
Family: Jacanidae						
21	<i>Hydrophasianus chirurgus</i> (Scopoli, 1786)	Pheasant-tailed Jacana	ALL	R	0.00338	IV
22	<i>Metopidius indicus</i> (Latham, 1790)	Bronze-winged Jacana	ALL	R	0.00605	O
Family: Scolopacidae						
23	<i>Actitis hypoleucos</i> (Linnaeus, 1758)	Common Sandpiper	W	WM	0.00018	C
24	<i>Gallinago gallinago</i> (Linnaeus, 1758)	Common Snipe	S, W	WM	0.00128	O
25	<i>Calidris temminckii</i> (Leisler, 1812)	Temminck's Stint	W	WM	0.00175	IV
Family: Laridae						
26	<i>Gelochelidon nilotica</i> (Gmelin, 1789)	Gull-billed Tern	PM,W	WM	0.00167	I
ORDER 6 : Ciconiiformes						
Family: Ciconiidae						
27	<i>Anastomus oscitans</i> (Boddaert, 1783)	Asian Openbill-Stork	ALL	R	0.01043	M
28	<i>Leptoptilos javanicus</i> (Horsfield, 1821)	Lesser Adjutant	S, M, W	R	0.00023	C

	Scientific name	Common name	Seasonal occurrence [#]	Status [^]	P _i value*	Feeding habit [§]
ORDER 7 : Columbiformes						
Family: Columbidae						
29	<i>Columba livia</i> (Gmelin, 1789)	Rock Pigeon	ALL	R	0.04163	G
30	<i>Spilopelia chinensis</i> (Scopoli, 1768)	Spotted Dove	ALL	R	0.01801	G
31	<i>Streptopelia decaocto</i> (Frisvaldszky, 1838)	Eurasian Collared-Dove	ALL	WM	0.01599	G
32	<i>Streptopelia tranquebarica</i> (Hermann, 1804)	Red Turtle Dove	PM, W	R	0.00026	H
33	<i>Treron phoenicopterus</i> (Latham, 1790)	Yellow-footed Green Pigeon	ALL	R	0.00532	F
ORDER 8 : Coraciiformes						
Family: Alcedinidae						
34	<i>Alcedo atthis</i> (Linnaeus, 1758)	Small blue Kingfisher	ALL	R	0.00461	C
35	<i>Ceryle rudis</i> (Linnaeus, 1758)	Pied Kingfisher	ALL	R	0.00086	C
36	<i>Halcyon smyrnensis</i> (Linnaeus, 1758)	White-throated Kingfisher	ALL	R	0.00469	C
Family: Coraciidae						
37	<i>Coracias benghalensis</i> (Linnaeus, 1758)	Indian Roller	ALL	R	0.00364	C
Family: Meropidae						
38	<i>Merops orientalis</i> (Latham, 1802)	Green Bee-eater	S, PM, W	R	0.03565	I
Family: Campephagidae						
39	<i>Coracina macei</i> (Lesson, 1830)	Large Cuckooshrike	PM, W	R	0.00018	I
ORDER 9 : Cuculiformes						
Family: Cuculidae						
40	<i>Centropus sinensis</i> (Stephens, 1815)	Greater Coucal	W	R	0.00021	C
41	<i>Centropus bengalensis</i> (Gmelin, 1788)	Lesser Coucal	ALL	R	0.00154	C
42	<i>Clamator jacobinus</i> (Boddaert, 1783)	Jacobin Cuckoo	S, M, PM	SM	0.00013	O
43	<i>Hierococcyx varius</i> (Vahl, 1797)	Common Hawk-Cuckoo	ALL	R	0.00065	O
44	<i>Eudynamis scolopacea</i> (Linnaeus, 1758)	Asian Koel	S, M, PM, W	R	0.00157	F
ORDER 10: Falconiformes						
Family: Falconidae						
45	<i>Falco tinnunculus</i> (Linnaeus, 1758)	Common Kestrel	W	R	0.00005	C
ORDER 11 : Galliformes						
Family: Phasianidae						
46	<i>Francolinus pondicerianus</i> (Gmelin, 1789)	Grey Francolin	S, PM, W	R	0.00123	G
ORDER 12 : Gruiformes						
Family: Rallidae						
47	<i>Amaurornis phoenicurus</i> (Pennant, 1769)	White-breasted Waterhen	ALL	R	0.00341	O
48	<i>Fulica atra</i> (Linnaeus, 1758)	Common Coot	ALL	R	0.00697	O
49	<i>Gallinula chloropus</i> (Linnaeus, 1758)	Common Moorhen	ALL	R	0.00521	O
50	<i>Porphyrio porphyrio</i> (Linnaeus, 1758)	Purple Swamphen	ALL	R	0.00875	O
ORDER 13 : Passeriformes						
Family: Alaudidae						
51	<i>Eremopterix griseus</i> (Scopoli, 1786)	Ashy-crowned Sparrow-lark	PM	WM	0.00026	O
Family: Cisticolidae						
52	<i>Orthotomus sutorius</i> (Pennant, 1769)	Common Tailorbird	S, M, PM	R	0.00225	O
53	<i>Prinia socialis</i> (Sykes, 1832)	Ashy Prinia	W	R	0.00010	O
54	<i>Cisticola juncidis</i> (Rafinesque, 1810)	Zitting Cisticola	PM, W	R	0.00118	I
Family: Corvidae						
55	<i>Corvus splendens</i> (Vieillot, 1817)	House Crow	ALL	R	0.02420	O

