

AN EVALUATION SURVEY ON WETLAND BIRDS IN VAGAIKULAM RIVER BASIN OF TIRUNELVELI DISTRICT, TAMIL NADU, INDIA

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Birds are considered to be indicators of wetland ecosystem, management, restoration, and creation. The physio-chemical parameters of water quality such as pH, temperature, oxygen, chlorine, and salinity are important factors in creating reliable habitats. A study on wetland birds in the Vagaikulam river revealed 1.732 birds under 102 species from 33 diverse families. Their occurrence percentage showed a higher 7.75% in the *Accipitridae* family and the lowest 0.08% in the *Anhingidae* family. Maximum the species in *Ardeolagraysii* was abundant comprising, about 360 individual birds followed by *Corvus splendens* (301), *Ciconia nigra* (200), *Acridotheres tristis* (185), and *Casmerodius albus* (173). The number of birds observed, occurrence, species richness, and physiochemical parameters are good in the Vagaikulam river basin. The rich diversity of birds documented in the study site should be protected for conservation.

Keywords: wetland birds, conservation, water quality, abundance, diversity, Tamil Nadu.

INTRODUCTION

Wetlands are the most important area in which multiple numbers of ecosystems persist in the world because of nutrient richness, protection from flooding, food provision, and recreational values (Maltby & Acreman, 2011). Birds present in an ecosystem are considered to be an important consumer in aquatic systems and are indicators of both water quality and biodiversity (Rajpar & Zakaria, 2011). The migration of birds from one location to another for nesting and reproduction plays a vital role in its biodiversity. In India, about 310 bird species are documented in which most of the birds are migratory from other locations and countries such as China, Russia, Central Asia, and Tibet (Jeyapraba *et al.*, 2017).

India is enveloped with a wealth of ecosystems in different geographical locations. It is estimated that around 4.1 million hectares of wetland are covered 1.5 million are covered by natural and 2.6 million by manmade. In wetlands in Tamil Nadu, 31 natural wetlands cover an area of 58,068 hectares and 20,030

manmade wetlands cover an area of 2, 01,132 hectares (Venkatraman, 2005). In wetland ecosystem, the biodiversity of birds are affected due to several reasons such as food availability, abiotic changes (Lagos *et al.*, 2008), and physiological changes in the environment (Gillis *et al.*, 2008).

The river Thamiraparani flows along the region Vakaikullam situated in the Tirunelveli district of Tamil Nadu, India. River occupies west to east region mixed with Maruthur dam. It's surrounded by macrophytes like Eichornia, Pista, Lemna, and Hydrilla, fishes, trees, and a sandy area. The shape of the river is parallel from west to east. Water tanks are found in and around the river area. The water flows throughout the year, which attracts birds for their nesting and breeding.

Monitoring and documentation of wetland birds provide a shred of valuable evidence on the ecological health and current status of wetlands which can be a vital tool for evolving awareness regarding the conservation value of the wetlands. In the present study, an attempt has been made to investigate the abundance of bird species at Vagaikulam river, Tirunelveli, Tamil Nadu, India.

MATERIAL AND METHODS

Physiochemical analysis of water

The parameters such as temperature, pH, oxygen level, chlorinity, and salinity of the study area were analyzed. The water samples were collected and transferred immediately to the laboratory for analysis. Analysis was carried out in a prescribed manner by an Indian standard institution (1964).

Population and identification studies

The availability of birds was monitored and documented according to the method described by Spindler *et al.* (1981). Field binoculars (7 × 50") were used to observe birds present in the study area. The birds were identified with the help of their special features according to Ali (1968) and Grimmett *et al.* (2001). The standardized common and scientific names of the birds were prepared using Manakadan & Pittie (2001).

Species richness

The richness of the species among the families and the percentage of occurrence in the study area were studied according to Krebs (1985).

