

# MEASUREMENT OF DIVERSITY INDICES OF AVIAN FAUNA IN RUKHI HILL FOREST, NAYAGARH, ODISHA.

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**Abstract:** A study was conducted to measure bird species diversity at Rukhi Hill Forest from June 2018 to March 2019, 4-5 days per week. The objective of the study was to identify avian diversity and main threats to them in the hill. Data were collected by direct census method. Various methodologies like Line Transect, Point Count and Opportunistic bird Sighting were adopted for the study. Birds were identified by vocal sounds, good photographs captured by DSLR Nikon D5300 with 70-300mm lens, Nikon Point and Shoot B700 and a binocular (10 x 50X). A total of 46 species of avifauna both migratory and residential were observed in the hill. It was concluded that order Passeriformes enlisted the highest numbers of species i.e. 20 species. The measurement of the Shannon-Weiner Diversity index ( $H'$ ) and Simpson's Evenness were 3.84 and 1.00 respectively. