

Population and Distribution of Avian Community at Different Habitat in and Around my School, Oussudu, Puducherry

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ABSTRACT

In the present investigation a total number of 45 species of bird were recorded in the entire study period which consists of 14 orders and 30 families. Some of the species yet to be identified. Out of 45 bird species, 44 (97.77%) bird species were Resident (R) and one (2.23%) species was Migrant (M). The minimum population density of bird species recorded were Green Bee-eater (17.25 Birds/m²), Grey Heron (3.50 Birds/m²), spotted Dove (6.13 Birds/m²), On the other hand, maximum population of bird species recorded were Red Vented Bulbul (359.25 Birds/m²), House Crow (320.25 Birds/m²), Baya Weaver (695.63 Birds/m²). Overall analysis of the birds sighted in two month periods more number of birds seen in wet marshy land followed by agricultural land and school. The study proved that the disturbance over the school area and less distribution of green patches, shrubs, bushes and trees make less preference of bird. The study also strongly says if the present ecological characteristics of wetland continue, the birds were unable to inhabit this habitat in the immediate future. Proper awareness regarding the importance of birds to the local people, through different programmes will ultimately help the protection of birds of this region. In the present study variations in the diversity of birds, based on Shannon-wiener diversity index, in different habitats was carried out. Overall Maximum diversity index was recorded during monsoon season ($x = 3.241$) and minimum diversity index was recorded during pre - monsoon seasons ($x = 3.139$).

Keywords : Species of Bird, Shannon-wiener diversity index, Red Vented Bulbul, House Crow, Baya Weaver, Green Bee-eater, Grey Heron, Spotted Dove, Oussudu, Puducherry.

I. INTRODUCTION

The study of avian communities and their distribution in diverse habitats provides invaluable insights into the local ecological landscape. This research aims to explore and understand the population dynamics and distribution patterns of avian species residing in the environs surrounding in Oussudu, Puducherry. Avifauna, the bird life in a given area, often serves as an indicator of environmental health, habitat quality, and biodiversity richness.

Oussudu, situated in the vicinity of Puducherry, exhibits a mosaic of habitats ranging from open grasslands, agricultural fields, wetlands, and possibly patches of remnant forests. These various habitats attract different avian species, each uniquely adapted to specific environmental niches. Given the proximity of these diverse habitats studying the avian community in this area presents an opportunity to observe the interactions between birds and their habitats within the school's vicinity.

Understanding the avian community's composition, abundance, and distribution across these habitats can provide valuable information about the ecosystem's health and resilience. Factors such as habitat preferences, seasonal variations, and anthropogenic influences play significant roles in shaping avian population dynamics.

This study seeks to conduct systematic surveys and observations to document the avian species richness, their distribution across different habitats, and any potential variations in their populations. By doing so, it aims to contribute essential data to the existing knowledge of avian ecology in this region and offer insights into the conservation and management of avian biodiversity in and around Oussudu.

II. STUDY AREA

Oussudu Lake, located at 11°56' to 11°58' N and 79°44'to 79°45'E, is a large shallow wetland situated along the eastern boundary of Puducherry, India

(Figure 1). It is the most important fresh-water lake of the Puducherry region, and is 12 km from Puducherry town on the Western side on PuducherryVillupuram-Valuthavur main road. The lake is rich in flora and fauna and is known to provide several ecological services, as well as several livelihood options for the local human community.

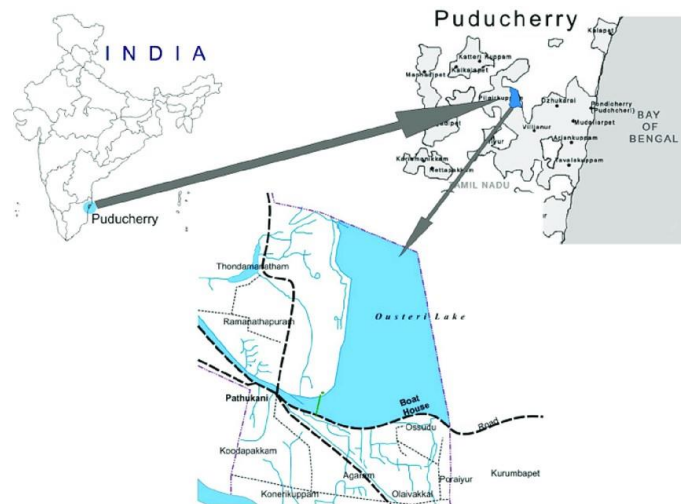


Figure 1. Location of Oussudu Lake, Puducherry.

III. AIM / OBJECTIVE

The study was carried out from 24-aug-2023 to 22-sep-2023 (Pre – Monsoon) & 11-oct-2023 to 10-Nov-2023 (Monsoon) with the following objectives.

- To determine the status of bird in three different habitat (Habitat A – School, Habitat B – Wet Marshy Land Next to my school & Habitat – C Agricultural Land back side of Oussudu Lake).
- To compare the status of bird count in three different habitat.
- To compare diversity index between monsoon and pre-monsoon.
- To identify the population distribution in three different habitat, including conservation status of the birds in and around Oussudu (Ousteri) Lake and its environs, Pondicherry, India.

Hypothesis:

H1. There will be maximum diversity of birds in Habitat B compare to Habitat A & C.

H2. The population distribution of birds & no species based on the habitat types and vegetative distribution in that area.

H3. Maximum diversity index was recorded during Monsoon season and minimum during post monsoon seasons.

IV. MATERIALS AND METHODOLOGY

The present study was carried out in different habitats in Agaram, Oussudu, and Puducherry, India between in 24-aug-2023 to 22-sep-2023 (Pre – Monsoon) & 11-oct-2023 to 10-Nov-2023 (Monsoon). 0.5 square kilometres area fall under the study area. On the basis of vegetation the study area is divided in to three habitats viz., a) Shree Bharath School (Habitat) b) Wet Marshy Land Habitat c) Agricultural Land behind Oussudu lake Habitat. The months are passing through 2 season such Pre monsoon end (3rd week of August) and monsoon starts (September 3rd week).

The abundance of avian community was estimated by adopting Line Transect Sampling method as suggested by Laake et al., (1993). Totally one line transects of 0.5 km length and 35mt to 50mt. width on each side were laid in different habitats. Each transect was laid with an interval of 100 m distance.

