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## REPORT OF THE EARLY WINTER MIGRANTS AND RESIDENT BIRDS IN AN INLAND WETLAND NEAR TUNDI CAMP, BAJANA, GUJARAT

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**Abstract:** The study is based on the avian community observed in the region. In total, 1,079 individuals, 62 genera and 79 species of birds belonging to 35 families have been recorded. Among them, the family Anatidae with 20.42% incidence is the most frequent; immediately followed by the family Phoenicopteridae (10.59% of occurrence). Little Cormorant *Phalacrocorax niger* is the most abundant avian species observed. The community consists of 44% resident; 36% resident-migrant and 20% migrant bird species. It was observed that the concerned community shows a considerable diversity and a correspondingly low value of dominance. In the feeding guild analysis, the insectivore guild has the most number of recorded avian species. The feeding guild affiliations also point out that the overall community is fairly rich in its composition as it houses bird species belonging to various feeding guilds.

**Keywords:** Avifaunal diversity, Gujarat, Tundi camp, water-birds, wetland.

**Abbreviations:** NT - Near Threatened; LC - Least Concern; RM - Resident-Migrant; R - Resident; M - Migrant; FU - Frugivore; N - Nectarivore; P - Piscivore; G - Granivore; I - Insect and other terrestrial invertebrate feeder; PL - Plankton feeder; IN - Aquatic Invertebrate feeder; A - Amphibian feeder; OP - Ophidiivore; RP - Reptile feeder; W - Weedivore; H - Herbivore; C - Carrion feeder; PD - Predatory.

Wetlands are defined as lands transitional between terrestrial and aquatic eco-systems where the water table is usually at or near the surface or the land is covered by shallow water (Mitsch & Gosselink 1986). Wetlands are among the most productive ecosystems in the world and play vital role in flood control, aquifer recharge, nutrient absorption and erosion control. In addition, wetlands provide a home for a huge diversity of wildlife such as birds, mammals, fish, frogs, insects and plants (Buckton 2007). Thus wetlands help in maintaining biodiversity of flora and fauna. Wetland supports congregation of large number of migratory and resident species of birds as it has high nutritional value as well as productivity (Whittaker & Likens 1973; Gibbs 1993; Paracuellos 2006). As per Ali & Ripley (1983), 273 species of birds in India can be considered as waterfowls, the birds that depend on the wetland ecosystem. These birds use wetland habitats either throughout or during

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certain parts of their life (Weller 1981).

Birds are ideal bio-indicators and useful models for studying a variety of environmental problems (Newton 1995). Birds occupy a wide range of ecological positions (Sekercioglu & Hakki 2006). In many respects biodiversity, both present and past are better understood for birds than for any other major group of organisms. One basic approach in generating an indicator of the state of wildlife is to measure diversity through time. Species loss or gain could then be used to gauge the trends in biodiversity (Van 1997). Thus the avifaunal diversity of a region is a very prompt indicator of the environmental conditions of the concerned place.

The Little Rann of Kutch (LRK) is one of the more popular tourist destinations in the state. It is also internationally famous for its salt pans and wetlands which harbor a vast variety of migratory birds. In spite of its economic importance; little scientific work has been done. Our work was aimed at filling that gap. Hence, this study is of unique importance, focusing mainly on the wide spectrum of birds that are available there and on their feeding habits; which in turn reveal the composition of a greater part of the ecological community present in the region.

## MATERIALS AND METHODS

### Study area

Gujarat is located on the Tropic of Cancer (20.016666°N–24.116666°N & 68.066666°E–74.066666°E); falls in the sub-tropical climatic zone and has a varied climate and climatic regions (SACON ENVIS Newsletter 2012). Kutch (22.686388°N–24.696388°N & 68.162777°E–71.913055°E), extending over 45,652sq. km. area lies in the western part of Gujarat state and falls under the Desert bio-geographic zone and 3B Desert-Kutch Province (Gajera et al. 2012). There are many natural seasonal wetlands in Kutch. In total about 258 wetlands were delineated through satellite imageries. These wetlands cover approximately 21,772sq.km. area, which is more than 80% of the entire Kutch region (Stanley 2004).