RESULTS AND DISCUSSION

The physicochemical parameters of the water have significant importance for the survival of aquatic organisms in the ecosystem. The altered parameters such as pH, temperature, oxygen, salinity, and chlorinity of the water show drastic changes in the availability of natural habitat. The water sample analysis showed a pH range of 6.5 to 7.8 throughout our study range. These slight changes toward alkaline pH support higher macroinvertebrates. Similarly, Longcore *et al.* (2006) reports alkaline pH of pond water attracts more aquatic birds such as ducks. The temperature of the water was 27.6 to 29 C, oxygen level or 6.89 mg/l to 8.15 mg/l. chlorine level was 0.25 ppt range. The salinity of the water ranged from 0.42 to 0.80 ppt range. The obtained results are tabulated in table 1. The physiochemical parameters not only affect the aquatic population and habitat but also the green land areas, such as trees, around the ponds. This change in the growth of trees affects directly bird diversity in terms of habitat, nesting, migration, climatic disturbances, etc.

Table 1

Physico-chemical analysis of water sampled from Vagaikulam river (december 2019 to march 2020)

Sl. No.	Parameters	December	January	February	March
1	pH	6.65	6.92	7.8	6.5
2	Temperature (⁰ C)	27.65	28.64	28.0	29
3	Oxygen level (mg/l)	6.89	7.23	8.15	7.70
4	Chlorinity (ppt)	0.37	0.39	0.41	0.25
5	Salinity (ppt)	0.80	0.56	0.58	0.42

During our study period, 102 bird species were identified under 33 families. A similar study made on twenty-seven wetlands of Coimbatore, Perambalur, Trichy and Thiruvavur districts in Tamil Nadu documented 14,208 birds of 78 species under 33 families (Guptha *et al.*, 2011). The birds identified are from the same families with different species documented. The highest numbers of species (10) were identified from *Accipitridae* and *Jacaniidae*, followed by 9 species from *Ardeidae*, 7 species from *Phasianidae*, 6 species each from *Scolopacidae*, *Passeridae*, and *Anatidae*.

About five species were identified from the *Ciconiidae* family, four species each from *Cuculidae* and *Nectarinidae*. About three species were identified *Apodidae*, *Columbidae*, *Corvidae*, and *Phalacrocoracidae*. In some families the number of species identified was limited or lesser from our study areas such as two and one species from *Hirundinidae*, *Meropidae*, *Strigidae*, *Sturnidae*, *Threskionithidae* followed by *Anhingidae*, *Centropodidae*, *Cerylidae*, *Coraciidae*, *Dacelonidae*, *Dendrocygnidae*, *Dicruridae*, *Laridae*, *Megalaimidae*, *Oriolidae*, *Pelecanidae*, *Psittacidae*, and *Tytonidae* respectively. The species birds are listed in the Table 2.

Table 2
Checklist of wetland birds recorded in Vagaikulam River Basin

S. No.	Family	Common Name	Scientific Name
1	Accipitridae	Shikra	<i>Accipiter badius</i>
2	Accipitridae	Eurasian Sparrow Hawk	<i>Accipiter nisus</i>
3	Accipitridae	Eurasian Marsh Harrier	<i>Circus aeruginosus</i>
4	Accipitridae	Pallid Harrier	<i>Circus macrourus</i>
5	Accipitridae	Pied Harrier	<i>Circus melanoleucos</i>
6	Accipitridae	Black-shouldered kite	<i>Elanus caeruleus</i>
7	Accipitridae	Brahminy kite	<i>Haliastur indus</i>
8	Accipitridae	Black Kite	<i>Milvus migrans</i>
9	Accipitridae	Osprey	<i>Pandion haliaetus</i>
10	Alcedinidae	Common kingfisher	<i>Alcedo atthis</i>
11	Anatidae	Northern Pintail	<i>Anas acuta</i>
12	Anatidae	Common Teal	<i>Anas crecca</i>
13	Anatidae	Spot-billed Duck	<i>Anas poecliorhyncha</i>
14	Anatidae	Gadwall	<i>Anas strepera</i>
15	Anatidae	Ferruginous Pochard	<i>Aythya nyroca</i>
16	Anatidae	Cotto pygmy goose	<i>Nettapus coromandelianus</i>
17	Anhingidae	Oriental Darter	<i>Anhinga melanogaster</i>
18	Apodidae	Indian Alpine Swift	<i>Tachymartitis melba</i>
19	Apodidae	House Swift	<i>Apus affinis</i>
20	Apodidae	Asian plam swift	<i>Cypsiurus balasiensis</i>
21	Ardeidae	Grey Heron	<i>Ardea cinerea</i>
22	Ardeidae	Purple Heron	<i>Ardea purpurea</i>
23	Ardeidae	Pond Heron	<i>Ardeola grayii</i>
24	Ardeidae	Cattle Egret	<i>Bubulcus ibis</i>
25	Ardeidae	Great Egret	<i>Casmerodius albus</i>
26	Ardeidae	Black Bittern	<i>Dupetor flavicollis</i>
27	Ardeidae	Little Egret	<i>Egretta garzetta</i>
28	Ardeidae	Weastern Reef Egret	<i>Egretta gularis</i>
29	Ardeidae	Intermediate Egret	<i>Mesophoyx intermedia</i>
30	Centropodidae	Greater Coucal	<i>Centropus sinensis</i>
31	Cerylidae	Lesser peid kingfisher	<i>Ceryle rudis</i>
32	Ciconiidae	Asian Open-billed Stork	<i>Anastomus oscitans</i>
33	Ciconiidae	White Stork	<i>Ciconia ciconia</i>