All transects were sampled immediately after sun rise and normally from 07.30am to 08.00am in habitat C (agricultural land), 8.00am to 8.30am in habitat B (Wet Marshy Land) & 8.30am to 9.00am habitat A (Shree Bharath School) with normal speed of walk (0.75 to 1.00 km/hr.) in evening time from 04.00pm to 04.30pm in habitat C (agricultural land), 4.30pm to 5.00pm in habitat B (Wet Marshy Land) & 5.00pm to 5.30pm habitat A (Shree Bharath School). Each and every bird sighting's perpendicular distance was measured with footstep. The data so obtained was extrapolated to estimate as density (birds/ Sq m). Relative abundance was assessed as 'very common' (seen on 75–100% of visits), 'common' (seen on 50–74% of visits), 'uncommon' (seen on 25–49% of visits), or 'rare' (seen on <25% of visits).

National threat status follows IUCN Bangladesh (2000). To find out the population density the following formula was used. Shannon-Wener index was calculated by the Magurran method (1988).

$$Population\ density = X / 2LW$$

Where,

X = No. of birds observed /total number of individuals

L = Length of the transect

W =Width of the transect / mean perpendicular distance

V. DATA ANALYSIS

Data Collection:

Table.1 Bird Species Recorded in Agaram, Oussudu, and Pondicherry between 24 Aug 2023 and 10th Nov 2023 in Three Different Habitat (Shree Bharath School, Wet Marshy Land & Agricultural Land)

S.No	Family	Order	Common Name	Status	Habitat			IUCN Status	Abundance
					School	Wet Marshy Ground	Agricultural Land		
AQUATIC BIRDS									
1	Rallidae	Gruiformes	Purple Swamphen	R	AB	P	AB	LC (UC)	Re
2	Rallidae	Gruiformes	White Breasted	R	AB	P	AB	LC	UC

			Waterhen					(UC)	
3	Charadriiformes	Charadriidae	Red Wattled Lapwing	R	P	P	AB	LC (UC)	C
4	Jacaniidae	Charadriiformes	Pheasant Tailed Jacana	R	AB	P	AB	LC (D)	C
5	Alcedinidae	Coraciiformes	Common Kingfisher	R	P	P	P	LC (UC)	C
6	Alcedinidae	Coraciiformes	White Throated Kingfisher	R	AB	P	P	LC (UC)	C
7	Ardeidae	Pelecaniformes	Indian Pond Heron	R	AB	P	AB	LC (UC)	C
8	Ardeidae	Pelecaniformes	Grey Heron	R	AB	P	AB	LC (UC)	C
9	Jacaniidae	Charadriiformes	Bronze Winged Jacana	M	AB	P	AB	LC (UC)	Re
PREY EATER									
1	Accipitridae	Accipitriformes	Black Kite	R	P	P	AB	LC (S)	C
2	Strigidae	Strigiformes	Spotted Owlet	R	P	AB	P	LC (S)	C
AERIAL BIRDS									
1	Apodidae	Apodiformes	Asian Palm swift	R	AB	P	P	LC (S)	C
2	Apodidae	Apodiformes	Little Swift	R	AB	P	P	LC (I)	FC
TERRESTRIAL BIRDS									
1	Phasianidae	Galliformes	Indian Peafowl	R	AB	P	P	LC (S)	C
2	Columbidae	Columbiformes	Spotted Dove	R	AB	P	AB	LC (I)	C
3	Columbidae	Columbiformes	Rock Pigeon	R	P	P	P	LC (S)	C
4	Corvidae	Passeriformes	House Crow	R	P	P	P	LC (S)	C
5	Corvidae	Passeriformes	Large Billed crow	R	P	P	P	LC (S)	C
6	Cuculidae	Cuculiformes	Greater Coucal	R	P	P	AB	LC (S)	C
7	Muscicapidae	Passeriformes	Indian Robin	R	P	P	AB	LC (S)	C
8	Muscicapidae	Passeriformes	Oriental Magpie	R	P	P	P	LC (S)	FC

	ae	es	Robin						
9	Motacillidae	Passeriformes	White Browed Wagtail	R	P	P	AB	LC (S)	C
10	Motacillidae	Passeriformes	Paddy field Pipit	R	AB	AB	P	LC (UC)	C
11	Sturnidae	Passeriformes	Common Myna	R	P	P	P	LC (I)	C
12	Leiothrichidae	Passeriformes	Yellow Billed babbler	R	P	P	AB	LC (S)	C
13	Passeridae	Passeriformes	House Sparrow	R	P	P	P	LC (D)	C
14	Ploceidae	Passeriformes	Baya Weaver	R	AB	P	P	LC (S)	C
15	Estrildidae	Passeriformes	Scaly Breasted Munia	R	AB	P	AB	LC (S)	FC
ARBOREAL BIRDS									
1	Pycnonotidae	Passeriformes	Red Vented Bulbul	R	P	P	P	LC (I)	C
2	Pycnonotidae	Passeriformes	Red Whiskered Bulbul	R	P	P	AB	LC (D)	C
3	Megalaimidae	Piciformes	Copper Smith Barbet	R	P	P	P	LC (UC)	C
4	Psittaculidae	Psittaciformes	Rose ringed Parakeet	R	P	P	P	LC (I)	C
5	Corvidae	Passeriformes	Rufous Treepie	R	P	P	P	LC (D)	C
6	Cuculidae	Cuculiformes	Asian Koel	R	P	P	P	LC (UC)	C
7	Oriolidae	Passeriformes	Golden Oriole	R	AB	P	P	LC (UC)	FC
8	Picidae	Piciformes	Black rumped Flameblack	R	P	P	AB	LC (UC)	C
9	Dicruridae	Passeriformes	Black Drango	R	P	P	P	LC (UC)	C
10	Meropidae	Coraciiformes	Green Bee-eater	R	P	P	P	LC (I)	C
11	Meropidae	Coraciiformes	Blue Tailed Bee-eater	R	P	P	P	LC (S)	FC
12	Cisticolidae	Passeriformes	Ashy Prinia	R	AB	P	P	LC (S)	UC
13	Cisticolidae	Passeriformes	Plain Prinia	R	AB	P	P	LC (S)	UC

		es							
14	Cisticolidae	Passeriformes	Common Tailor Bird	R	P	P	P	LC (UC)	C
15	Nectariniidae	Passeriformes	Purple Sunbird	R	P	P	P	LC (S)	C
16	Dicaeidae	Passeriformes	Pale Billed Flowerpecker	R	P	P	P	LC (S)	C
17	Nectariniidae	Passeriformes	Lotens Sunbird	R	P	P	P	LC (S)	C