The study was carried out in the vicinity of a forest camp located in the Wild Ass Sanctuary, Little Rann of Kutch, Gujarat which is locally known as the Tundi Camp (at the intersection of 23.147222°N & 71.741388°E). The camp is located at a distance of 12.2km (by road) due west from the nearest landmark township of Bajana. We carried out our survey on an adjacent wetland and its adjoining areas, which acted as a watering-hole for the animal community of the region. The wetland extends from 23.149722°N–23.150833°N &

71.743055°E–71.748888°E. It is fed by a non-perennial river called the Okaro-Kharaghoda. The sites for study on the bank of the wetland are marked in the satellite image given in Fig. 1. The place is entirely devoid of any anthropogenic interventions. This fact, on its own, makes the study far more interesting.

### Bird species survey

The survey was conducted in early and mid-December of 2013. During the surveys, birds were identified early in the morning from 06:00–10:00 hr and late afternoon from 16:00–18:30 hr when the temperature was relatively warm (in the morning, the temperature usually remains within 28–32°C and in the evening it is usually within 35–36°C). Additional surveys had also taken place between 20:00–22:30 hr for the identification of nocturnal birds. Birds were identified with the aid of standard field guide (Grimmett et al. 2011). On every occasion, the counting distance was restricted to around 50m for identification purposes. Birds that flew overhead but did not land in the sites were also recorded. The checklist was prepared following the standardized common and scientific names of the birds of the Indian subcontinent by Manakkadan & Pittie (2001).

### Statistical analyses

The various richness (species, genus and family) indices, Shannon evenness ( $J'$ ), Shannon-Wiener diversity ( $H'$ ), Simpson's Diversity Index ( $I$ ) and Simpson's index of dominance ( $D'$ ) have been calculated (Bower et al. 1997). The various indices were computed using the software, PAST [version 3.08] (Hammer et al. 2001). From the value of the Shannon-Wiener diversity index, the effective number of species (ENS), a way of converting diversity measures to an easily interpretable linear scale, has been derived (Jost 2006). Shannon's diversity index is converted by taking its exponential;  $ENS = \exp(H')$ , where,  $H'$  is the value of the Shannon-Wiener diversity index (Jost 2006). Evenness ranges from 0 to 1 and as it approaches 1, individuals are partitioned equally among species. High values of  $H'$  and low values of  $D'$  indicate high species diversity (Bower et al. 1997).

## RESULTS

The overall picture of the avifaunal community observed at the study-site is provided in Table 1. Overall, 1079 individuals of 79 different species of birds, belonging to 62 different genera and 35 families; have been recorded during the study period. The observed birds belonged to only two IUCN Red List of