Table 2 (continued)

34	Ciconiidae	White-necked Stork	<i>Ciconia episcopus</i>
35	Ciconiidae	Black Stork	<i>Ciconia nigra</i>
36	Ciconiidae	Painted Stork	<i>Mycteria leucocephala</i>
37	Columbidae	Rock Pigeon	<i>Columba livia</i>
38	Columbidae	Indian Spotted Dove	<i>Streptopelia chinensis</i>
39	Columbidae	Eurasian Collared Dove	<i>Streptopelia decaocta</i>
40	Coraciidae	Indian Roller	<i>Coracias benghalensis</i>
41	Corvidae	Common Lora	<i>Aegithina tiphia</i>
42	Corvidae	Jungle Crow	<i>Corvus macrorhynchos</i>
43	Corvidae	House Crow	<i>Corvus splendens</i>
44	Cuculidae	Pied Cuckoo	<i>Clamator jacobinus</i>
45	Cuculidae	Indian Hawk Cuckoo	<i>Hierococcyx varius</i>
46	Cuculidae	Indian Cuckoo	<i>Cuculus micropterus</i>
47	Cuculidae	AsainKoel	<i>Eudynamys scolopacea</i>
48	Dacelonidae	White-throated kingfisher	<i>Halcyon smyrnensis</i>
49	Dendrocygnidae	Lesser Whistling Duck	<i>Dendrocygna javanica</i>
50	Dicruridae	Black Drongo	<i>Dicrurus macrocercus</i>
51	Hirundinidae	Red-rumped Swallow	<i>Hirundo daurica</i>
52	Hirundinidae	Barn Common Swallow	<i>Hirundo rustica</i>
53	Jacaniidae	Pheasant-tailed jacana	<i>Hydrophasianus chirurgus</i>
54	Jacaniidae	Bronze-winged jacana	<i>Metopidius himantopus</i>
55	Jacaniidae	Black winged stilt	<i>Himantopus himantopus</i>
56	Jacaniidae	Pied Avocet	<i>Recurvirostra avosetta</i>
57	Jacaniidae	Red-wattled lapwing	<i>Vanellus indicus</i>
58	Jacaniidae	Yellow-wattled lapwing	<i>Vanellus malabaricus</i>
59	Jacaniidae	Lesser sand plover	<i>Charadrius mongolus</i>
60	Jacaniidae	Little Ringed plover	<i>Charadrius dubius</i>
61	Jacaniidae	Ringed plover	<i>Charadrius hiaticula</i>
62	Jacaniidae	Kentish plover	<i>Charadrius alexandrines</i>
63	Laridae	Black-headed Gull	<i>Larus ridibundus</i>
64	Megalaimidae	White-cheaked Barbet	<i>Megalamia viridis</i>
65	Meropidae	Blue-tailed Bee-eater	<i>Merops philippinus</i>
66	Meropidae	Green Bee-eater	<i>Merops orientalis</i>
67	Nectarinidae	Flower peaker	<i>Dicaeum agile</i>
68	Nectarinidae	Purple sunbird	<i>Nectarinia asiatica</i>