* Re: Rare, FC: Fairly Common, UC: Uncommon, C: Common

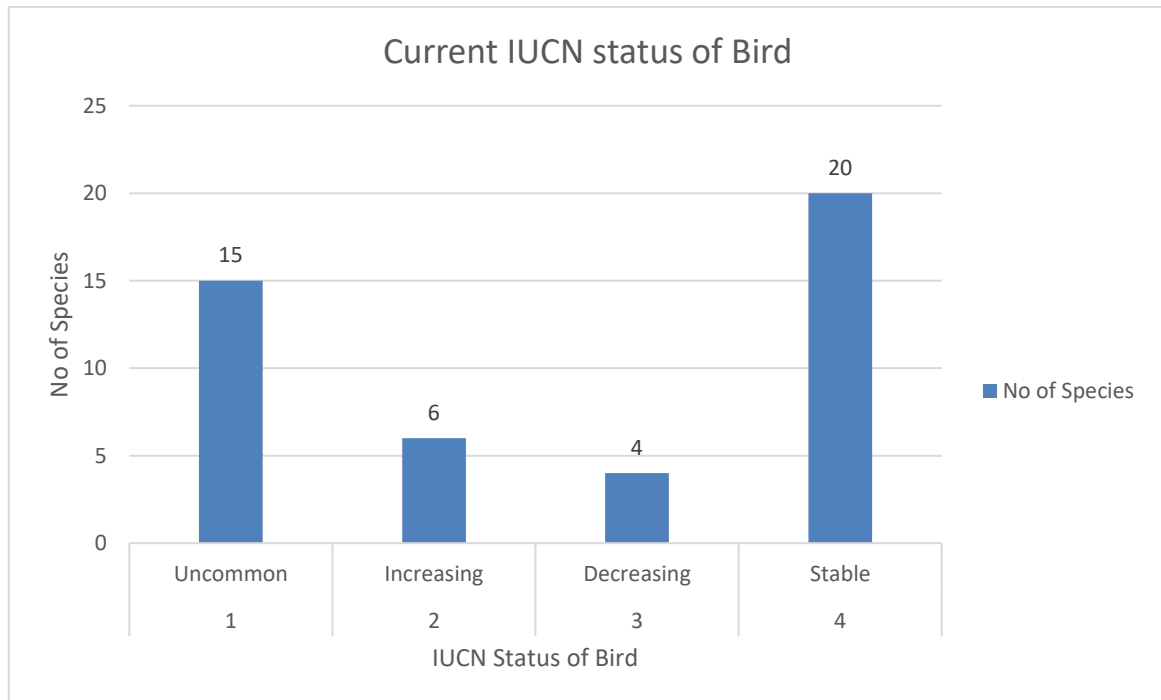


Figure 2. Current IUCN Status of Bird

Data interpretation:

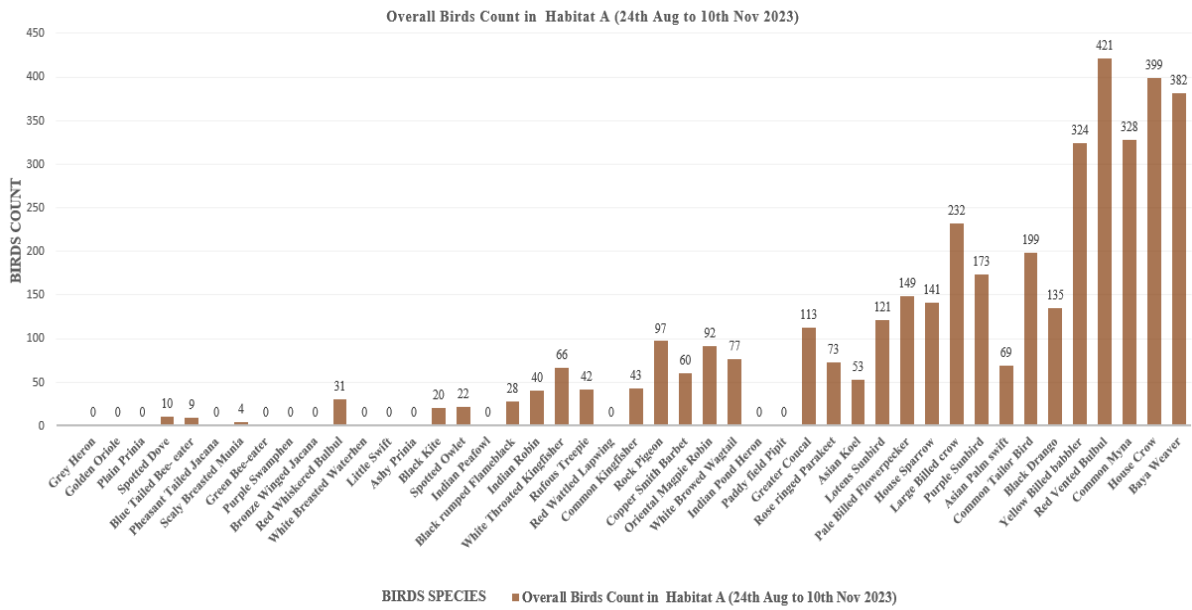


Figure 3. Overall Birds Count in Habitat A (24th Aug to 10th Nov 2023)