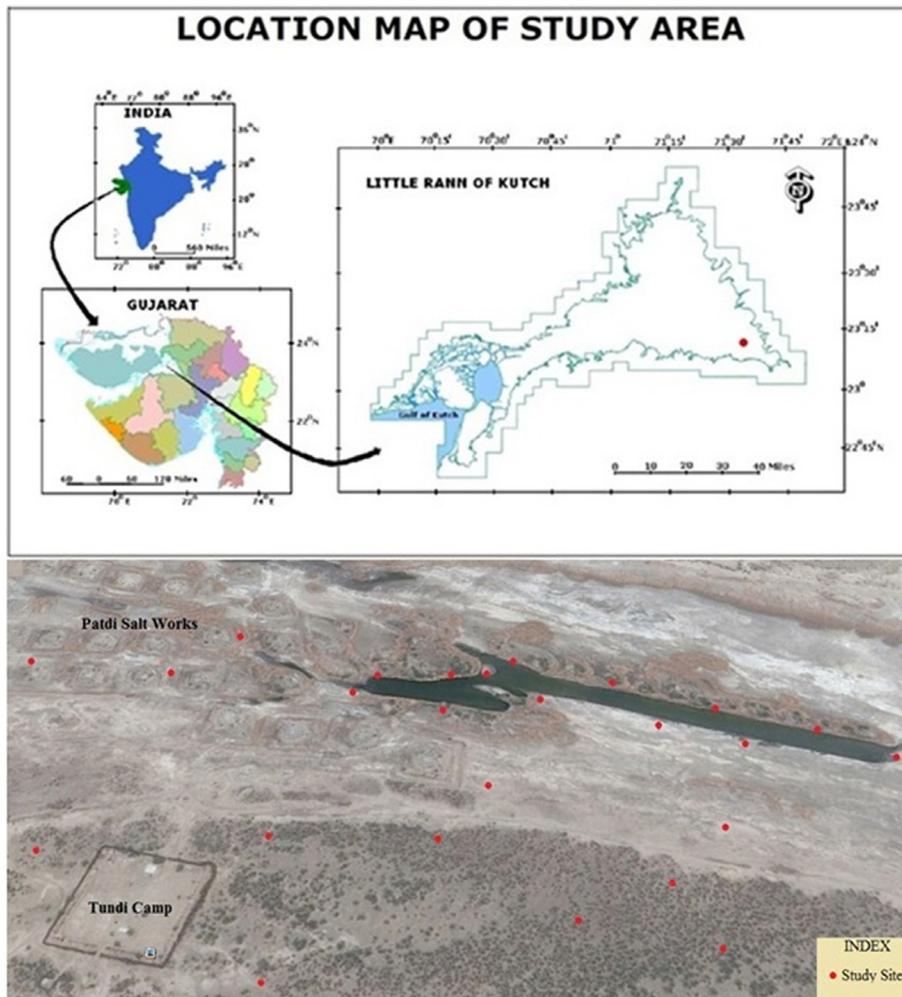


Figure 1. Satellite image of Tundi Camp and its adjacent wetland with the study-sites marked as red dots

Threatened Species categories, viz., Least Concerned (LC) and Near Threatened (NT) [IUCN 2001]. Among the observed 79 avian species, 76 of them (96.2 percent), belong to the Least Concerned category; whereas, only three bird species (3.8 percent)—the Painted Stork *Mycteria leucocephala*, Oriental White Ibis *Threskiornis melanocephalus* and Lesser Flamingo *Phoenicopterus minor*, belong to the Near Threatened category.

In the study, 35 families of birds were observed; among which family Anatidae has recorded the highest number of species (as shown in Table 2). All the different kinds of migration categories, viz., the resident (R) birds, the resident-migrant (RM) birds and the migrant or migratory (M) birds have been observed during the survey. 35 resident (44%), 28 resident-migrant (36%) and 16 migratory (20%) species were observed. Therefore, in total, 44 migratory bird species have been recorded (Fig. 2); which account for 56 percent of the total species observed.

Fourteen (14) kinds of feeding guilds, viz., aquatic

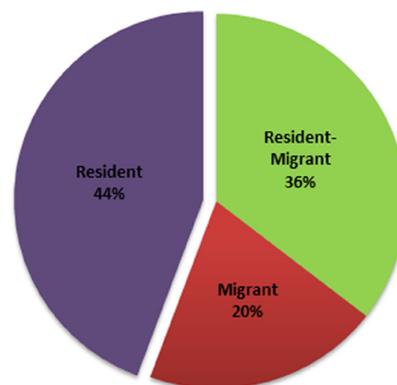


Figure 2. Percent composition of bird species observed according to their migration status.

invertebrate-feeder, piscivore, insectivore, granivore, frugivore, reptile-feeder, ophidiovore, amphibian-feeder, nectarivore, weedivore, plankton-feeder, herbivore, carrion-feeder and predatory were identified; among the bird species observed (Ali & Ripley 1987) (Fig.