	Scientific name	Common name	Seasonal occurrence [#]	Status [^]	P _i value*	Feeding habit [§]
56	<i>Dendrocitta vagabunda</i> (Latham, 1790)	Rufous Treepie	ALL	R	0.00797	O
Family: Dicuridae						
57	<i>Dicurus macrocercus</i> (Vieillot, 1817)	Black Drongo	ALL	R	0.02608	I
58	<i>Dicurus aeneus</i> (Vieillot, 1817)	Bronzed Drongo	M	R	0.00005	I
Family: Estrildidae						
59	<i>Euodice malabarica</i> (Linnaeus, 1758)	Indian Silverbill	ALL	R	0.01814	O
60	<i>Lonchura punctulata</i> (Linnaeus, 1758)	Scaly-breasted Munia	ALL	R	0.01473	G
Family: Hirundinidae						
61	<i>Hirundo rustica</i> (Linnaeus, 1758)	Barn Swallow	S, W	WM	0.00133	I
62	<i>Ptyonoprogne concolor</i> (Sykes, 1832)	Dusky Crag Martin	W	WM	0.00078	I
Family: Laniidae						
63	<i>Lanius cristatus</i> (Linnaeus, 1758)	Brown Shrike	W	WM	0.00005	IV
64	<i>Lanius schach</i> (Linnaeus, 1758)	Long-tailed Shrike	W	WM	0.00013	IV
65	<i>Turdoides striata</i> (Dumont, 1823)	Jungle Babbler	ALL	R	0.03807	I
66	<i>Iduna caligata</i> (Lichtenstein, 1823)	Booted Warbler	W	R	0.00036	I
67	<i>Acrocephalus stentoreus</i> (Hemprich & Ehrenberg, 1833)	Clamorous Reed Warbler	PM, W	R	0.00010	I
Family: Motacillidae						
68	<i>Anthus rufulus</i> (Vieillot, 1818)	Paddyfield Pipit	ALL	R	0.00642	I
69	<i>Anthus hodgsoni</i> (Richmond, 1907)	Olive-backed Pipit	PM, W	WM	0.00097	O
70	<i>Anthus trivialis</i> (Linnaeus, 1758)	Tree Pipit	PM		0.00018	O
71	<i>Motacilla alba</i> (Linnaeus, 1758)	White Wagtail	ALL	WM	0.00571	C
72	<i>Motacilla cinerea</i> (Tunstall, 1771)	Grey Wagtail	S,W	WM	0.00149	I
73	<i>Motacilla citreola</i> (Pallas, 1776)	Citrine Wagtail	S, PM,W	WM	0.00217	C
74	<i>Motacilla flava</i> (Linnaeus, 1758)	Yellow Wagtail	S, W	WM	0.00212	O
Family: Muscipidae						
75	<i>Copsychus saularis</i> (Linnaeus, 1758)	Oriental Magpie Robin	ALL	R	0.00791	I
76	<i>Ficedula albicilla</i> (Pallas, 1811)	Taiga Flycatcher	W	WM	0.00021	I
77	<i>Saxicoloides fulicatus</i> (Linnaeus, 1766)	Indian Robin	ALL	R	0.00333	O
78	<i>Saxicola maurus</i> (Pallas, 1773)	Siberian Stonechat	W	WM	0.00026	I
79	<i>Phoenicurus ochruros</i> (S.G. Gmelin, 1774)	Black Redstart	W	WM	0.00002	O
80	<i>Eumyias thalassinus</i> (Swainson, 1838)	Verditer Flycatcher	W	WM	0.00002	O
81	<i>Luscinia svecica</i> (Linnaeus, 1758)	Blue Throat	PM, W	WM	0.00178	O
Family: Nectariniidae						
82	<i>Cinnyris asiaticus</i> (Latham, 1790)	Purple Sunbird	ALL	R	0.00228	N
83	<i>Leptocoma zeylonica</i> (Linnaeus, 1766)	Purple-rumped Sunbird	ALL	R	0.00333	N
Family: Oriolidae						
84	<i>Oriolus kundoo</i> (Sykes, 1832)	Indian Golden Oriole	ALL	R	0.00440	O
85	<i>Oriolus xanthornus</i> (Linnaeus, 1758)	Black-hooded Oriole	ALL	R	0.00506	O
Family: Passeridae						
86	<i>Passer domesticus</i> (Linnaeus, 1758)	House Sparrow	ALL	R	0.00797	G
87	<i>Gymnoris xanthocolis</i> (Burton, 1838)	Chestnut Shouldered Petronia	PM	R	0.00002	H
Family: Ploceidae						
88	<i>Ploceus philippinus</i> (Linnaeus, 1766)	Baya Weaver	ALL	R	0.01324	G
Family: Pycnonotidae						
89	<i>Pycnonotus cafer</i> (Linnaeus, 1766)	Red-vented Bulbul	S, M, PM	R	0.00749	O
Family: Phylloscopidae						
90	<i>Phylloscopus trochiloides</i> (Sundevall, 1837)	Greenish Warbler	S, M	WM	0.00031	IV



	Scientific name	Common name	Seasonal occurrence [#]	Status [^]	P _i value [*]	Feeding habit [§]
Family: Sturnidae						
91	<i>Acridotheres ginginianus</i> (Latham, 1790)	Bank Myna	ALL	R	0.09439	O
92	<i>Acridotheres tristis</i> (Linnaeus, 1766)	Common Myna	ALL	R	0.07866	O
93	<i>Gracupica contra</i> (Linnaeus, 1758)	Asian Pied Starling	ALL	R	0.04719	O
94	<i>Sturnia malabarica</i> (Gmelin, 1789)	Chestnut-tailed Starling	ALL	R	0.00749	O
95	<i>Sturnia pagodarum</i> (Gmelin, 1789)	Brahminy Starling	ALL	R	0.00773	O
Family: Chloropseidae						
96	<i>Chloropsis jerdoni</i> (Blyth, 1844)	Jordan's Leafbird	PM, W	R	0.00073	O
ORDER 14 : Pelecaniformes						
Family: Ardeidae						
97	<i>Ardea alba</i> (Linnaeus, 1758)	Great White Egret	ALL	R	0.00086	C
98	<i>Ardea intermedia</i> (Wagler, 1827)	Intermediate Egret	S, W	R	0.00010	C
99	<i>Ardea purpurea</i> (Linnaeus, 1766)	Purple Heron	S, PM, W	R	0.00028	C
100	<i>Ardeola grayii</i> (Sykes, 1832)	Indian Pond Heron	ALL	R	0.01208	C
101	<i>Bubulcus ibis</i> (Linnaeus, 1758)	Cattle Egret	ALL	R	0.00975	C
102	<i>Egretta garzetta</i> (Linnaeus, 1766)	Little Egret	ALL	R	0.01491	C
103	<i>Nycticorax nycticorax</i> (Linnaeus, 1758)	Black-crowned Night Heron	ALL	R	0.00576	C
Family: Threskiornithidae						
104	<i>Pseudibis papillosa</i> (Temminck, 1824)	Red-Naped Ibis	ALL	WM	0.01030	C
105	<i>Threskiornis melanocephalus</i> (Latham, 1790)	Black-headed Ibis	ALL	WM	0.00870	I
ORDER 15 : Piciformes						
Family: Picidae						
106	<i>Dinopium benghalense</i> (Linnaeus, 1758)	Black-rumped Flameback Woodpecker	ALL	R	0.00099	I
Family: Megalaimidae						
107	<i>Psilopogon haemacephalus</i> (Statius Muller, 1776)	Coppersmith Barbet	S, PM, W	R	0.00401	F
ORDER 16 : Podicipediformes						
Family: Podicipedidae						
108	<i>Tachybaptus ruficollis</i> (Pallas, 1764)	Little Grebe	ALL	R	0.00388	C
ORDER 17 : Psittaciformes						
Family: Psittaculidae						
109	<i>Psittacula eupatria</i> (Linnaeus, 1766)	Alexandrine Parakeet	ALL	R	0.02168	H
110	<i>Psittacula krameri</i> (Scopoli, 1769)	Rose-ringed Parakeet	ALL	R	0.02003	H
ORDER 18: Strigiformes						
Family: Strigidae						
111	<i>Athene brama</i> (Temminck, 1821)	Spotted Owlet	ALL	R	0.00361	C
112	<i>Bubo bengalensis</i> (Franklin, 1831)	Indian Eagle-owl	S	R	0.00002	C
113	<i>Tyto alba</i> (Scopoli, 1769)	Barn Owl	ALL	R	0.00152	C
ORDER 19: Suliformes						
Family: Phalacrocoracidae						
114	<i>Phalacrocorax carbo</i> (Linnaeus, 1758)	Great Cormorant	S	R	0.00002	C
115	<i>Phalacrocorax fuscicollis</i> (Stephens, 1826)	Indian Cormorant	ALL	R	0.01224	C

[#] PM—Pre Monsoon | M—Monsoon | W—Winter | S—Summer

[^]R—Resident | WM—Winter migrant | SM—Summer Migrant

^{*} P_i value— species abundance/total abundance in the community

[§] O—Omnivorous | C—Carnivorous | I—Insectivorous | IV—Invertivorous | M—Molluscivorous | H—Herbivorous | G—Granivorous | N—Nectarivorous | F—Frugivorous

Table 2. Species richness values (both month-wise and season-wise) of the birds recorded in the present study.

Seasons	Months	Species Richness Values	
		Month wise	Season wise
Summer	Mar	81	85
	Apr	69	
	May	67	
Monsoon	Jun	62	69
	Jul	58	
	Aug	61	
Post-monsoon	Sep	63	86
	Oct	66	
	Nov	82	
Winter	Dec	99	104
	Jan	96	
	Feb	85	

reported in 2000 (Nandi et al. 2004); Santragachi Lake of Howrah District, West Bengal (22 species) (Roy et al. 2011); and Bakreswar and Hinglo Reservoirs and Adra Saheb Bandh Lake (24 species) (Khan et al. 2016). Though Purulia is an arid district, local aquatic bodies, especially Saheb Bandh and Kansai River, support the avian groups that dependent on aquatic habitat. The species richness value for the avian species was highest in winter, which is due to the presence of a large number of migratory birds especially in local water bodies like Saheb Bandh.

The resultant data reveals the functional roles and resource utilization patterns in the local ecosystem of the town. The availability of food resources is directly dependent on the precipitation rate and as an arid district of West Bengal, Purulia is severely deprived of water. Therefore, scarcity of water acts as a limiting factor for the survival of avian groups and a lesser number of granivores, herbivores, frugivores, and nectarivores throughout the year justifies the fact (Fig. 4). Interestingly, omnivores were highest in number followed by insectivores which might also be due to extreme weather conditions (Fig. 4). There are evidence about the influence of landscape on local species richness (Gaston 2000; Lawton 2000; Daube et al. 2003; Hossain & Aditya 2016).

As urbanization and developmental activities may destroy or degrade the natural habitats of birds therefore, there are urgent needs for the conservation of local habitats, including wetlands and water bodies.

Successful conservation of birds would require continuous monitoring by government authorities and awareness among local people.

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Image 1–60. Birds photographed during the study: 1—*Accipiter badius* | 2—*Milvus migrans* | 3—*Pernis ptilorhynchus* | 4—*Circus aeruginosus* | 5—*Dendrocygna javanica* | 6—*Netta rufina* | 7—*Nettapus coromandelianus* | 8—*Anas clypeata* | 9—*Spatula querquedula* | 10—*Mareca penelope* | 11—*Anas acuta* | 12—*Mareca strepera* | 13—*Aythya nyroca* | 14—*Cyprus balasensis* | 15—*Apus affinis* | 16—*Upupa epops* | 17—*Ocyrceros birostris* | 18—*Charadrius dubius* | 19—*Vanellus indicus* | 20—*Vanellus malabaricus* | 21—*Hydrophasianus chirurgus* | 22—*Metopidius indicus* | 23—*Actitis hypoleucos* | 24—*Gallinago gallinago* | 25—*Calidris temminckii* | 26—*Gelochelidon nilotica* | 27—*Anastomus oscitans* | 28—*Leptoptilos javanicus* | 29—*Columba livia* | 30—*Spilopelia chinensis* | 31—*Streptopelia decaocto* | 32—*Streptopelia tranquebarica* | 33—*Treron phoeniceus* | 34—*Alcedo atthis* | 35—*Ceryle rudis* | 36—*Halcyon smyrnensis* | 37—*Coracias benghalensis* | 38—*Merops orientalis* | 39—*Coracina macei* | 40—*Centropus sinensis* | 41—*Centropus bengalensis* | 42—*Clamator jacobinus* | 43—*Hierococcyx varius* | 44—*Eudynamis scolopacea* | 45—*Falco tinnunculus* | 46—*Francolinus pondicerianus* | 47—*Amaurornis phoeniceus* | 48—*Fulica atra* | 49—*Gallinula chloropus* | 50—*Porphyrio porphyrio* | 51—*Eremopterix griseus* | 52—*Orthotomus sutorius* | 53—*Prinia socialis* | 54—*Cisticola juncidis* | 55—*Corvus splendens* | 56—*Dendrocitta vagabunda* | 57—*Dicrurus macrocercus* | 58—*Dicrurus aeneus* | 59—*Euodice malabarica* | 60—*Lonchura punctulata* | All photographs © Swastik Mahato.



Image 61–115. Birds photographed during the study: 61—*Hirundo rustica* | 62—*Ptyonoprogne concolor* | 63—*Lanius cristatus* | 64—*Lanius schach* | 65—*Turdoides striata* | 66—*Iduna caligata* | 67—*Acrocephalus stentoreus* | 68—*Anthus rufulus* | 69—*Anthus hodgsoni* | 70—*Anthus trivialis* | 71—*Motacilla alba* | 72—*Motacilla cinerea* | 73—*Motacilla citreola* | 74—*Motacilla flava* | 75—*Copsychus saularis* | 76—*Ficedula albicilla* | 77—*Saxicoloides fulicatus* | 78—*Saxicola maurus* | 79—*Phoenicurus ochruros* | 80—*Eumyias thalassinus* | 81—*Luscinia svecica* | 82—*Cinnyris asiaticus* | 83—*Leptocoma zeylonica* | 84—*Oriolus kundoo* | 85—*Oriolus xanthornus* | 86—*Passer domesticus* | 87—*Gymnoris xanthocollis* | 88—*Ploceus philippinus* | 89—*Pycnonotus cafer* | 90—*Phylloscopus trochiloides* | 91—*Acridotheres ginginianus* | 92—*Acridotheres tristis* | 93—*Gracupica contra* | 94—*Sturnia malabarica* | 95—*Sturnia pagodarum* | 96—*Chloropsis jerdoni* | 97—*Ardea alba* | 98—*Ardea intermedia* | 99—*Ardea purpurea* | 100—*Ardeo lagrayii* | 101—*Bubulcus ibis* | 102—*Egretta garzetta* | 103—*Nycticorax nycticorax* | 104—*Pseudibis papillosa* | 105—*Threskiornis melanocephalus* | 106—*Dinopium benghalense* | 107—*Psilopogon haemacephalus* | 108—*Tachybaptus ruficollis* | 109—*Psittacula eupatria* | 110—*Psittacula krameri* | 111—*Athene brama* | 112—*Bubo bengalensis* | 113—*Tyto alba* | 114—*Phalacrocorax carbo* | 115—*Phalacrocorax fuscicollis* | All photographs © Swastik Mahato.



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