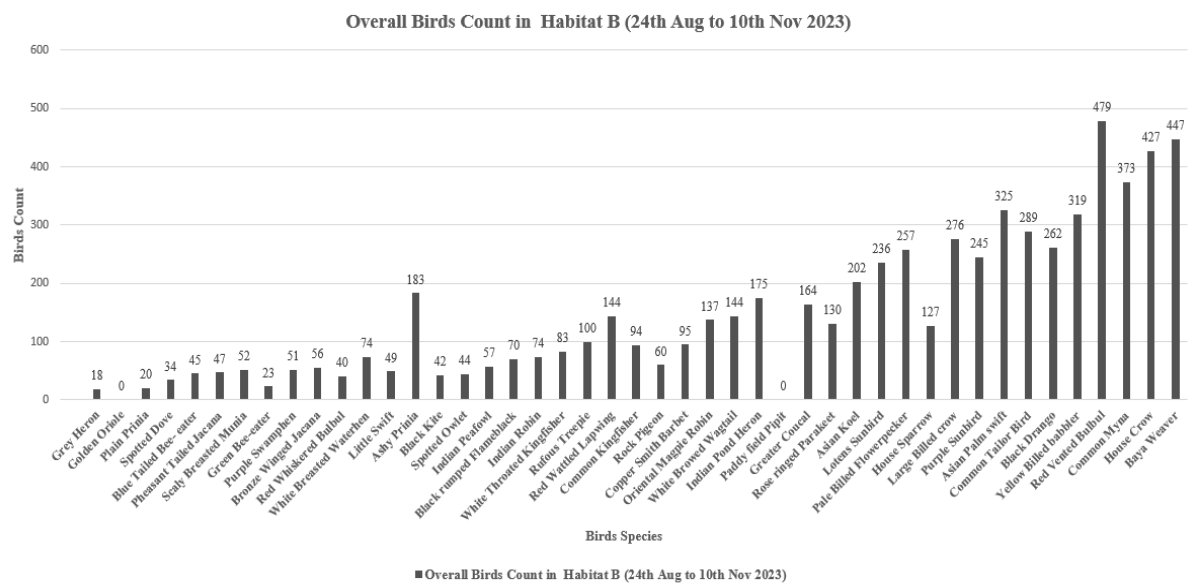


Figure 4. Overall Birds Count in Habitat B (24th Aug to 10th Nov 2023)

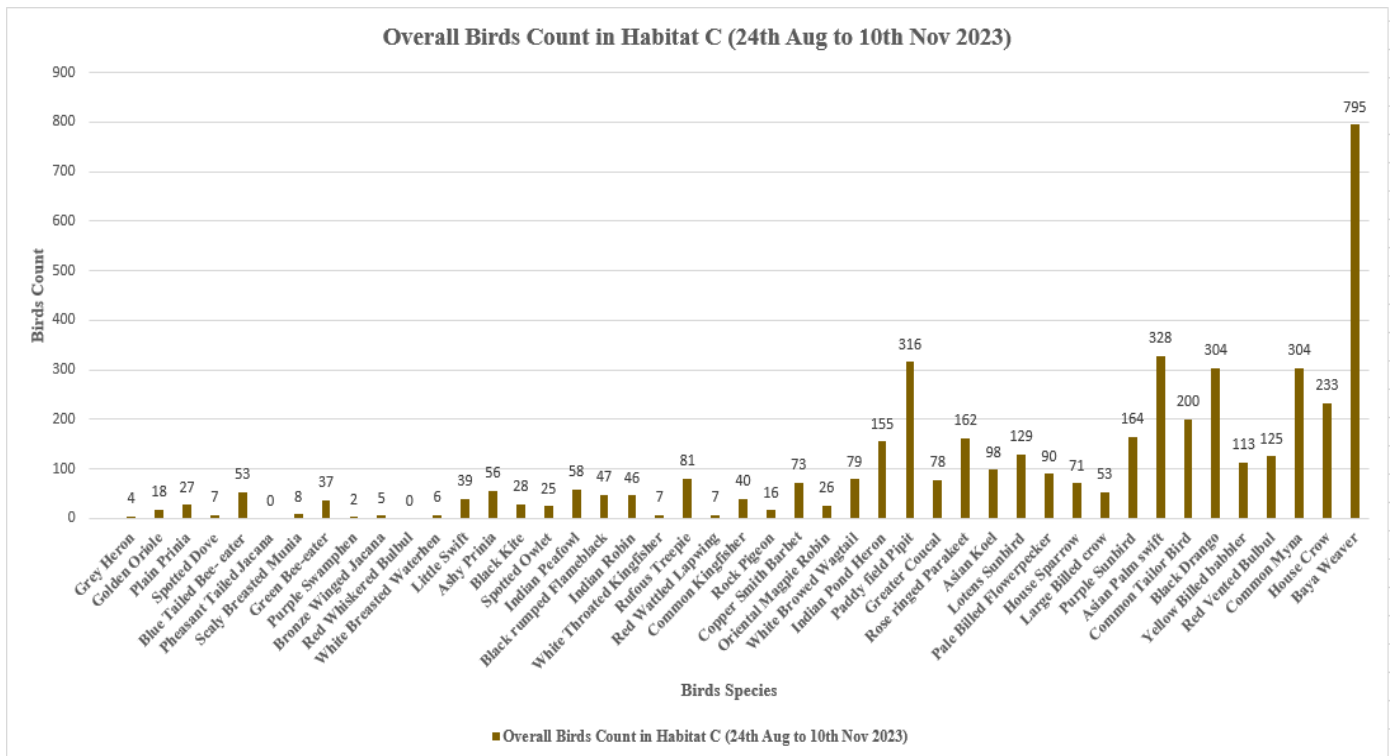


Figure 5. Overall Birds Count in Habitat C (24th Aug to 10th Nov 2023)

Table 2. Overall Birds Comparison in Habitat A, B & C (24th Aug to 10th Nov 2023)

Overall Bird Comparison in Habitat A, B & C (24 th Aug to 10 th Nov 2023)				
S.No	Name of the Birds	Overall Birds Count in Habitat A	Overall Birds Count in Habitat B	Overall Birds Count in Habitat C
1	Grey Heron	0	18	4
2	Golden Oriole	0	0	18
3	Plain Prinia	0	20	27
4	Spotted Dove	10	34	7
5	Blue Tailed Bee- eater	9	45	53
6	Pheasant Tailed Jacana	0	47	0
7	Scaly Breasted Munia	4	52	8
8	Green Bee-eater	0	23	37
9	Purple Swamphen	0	51	2
10	Bronze Winged Jacana	0	56	5
11	Red Whiskered Bulbul	31	40	0

12	White Breasted Waterhen	0	74	6
13	Little Swift	0	49	39
14	Ashy Prinia	0	183	56
15	Black Kite	20	42	28
16	Spotted Owlet	22	44	25
17	Indian Peafowl	0	57	58
18	Black rumped Flameblack	28	70	47
19	Indian Robin	40	74	46
20	White Throated Kingfisher	66	83	7
21	Rufous Treepie	42	100	81
22	Red Wattled Lapwing	0	144	7
23	Common Kingfisher	43	94	40
24	Rock Pigeon	97	60	16
25	Copper Smith Barbet	60	95	73
26	Oriental Magpie Robin	92	137	26
27	White Browed Wagtail	77	144	79
28	Indian Pond Heron	0	175	155
29	Paddy field Pipit	0	0	316
30	Greater Coucal	113	164	78
31	Rose ringed Parakeet	73	130	162
32	Asian Koel	53	202	98
33	Lotens Sunbird	121	236	129
34	Pale Billed Flowerpecker	149	257	90
35	House Sparrow	141	127	71
36	Large Billed crow	232	276	53
37	Purple Sunbird	173	245	164
38	Asian Palm swift	69	325	328
39	Common Tailor Bird	199	289	200
40	Black Drango	135	262	304
41	Yellow Billed babbler	324	319	113
42	Red Vented Bulbul	421	479	125
43	Common Myna	328	373	304
44	House Crow	399	427	233
45	Baya Weaver	382	447	795

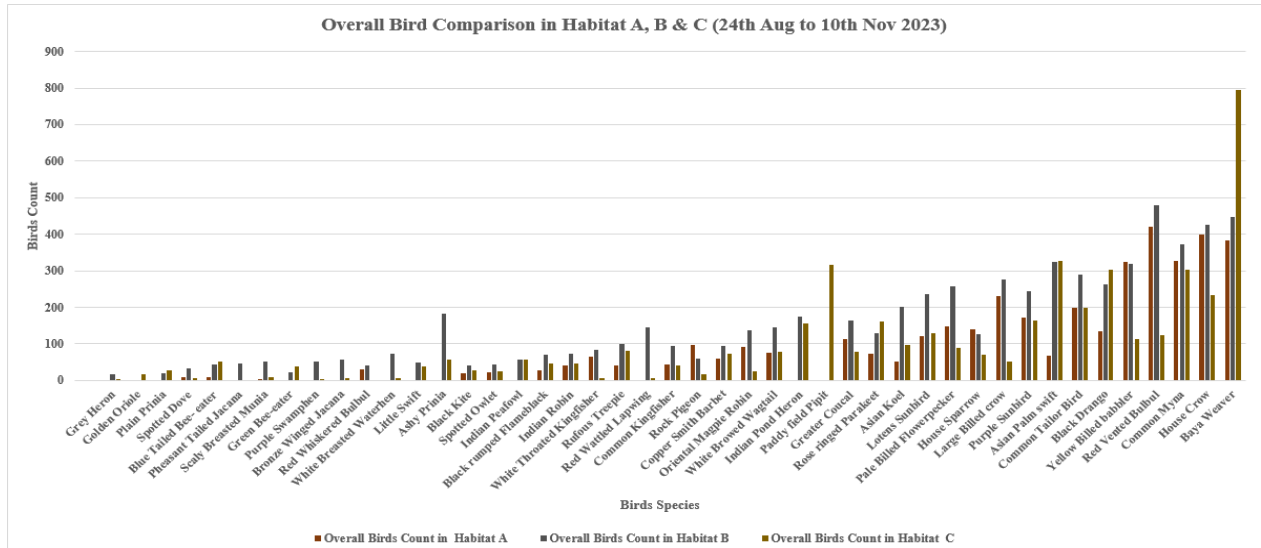


Figure 6. Overall Birds Comparison in Habitat A, B & C (24th Aug to 10th Nov 2023)

Table 3. Overall Birds Population Density Comparison in Different Habitat A, B & C (24th Aug to 10th Nov 2023)

Population Density in Different Habitat (24th Aug to 10th Nov 2023)				
S.No	Name of the Birds	POPULATION DENSITY = $X/2*L*W$ BIRDS/M ² (Habitat A)	POPULATION DENSITY = $X/2*L*W$ BIRDS/M ² (Habitat B)	POPULATION DENSITY = $X/2*L*W$ BIRDS/M ² (Habitat C)
1	Grey Heron	0.00	13.50	3.50
2	Golden Oriole	0.00	0.00	15.75
3	Plain Prinia	0.00	15.00	23.63
4	Spotted Dove	7.50	25.50	6.13
5	Blue Tailed Bee-eater	6.75	33.75	46.38
6	Pheasant Tailed Jacana	0.00	35.25	0.00
7	Scaly Breasted Munia	3.00	39.00	7.00
8	Green Bee-eater	0.00	17.25	32.38
9	Purple Swamphen	0.00	38.25	1.75
10	Bronze Winged Jacana	0.00	42.00	4.38
11	Red Whiskered Bulbul	23.25	30.00	0.00
12	White Breasted Waterhen	0.00	55.50	5.25
13	Little Swift	0.00	36.75	34.13
14	Ashy Prinia	0.00	137.25	49.00
15	Black Kite	15.00	31.50	24.50
16	Spotted Owlet	16.50	33.00	21.88

17	Indian Peafowl	0.00	42.75	50.75
18	Black rumped Flameblack	21.00	52.50	41.13
19	Indian Robin	30.00	55.50	40.25
20	White Throated Kingfisher	49.50	62.25	6.13
21	Rufous Treepie	31.50	75.00	70.88
22	Red Wattled Lapwing	0.00	108.00	6.13
23	Common Kingfisher	32.25	70.50	35.00
24	Rock Pigeon	72.75	45.00	14.00
25	Copper Smith Barbet	45.00	71.25	63.88
26	Oriental Magpie Robin	69.00	102.75	22.75
27	White Browed Wagtail	57.75	108.00	69.13
28	Indian Pond Heron	0.00	131.25	135.63
29	Paddy field Pipit	0.00	0.00	276.50
30	Greater Coucal	84.75	123.00	68.25
31	Rose ringed Parakeet	54.75	97.50	141.75
32	Asian Koel	39.75	151.50	85.75
33	Lotens Sunbird	90.75	177.00	112.88
34	Pale Billed Flowerpecker	111.75	192.75	78.75
35	House Sparrow	105.75	95.25	62.13
36	Large Billed crow	174.00	207.00	46.38
37	Purple Sunbird	129.75	183.75	143.50
38	Asian Palm swift	51.75	243.75	287.00
39	Common Tailor Bird	149.25	216.75	175.00
40	Black Drango	101.25	196.50	266.00
41	Yellow Billed babbler	243.00	239.25	98.88
42	Red Vented Bulbul	315.75	359.25	109.38
43	Common Myna	246.00	279.75	266.00
44	House Crow	299.25	320.25	203.88
45	Baya Weaver	286.50	335.25	695.63

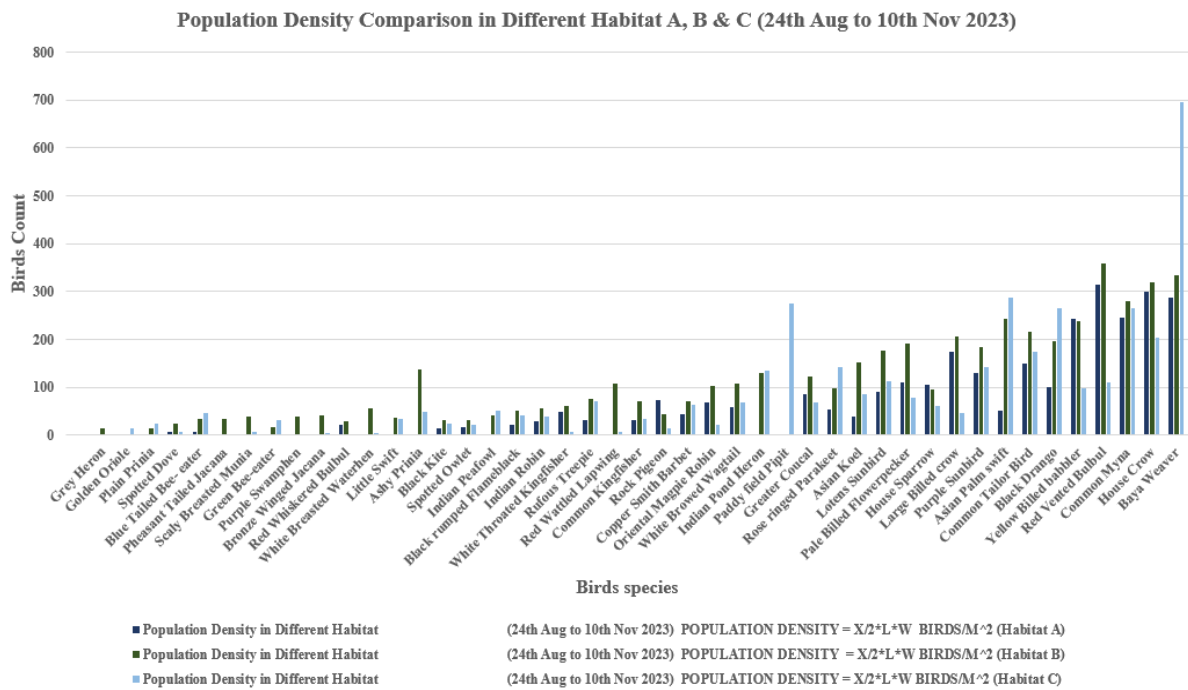


Figure 7. Overall Birds Population Density Comparison in Habitat A, B & C (24th Aug to 10th Nov 2023)

Table 4. Birds Richness, Total number of individuals, Average population Size and Evenness Comparison for Pre Monsoon and Monsoon Season

Habitat	No. of Species(Richness) (S)			Total No of Birds Individuals			Average population Size			Evenness (E)		
	A	B	C	A	B	C	A	B	C	A	B	C
Pre Monsoon (24th Aug - 25th Sep)	29	42	34	1847	2883	1926	63.68	68.64	56.61	0.889	0.904	0.87
Monsoon (11th Oct - 10th Nov)	31	43	43	2106	3868	2590	67.94	85.72	60.23	0.888	0.923	0.85

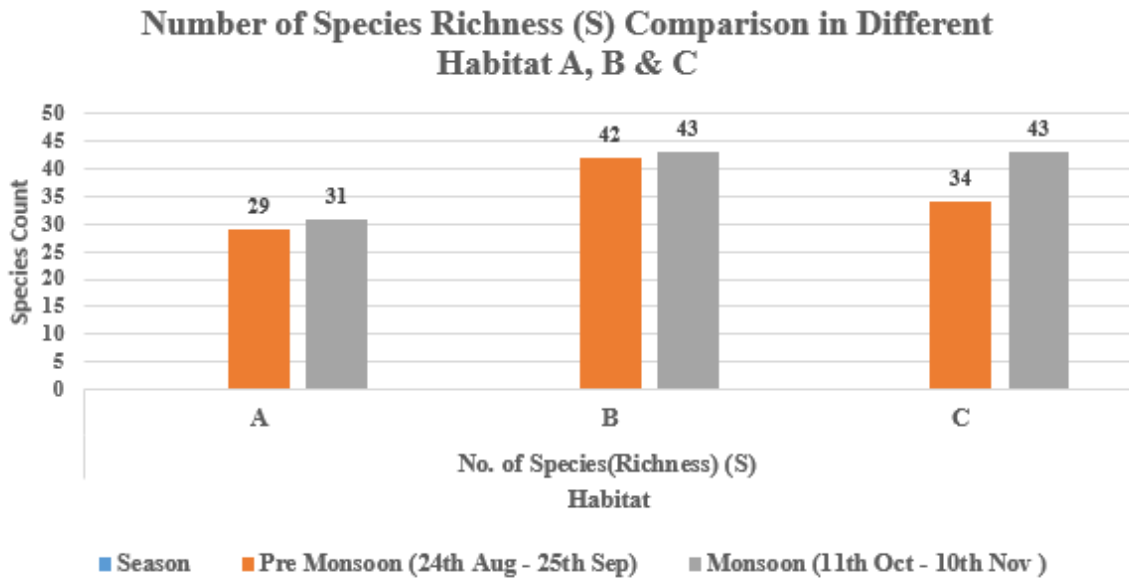


Figure 8. Number of Species Richness (S) in Different Habitat A, B & C

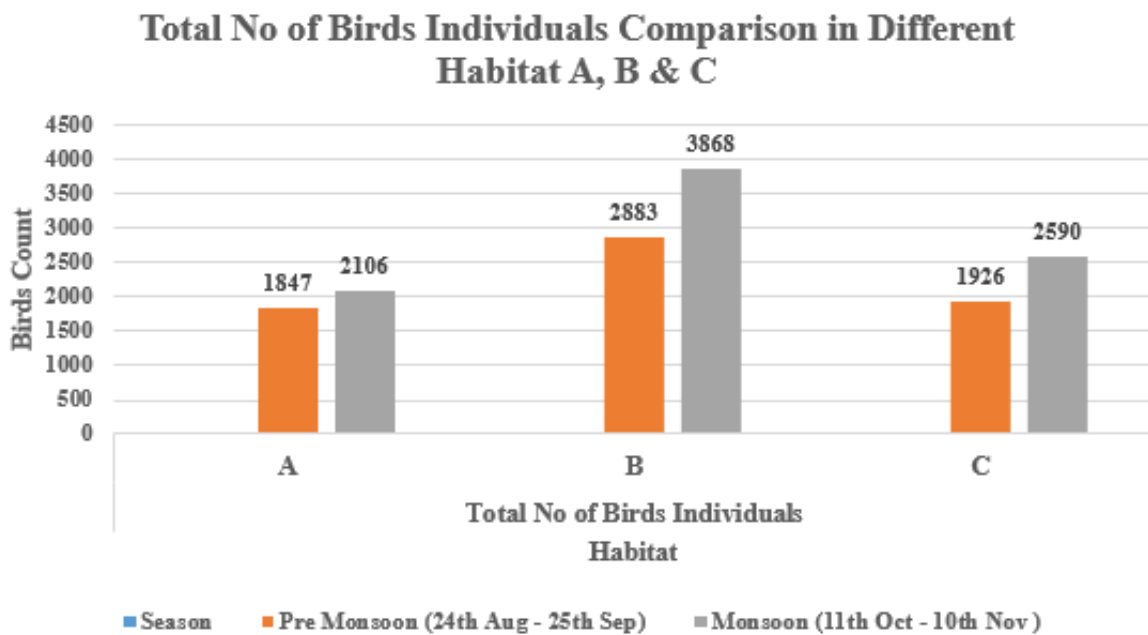


Figure 9. Total No of Birds Individuals Comparison in Different Habitat A, B & C

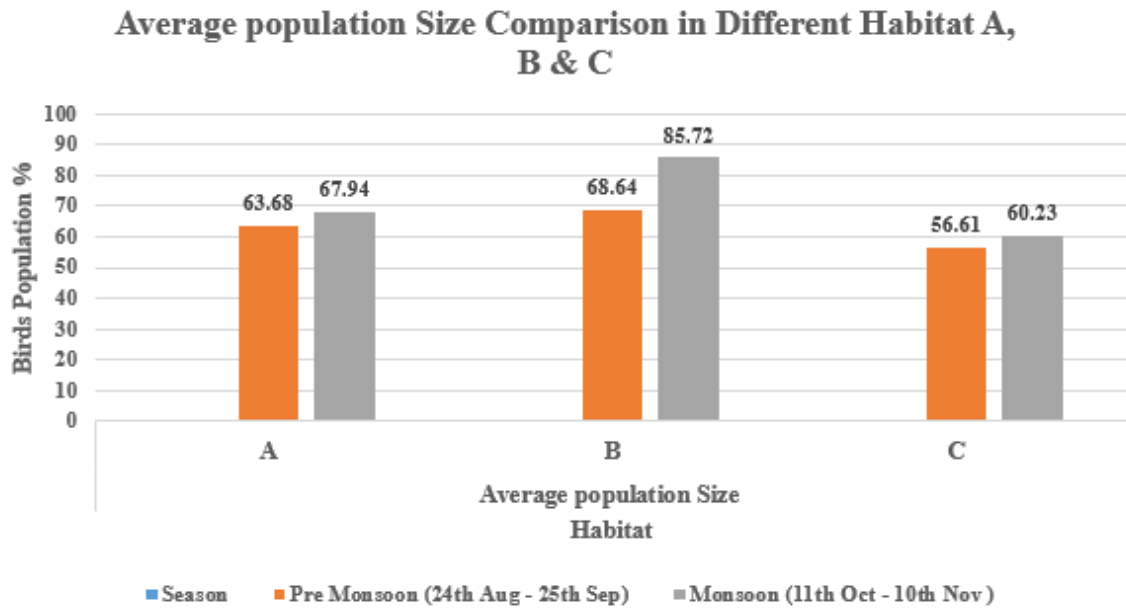


Figure 10. Average population Size Comparison in Different Habitat A, B & C

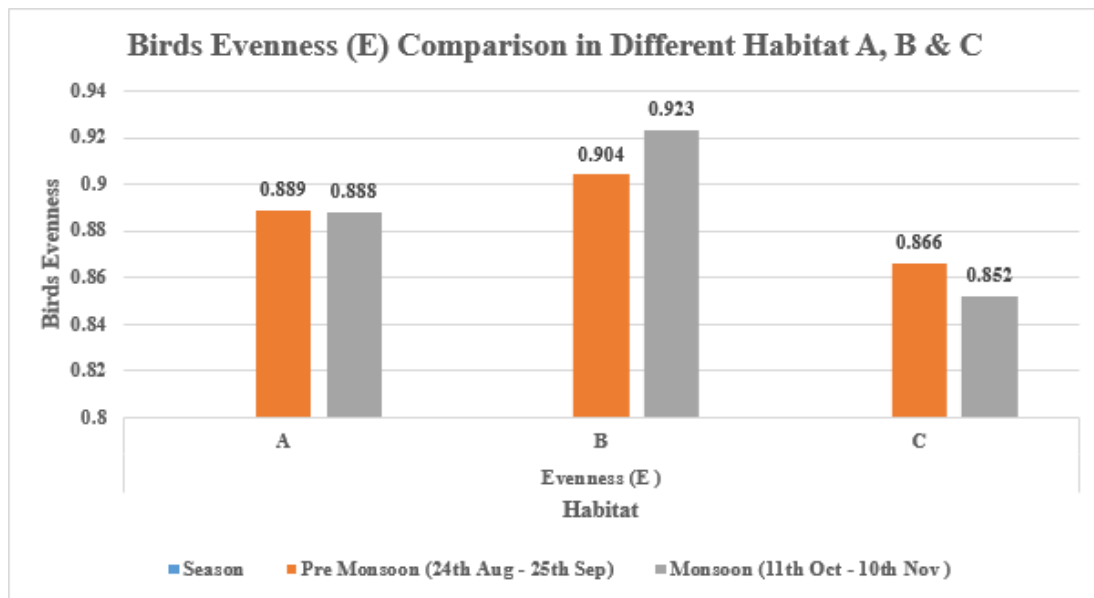


Figure 11. Average population Size Comparison in Different Habitat A, B & C

Table 5. Shanon & Weiner Diversity Index Of Bird Species In Different Seasons Among Different Habitats A, B & C In Agaram, Oussudu Area, Puducherry (Aug 24th To Nov 6th 2023).

SHANON & WEINER DIVERSITY INDEX OF BIRD SPECIES IN DIFFERENT SEASONS AMONG DIFFERENT HABITATS A, B & C IN AGARAM, OUSSUDU AREA, PUDUCHERRY (AUG 24 TH TO NOV 10 TH 2023).				
Season	Various Habitats			OVER ALL
	Habitat (A) School	Habitat (B) Wet Marshy Land	Habitat (C) Agricultural Area	
Pre Monsoon (24th Aug - 25th Sep)	2.99	3.378	3.05	3.139
Monsoon (11th Oct - 10th Nov)	3.048	3.47	3.204	3.241

SHANON & WEINER DIVERSITY INDEX OF BIRD SPECIES IN DIFFERENT SEASONS AMONG DIFFERENT HABITATS A, B & C IN AGARAM, OUSSUDU AREA, PUDUCHERRY AUG 24TH TO NOV 10TH 2023.

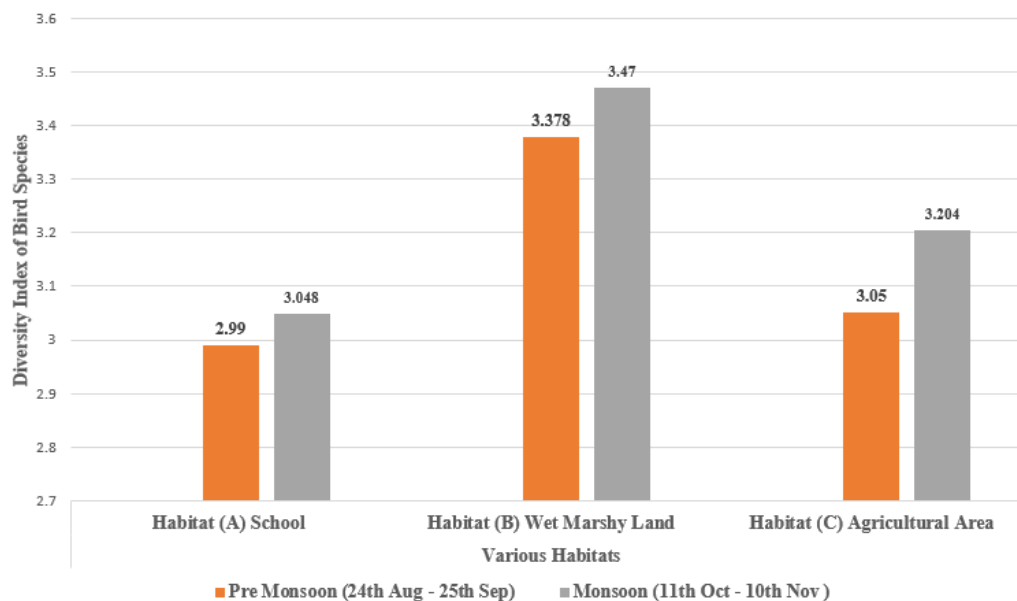


Figure 12. Shanon & Weiner Diversity Index Of Bird Species In Different Seasons Among Different Habitats A, B & C In Agaram, Oussudu Area, Puducherry (Aug 24th To Nov 10th 2023).

Diversity Index

In the present study variations in the diversity of birds, based on Shannon-wiener diversity index, in different habitats was carried out. The Diversity index showed high values of pre monsoon in Habitat B (x= 3.

378) and lower in Habitat A (x= 2.99). The Diversity index showed high values of monsoon in Habitat B (x=3.470) and lower in Habitat A (x=3.048). Overall Maximum diversity index was recorded during monsoon season (x = 3.241) and minimum diversity

index was recorded during pre - monsoon seasons ($x = 3.139$). Average population size in maximum in habitat B and minimum in habitat A.

VI. RESULT / DISCUSSION

Overall analysis of the birds sighted in one month periods shown that the yellow billed babbler, red vented bulbul, common myna, house crow and baya weaver were sighted more in all three habitat. More number of birds seen in wet marshy land next to my school campus followed by agricultural land and school. Very few bird species were seen in school campus. The study proved that the disturbance over the school area and less distribution of green patches, shrubs, bushes and trees make less preference of bird. The study also strongly says if the present ecological characteristics of wetland continue, the birds were unable to inhabit this habitat in the immediate future. Proper awareness regarding the importance of birds to the local people, through different programmes will ultimately help the protection of birds of this region. In the present study variations in the diversity of birds, based on Shannon-wiener diversity index, in different habitats was carried out. The Diversity index showed high values of pre monsoon in Habitat B ($x= 3.378$) and lower in Habitat A ($x= 2.99$). The Diversity index showed high values of monsoon in Habitat B ($x=3.470$) and lower in Habitat A ($x=3.048$). Overall Maximum diversity index was recorded during monsoon season ($x = 3.241$) and minimum diversity index was recorded during pre - monsoon seasons ($x = 3.139$).

VII. CONCLUSION

In conclusion, the study conducted on the population and distribution of avian communities in various habitats surrounding in Oussudu, Puducherry, revealed a diverse array of avian species coexisting within the vicinity. Through systematic surveys and observations, it was evident that different habitats,

including open grasslands, agricultural fields, wetlands, and potential patches of remnant forests, hosted a rich avian diversity. The research findings highlighted varying preferences among avian species for specific habitats, indicating distinct ecological niches occupied by different bird species. This suggests the importance of maintaining a variety of habitats to support diverse avian communities in the region. Furthermore, seasonal variations were observed, impacting the presence and abundance of certain bird species across different times of the year. Human activities and anthropogenic influences were also found to potentially affect avian populations and habitat utilization. The study underscores the significance of preserving and managing diverse habitats to sustain avian biodiversity in the area surrounding. Continued monitoring and conservation efforts are crucial to safeguarding these avian populations and maintaining the ecological balance within the local ecosystem.

VIII. REFERENCES

- [1]. ABBASI, S. A. 1997. Wetlands of India-Ecology and Threats: The Ecology and the Exploitation of Typical South Indian Wetlands. Vol. I. Discovery Publishing House, New Delhi. 149 pp.
- [2]. IUCN. 2007. IUCN Red List of Threatened Species. Version 2007.1. Electronic Database accessible at <http://www.iucnredlist.org/>. Captured on 20 February 2007.

Bibliography



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