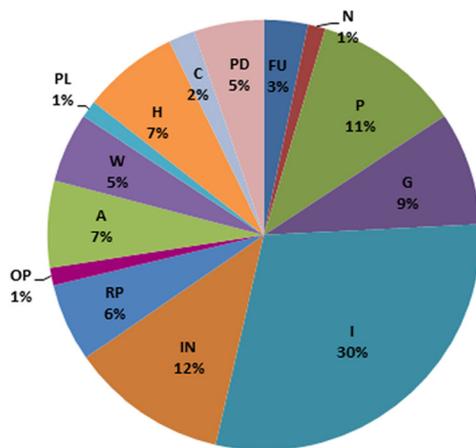


Figure 3. Percent composition of bird species observed according to their feeding guilds

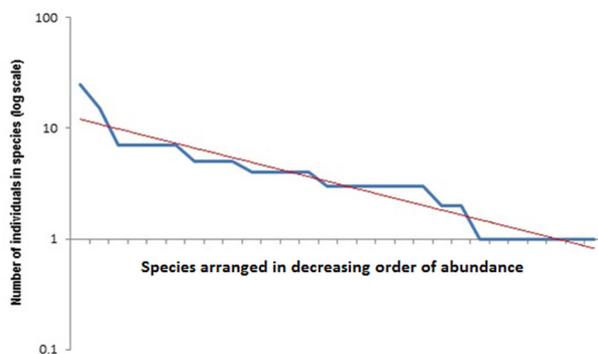


Figure 4. A dominance-diversity curve or species importance curve of the bird species.

3). Here, the insectivore guild is the most frequent one with thirty percent incidence and 45 species occurring under this shared category. Whereas, nectarivore and plankton-feeder guilds are the least frequent with only two species observed in each.

In order to visually represent the diversity of the avian community a dominance-diversity curve (Bower et al. 1997) has been plotted in Fig. 4. The values of the various diversity indices have been provided in Table 3. We have observed that the high values of the Simpson diversity index (0.9676) indicates the high diversity observed.

## DISCUSSION

Wetlands and natural grasslands are important habitats for avian populations throughout the world and the studied one is no exception. The overall condition of the wetland is pretty good and it shows signs of a self-sustaining environment which is mostly because of the very sparse human interventions. This enabled us to

study the wetland at its ecological prime.

The dominance-diversity curve (in Fig. 4) has been plotted in order to get an idea of the amount of diversity observed in the studied avian community. In this case, the trend-line on the curve shows that the studied community exhibits a high amount of diversity; because of the petite angle of intersection and the right-hand side alignment of the curve.

The calculated values of the various diversity indices, especially that of the Simpson Dominance ( $I$ ) = 0.0324 proves that the community of avifaunal species show very low dominance. On the other hand, this depicts considerably high diversity of the avian community. The maximum value of the Simpson Diversity Index ( $D_s$ ) can be 1 (Magurran 2004). Here, its value is 0.9676. The value of the Shannon-Wiener Diversity Index ( $H'$ ) of the studied community depicts that the chances of getting an individual of the same species in a random sample is about 3.75; which points out to the considerably vast population size of almost every species sampled during our study. When converted to ENS, its value becomes approximately 42.39; which means that a community with Shannon index of 3.75 has an equivalent diversity as a community with almost 42 equally-abundant species. This is further proved by the fact that the value of Shannon Evenness Index ( $J'$ ); which being quite close to 0.5 shows that there is an intermediate amount of variance in the population size of different avian species. Species diversity is more positively correlated with evenness (Bock et al. 2007). This testifies to the sizeable diversity observed in the studied avian community. The overall scenario, as is evident in the calculated values of these diversity indices (Table 3), is that the sampled community is greatly diverse in its composition.

The pie-chart depicting the Feeding Guilds of the various avifauna (Fig. 3) observed, clearly shows that the community of this ecosystem is also sufficiently rich and greatly diversified. Hence it is able to support birds with such a varied spectrum of feeding habits.