Table 2 (continued)

69	Nectarinidae	Losten's sunbird	<i>Nectarinia lotenia</i>
70	Nectarinidae	Purple-rumped sunbird	<i>Nectarinia zeylonica</i>
71	Oriolidae	Eurasian Golden Oriole	<i>Oriolus oriolus</i>
72	Passeridae	Red munia	<i>Amandava amandava</i>
73	Passeridae	Paddy Field Pipet	<i>Anthus rufulus</i>
74	Passeridae	Grey wagtail	<i>Motacilla cinerea</i>
75	Passeridae	Yellow wagtail	<i>Motacilla flava</i>
76	Passeridae	Large pied Wagtail	<i>Motacilla maderaspatensis</i>
77	Passeridae	Baya Weaver	<i>Ploceus philippinus</i>
78	Pelecanidae	Spot-billed Pelican	<i>Pelecanus philippensis</i>
79	Phalacrocoracidae	Little cormorant	<i>Phalacrocorax niger</i>
80	Phalacrocoracidae	Great cormorant	<i>Phalacrocorax carbo</i>
81	Phalacrocoracidae	Indian cormorant	<i>Phalacrocorax fuscicollis</i>
82	Phasianidae	Grey Francolin	<i>Francolinus pondicerianus</i>
83	Phasianidae	Red spur fowl	<i>Galloperdix spadicea</i>
84	Phasianidae	White-breasted Waterhen	<i>Amaurornis phoenicurus</i>
85	Phasianidae	Common Coot	<i>Fulica atra</i>
86	Phasianidae	Common Moorhen	<i>Gallinula chloropus</i>
87	Phasianidae	Purple Swampfen	<i>Porphyrio porphyria</i>
88	Phasianidae	Ruddy-breasted crane	<i>Porzana fusca</i>
89	Psittacidae	Rodr-ringed parakeet	<i>Psittacula krameri</i>
90	Scolopacidae	Eurasian Curlew	<i>Numenius arquata</i>
91	Scolopacidae	Common Greenshank	<i>Tringa nebularia</i>
92	Scolopacidae	Wood Sandpiper	<i>Tringa glareola</i>
93	Scolopacidae	Green Sandpiper	<i>Tringa ochropus</i>
94	Scolopacidae	Little Stint	<i>Calidris minuta</i>
95	Scolopacidae	Temminek's Stink	<i>Calidris temminckii</i>
96	Strigidae	Spotted Owlet	<i>Athene brama</i>
97	Strigidae	Brown Wood Owl	<i>Strix leptogrammica</i>
98	Sturnidae	Jungle Myna	<i>Acridotheres fuscus</i>
99	Sturnidae	Common Myna	<i>Acridotheres tristis</i>
100	Threskionithidae	Eurasian Spoonbill	<i>Platalea leucorodia</i>
101	Threskionithidae	Asain White Ibis	<i>Threskiornis melanocephalus</i>
102	Tytonidae	Barn Owl	<i>Tyto alba</i>

Birds are considered to be an indicator of the ecological conditions and productivity of an ecosystem (Desai & Shanbhag, 2007; Li & Mundkur, 2007). The richness of an ecosystem is denoted by the availability of diverse species, present in the ecosystem. Any changes in their environment make the species fly away to another location to avoid any obnoxious conditions (Ramamurthy & Rajakumar, 2014). The availability of different bird species from diverse families represents species richness (Table 3), the abundance of nutrient resources, and a non-toxic environment.

Table 3

Number of birds from different families and their occurrence percentage

S. No.	Family	No. of Species	Percentage of Occurrence
1	Accipitridae	9	7.75
2	Alcedinidae	1	0.86
3	Anatidae	6	5.17
4	Anhingidae	1	0.08
5	Apodidae	3	2.58
6	Ardeidae	9	0.07
7	Centropodidae	1	0.86
8	Cerylidae	1	0.86
9	Ciconiidae	5	4.31
10	Columbidae	3	2.58
11	Coraciidae	1	0.86
12	Corvidae	3	3.44
13	Cuculidae	4	4.31
14	Dacelonidae	1	0.86
15	Dendrocygnidae	1	0.86
16	Dicruridae	1	0.86
17	Hirundinidae	2	1.72
18	Jacaniidae	10	1.72
19	Laridae	1	0.86
20	Megalaimidae	1	0.86
21	Meropidae	2	1.72
22	Nectarinidae	4	3.44
23	Oriolidae	1	0.86
24	Passeridae	6	5.17
25	Pelecanidae	1	0.86

Table 3 (continued)

26	Phalacrocoracidae	3	2.58
27	Phasianidae	7	1.72
28	Psittacidae	1	0.86
29	Scolopacidae	6	5.17
30	Strigidae	2	1.72
31	Sturnidae	2	1.72
32	Threskionithidae	2	1.72
33	Tytonidae	1	0.86

Species diversity among the birds from the same species and diverse community implies abundance. The documentation of the number of species from the same families helps to have a keen idea of the occurrence of wetland birds. Their percentage of occurrence was also calculated in Fig. 1.

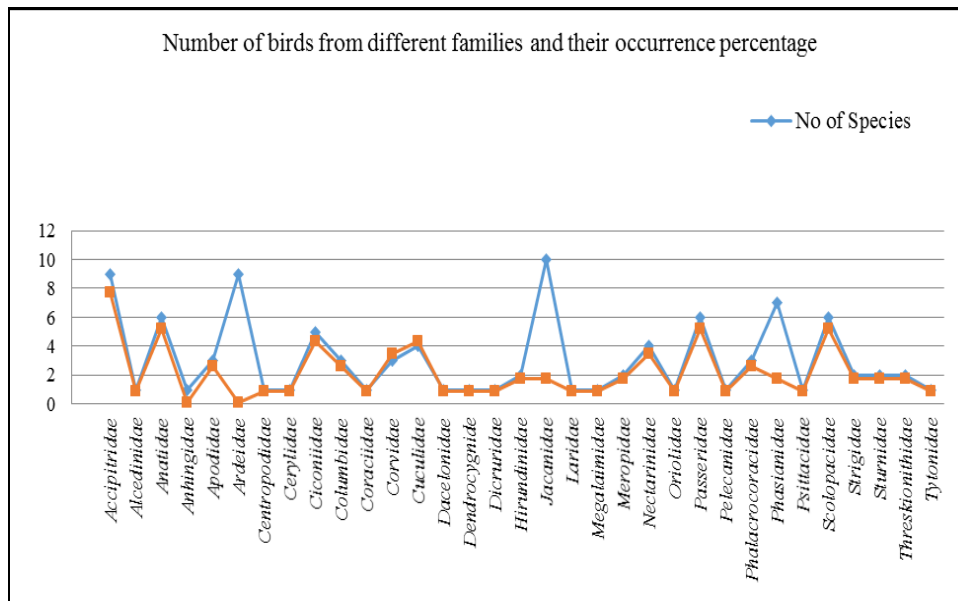


Fig. 1. Number of birds from different families and their occurrence percentage.

The occurrence of a few wetland species is most common in the study environment. This represents the unique nature of biodiversity and reliability. The most commonly observed species was *Ardeola grayii*, with 360 individuals their occurrence was 19.5% of the total. This exhibited the higher percentage from our study area, results documented are tabulated in the Table 4. the Multiple numbers

of occurrence of the same species reveal the non-toxic nature and eco-friendly nature of an ecosystem. Nowadays the abundance of wetland species is reduced due to different environmental conditions, hunting, pollution, climate changes, etc. Proper measures are to be taken to safeguard the wetland ecosystem and monitor them.

Table 4

Individual numbers and their occurrence rate of ten most abundant species

S. No.	Common Name	Scientific Name	Individual Numbers	Occurrence %
1	Pond Heron	<i>Ardeola grayii</i>	360	19.50
2	House Crow	<i>Corvus splendens</i>	301	16.30
3	Black Stork	<i>Ciconia nigra</i>	200	10.83
4	Common Myna	<i>Acridotheres tristis</i>	185	10.02
5	Great Egret	<i>Casmerodius albus</i>	173	9.37
6	Common Kingfisher	<i>Alcedo atthis</i>	162	8.77
7	Black Pigeon	<i>Dicrurus macrocercus</i>	130	7.04
8	Rock Pigeon	<i>Columba livia</i>	122	6.60
9	Green Sandpiper	<i>Tringa ochropus</i>	114	6.17
10	Common Hawk-Cuckoo	<i>Heirococeyx varius</i>	99	5.36

Most of the migratory birds are recorded in March. From December to March, there was a progressive increase in the number of migrant bird species (Table 5). Fig. 2 shows the number of migratory birds recorded from December 19 to March 20.

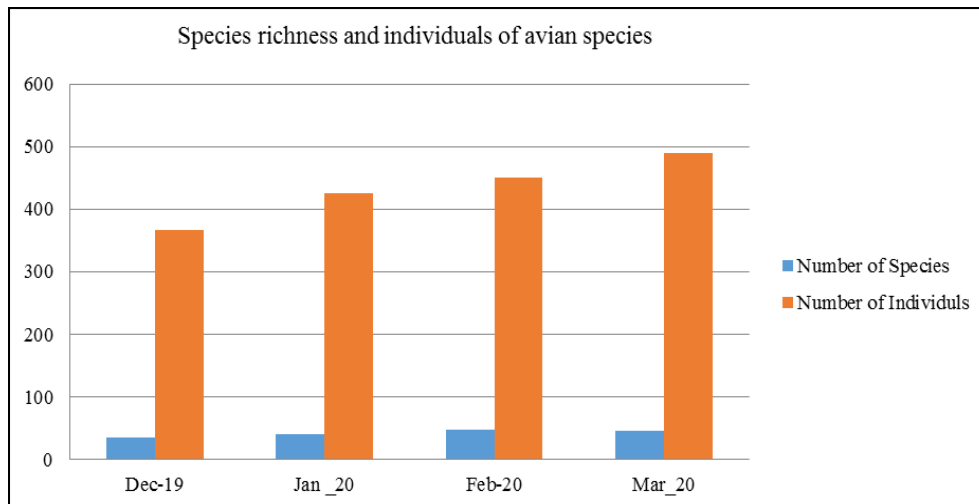


Fig. 2. Species richness and individuals of avian species.

Table 5

Species richness and individuals of avian species

Month/Year	Number of Species	Number of Individuals
December 19	35	367
January 20	40	425
February 20	48	450
March 20	46	490
Total Counts	168	1732

There was much correlation between PH and saprobic index. PH values were much better correlated with diversity indices like the Shannon-Weiner index, Simpson's index, and the Margalef index. This indicates the direct relationship between the two indices. The temperature was highly co-related with pollution indicators like Niggard's index. The amount of oxygen did not correlate with any one of the indices at 95% significance. The co-Relation (r^2) value between the physio-chemical parameter and Biomonitoring indices at $P < 0.05$ was given in Table 6.

Table 6

Co-relation (r^2) value between physio-chemical parameter and biomonitoring indices at $p < 0.05$

Parameter	Saprobic index	Niggard's index	Palmer's pollution species index	Biological index	Shannon's index	Simpson's index	Margalef index	Menhinick index
PH	0.2	0.5	0.3	0.08	0.7	0.7	0.8	0.6
Temperature	0.5	0.6	0.2	0.2	0.5	0.4	0.3	0.4
Oxygen	0.1	0.2	0.1	0.2	0.2	0.2	0.2	0.13
Chlorinity	0.5	0.6	0.4	0.5	0.3	0.6	0.6	0.6
Salinity	0.1	0.3	0.1	0.4	0.5	0.5	0.6	0.5

CONCLUSIONS

The physiochemical parameters not only affect the aquatic population and habitat but also the green land areas, such as trees, around the ponds. This change in the growth of trees affects directly bird diversity in terms of habitat, nesting, migration, climatic disturbances, etc.

During our study period, 102 bird species from 33 families were identified. A similar study made on twenty-seven wetlands of Coimbatore, Perambalur, Trichy and Thiruvavur districts in Tamil Nadu documented 14,208 birds of 78 species from 33 families. The birds identified are from the same families with

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Most of the migratory birds are recorded in March. From December to March, there was a progressive increase in the number of migrant bird species.

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