## CONCLUSION

On the basis of our study, we can now conclude that the avian community observed at the wetland shows little dominance, but a fair amount of diversity. In addition, the presence of the various feeding guilds bear proof of the fact that the entire ecological community is fairly diverse and show signs of a healthy environment.

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Table 1. Checklist of the bird species observed at Tundi Camp

	Common name	Family	Scientific name	Migration status	Feeding habit	IUCN Red List category
1.	Great White Pelican	Pelecanidae	<i>Pelecanus onocrotalus</i>	RM	P	LC
2.	Little Cormorant	Phalacrocoracidae	<i>Phalacrocorax niger</i>	RM	P	LC
3.	Indian Cormorant	Phalacrocoracidae	<i>Phalacrocorax fuscicollis</i>	RM	P	LC
4.	Grey Heron	Ardeidae	<i>Ardea cinerea</i>	R	P, A	LC
5.	Purple Heron	Ardeidae	<i>Ardea purpurea</i>	RM	P, A, OP	LC
6.	Large Egret	Ardeidae	<i>Ardea alba</i>	R	P, A	LC
7.	Cattle Egret	Ardeidae	<i>Bubulcus ibis</i>	R	I, P, A	LC
8.	Painted Stork	Ciconiidae	<i>Mycteria leucocephala</i>	RM	P, IN	NT
9.	Open Bill Stork	Ciconiidae	<i>Anastomus oscitans</i>	RM	P, IN	LC
10.	Black Ibis	Threskiornithidae	<i>Pseudibis papillosa</i>	R	I, G, RP	LC
11.	Oriental White Ibis	Threskiornithidae	<i>Threskiornis melanocephalus</i>	R	A, IN, I, W	NT
12.	Eurasian Spoonbill	Threskiornithidae	<i>Platalea leucorodia</i>	RM	A, IN, I, W	LC
13.	Greater Flamingo	Phoenicopteridae	<i>Phoenicopterus roseus</i>	RM	IN, PL	LC
14.	Lesser Flamingo	Phoenicopteridae	<i>Phoenicopterus minor</i>	RM	PL	NT
15.	Bar-headed Goose	Anatidae	<i>Anser indicus</i>	M	H	LC
16.	Brahminy Shelduck	Anatidae	<i>Tadorna ferruginea</i>	RM	IN, P, RP, C	LC
17.	Spot-billed Duck	Anatidae	<i>Anas poecilorhyncha</i>	RM	W, H	LC
18.	Lesser Whistling Duck	Anatidae	<i>Dendrocygna javanica</i>	RM	H, G, IN, P	LC
19.	Greylag Goose	Anatidae	<i>Anser anser</i>	M	W, IN	LC
20.	Mallard	Anatidae	<i>Anas platyrhynchos</i>	RM	H	LC
21.	Northern Pintail	Anatidae	<i>Anas acuta</i>	M	H, IN	LC
22.	Comb Duck	Anatidae	<i>Sarkidiornis melanotos</i>	R	G, H, IN	LC
23.	Common Teal	Anatidae	<i>Anas crecca</i>	M	G, H	LC
24.	Gadwall	Anatidae	<i>Anas strepera</i>	M	H	LC
25.	Tawny Eagle	Accipitridae	<i>Aquila rapax</i>	R	C, PD	LC
26.	Brahminy Kite	Accipitridae	<i>Haliastur indus</i>	R	P, A, OP, I, PD	LC
27.	Western Marsh Harrier	Accipitridae	<i>Circus aeruginosus</i>	M	P, A, C, PD	LC
28.	Booted Eagle	Accipitridae	<i>Hieraaetus pennatus</i>	RM	PD, RP	LC
29.	Bonelli's Eagle	Accipitridae	<i>Hieraaetus fasciatus</i>	R	PD	LC
30.	Common Kestrel	Accipitridae	<i>Falco tinnunculus</i>	RM	I, RP, PD	LC
31.	Osprey	Pandionidae	<i>Pandion haliaetus</i>	RM	P	LC
32.	Demoiselle Crane	Gruidae	<i>Grus virgo</i>	M	W, G, RP, I	LC
33.	Purple Swamphen	Rallidae	<i>Porphyrio porphyrio</i>	R	W, I, IN	LC
34.	Common Moorhen	Rallidae	<i>Gallinula chloropus</i>	RM	H, I, IN	LC
35.	Common Coot	Rallidae	<i>Fulica atra</i>	RM	IN, W, H	LC
36.	Red-wattled Lapwing	Charadriidae	<i>Vanellus indicus</i>	RM	I, IN	LC
37.	Green Sandpiper	Scolopacidae	<i>Tringa ochropus</i>	M	IN, I	LC
38.	Common Snipe	Scolopacidae	<i>Gallinago gallinago</i>	RM	I	LC
39.	Black-winged Stilt	Recurvirostridae	<i>Himantopus himantopus</i>	R	IN	LC
40.	Rock Pigeon	Columbidae	<i>Columba livia</i>	R	G	LC
41.	Red Turtle Dove	Columbidae	<i>Streptopelia tranquebarica</i>	R	G	LC
42.	Laughing Dove	Columbidae	<i>Streptopelia senegalensis</i>	R	G	LC
43.	Spotted Owlet	Tytonidae	<i>Athene brama</i>	R	I, RP, PD	LC

	Common name	Family	Scientific name	Migration status	Feeding habit	IUCN Red List category
44.	Indian Little Nightjar	Caprimulgidae	<i>Caprimulgus asiaticus</i>	R	I	LC
45.	Little Swift	Apodidae	<i>Apus affinis</i>	RM	I	LC
46.	Lesser Pied Kingfisher	Alcedinidae	<i>Ceryle rudis</i>	R	P, A, IN	LC
47.	Small Blue Kingfisher	Alcedinidae	<i>Alcedo atthis</i>	RM	P, A, IN	LC
48.	Little Green Bee- Eater	Meropidae	<i>Merops orientalis</i>	R	I	LC
49.	Indian Roller	Coraciidae	<i>Coracias benghalensis</i>	R	I, RP	LC
50.	Common Hoopoe	Upupidae	<i>Upupa epops</i>	RM	I	LC
51.	Eurasian Wryneck	Picidae	<i>Jynx torquilla</i>	M	I	LC
52.	Indian Bush Lark	Alaudidae	<i>Mirafra erythroptera</i>	R	I, W	LC
53.	Tawny Pipit	Motacillidae	<i>Anthus campestris</i>	M	I	LC
54.	Paddyfield Pipit	Motacillidae	<i>Anthus rufulus</i>	R	I	LC
55.	Yellow Wagtail	Motacillidae	<i>Motacilla flava</i>	RM	I	LC
56.	Grey Wagtail	Motacillidae	<i>Motacilla cinerea</i>	M	I	LC
57.	White Wagtail	Motacillidae	<i>Motacilla alba</i>	M	I	LC
58.	White-eared Bulbul	Pycnonotidae	<i>Pycnonotus leucotis</i>	R	FU, I	LC
59.	Red-vented Bulbul	Pycnonotidae	<i>Pycnonotus cafer</i>	R	FU, I, H	LC
60.	Bay-backed Shrike	Laniidae	<i>Lanius vittatus</i>	R	I, RP	LC
61.	Long-tailed Shrike	Laniidae	<i>Lanius schach</i>	R	I, RP, PD	LC
62.	Isabelline Shrike	Laniidae	<i>Lanius isabellinus</i>	M	I	LC
63.	Blue Rock Thrush	Turdidae	<i>Monticola solitarius</i>	RM	I, FU	LC
64.	Blue Throat	Muscicapidae	<i>Luscinia svecica</i>	RM	I	LC
65.	Isabelline Wheatear	Muscicapidae	<i>Oenanthe isabellina</i>	RM	I	LC
66.	Pied Bushchat	Muscicapidae	<i>Saxicola caprata</i>	M	I	LC
67.	Red-breasted Flycatcher	Muscicapidae	<i>Ficedula parva</i>	M	I	LC
68.	Indian Robin	Muscicapidae	<i>Saxicoloides fulicatus</i>	R	I	LC
69.	Common Babbler	Timalidae	<i>Turdoides caudata</i>	R	I, FU, G	LC
70.	Jungle Prinia	Cisticolidae	<i>Prinia sylvatica</i>	R	I	LC
71.	Rufous-fronted Prinia	Cisticolidae	<i>Prinia buchanani</i>	R	I	LC
72.	Zitting Cisticola	Cisticolidae	<i>Cisticola juncidis</i>	R	I	LC
73.	Common Tailor Bird	Cisticolidae	<i>Orthotomus sutorius</i>	R	I, N	LC
74.	Booted Warbler	Sylviidae	<i>Hippolais caligata</i>	RM	I	LC
75.	Clamorous-reed Warbler	Sylviidae	<i>Acrocephalus stentoreus</i>	R	I	LC
76.	Siberian Chiffchaff	Sylviidae	<i>Phylloscopus tristis</i>	M	I	LC
77.	Yellow-throated Sparrow	Passeridae	<i>Petronia xanthocollis</i>	R	G	LC
78.	Brahminy Starling	Sturnidae	<i>Temenuchus pagodarum</i>	R	FU	LC
79.	Black Drongo	Dicruridae	<i>Dicrurus macrocercus</i>	R	I, N	LC

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**Table 2. Family-wise distribution of the recorded bird genera and species along with their respective percentage of occurrence.**

	Name of the family	No. of genera observed	No. of species observed	Percent occurrence in sample
1.	Pelecanidae	1	1	4.34
2.	Phalacrocoracidae	1	2	10.59
3.	Ardeidae	2	4	4.09
4.	Ciconidae	2	2	9.38
5.	Threskiornithidae	3	3	1.82
6.	Phoenicopteridae	1	2	5.14
7.	Anatidae	5	10	20.42
8.	Accipitridae	5	6	1.06
9.	Pandionidae	1	1	0.15
10.	Gruidae	1	1	1.36
11.	Rallidae	3	3	3.78
12.	Charadriidae	1	1	1.06
13.	Scolopacidae	2	2	0.60
14.	Recurvirostridae	1	1	1.82
15.	Columbidae	2	3	3.93
16.	Tytonidae	1	1	0.61
17.	Caprimulgidae	1	1	2.87
18.	Apodidae	1	1	5.30
19.	Alcedinidae	2	2	0.91
20.	Meropidae	1	1	3.93
21.	Coraciidae	1	1	0.45
22.	Upupidae	1	1	0.30
23.	Picidae	1	1	0.15
24.	Alaudidae	1	1	0.15
25.	Motacillidae	2	5	1.66
26.	Pycnonotidae	1	2	4.09
27.	Laniidae	1	3	0.45
28.	Turdidae	1	1	0.15
29.	Muscicapidae	5	5	1.66
30.	Timalidae	1	1	4.69
31.	Cisticolidae	3	4	0.91
32.	Sylviidae	3	3	0.45
33.	Passeridae	1	1	0.61
34.	Sturnidae	1	1	0.30
35.	Dicruridae	1	1	1.97

**Table 3. Values of the various indices**

	Name of the indices	VALUE
<b>Richness Indices</b>		
1.	Family Richness	35
2.	Genus Richness	62
3.	Species Richness	79
<b>Diversity Indices</b>		
1.	Simpson Diversity Index	0.9676
2.	Shannon -Wiener Index	3.747
<b>Dominance Index</b>		
1.	Simpson's index of dominance	0.03236
<b>Evenness Index</b>		
1.	Shannon evenness Index	0.5366

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#### Correction

Corrigendum - Butterfly host plant Monograph, P. 11701

#### Miscellaneous

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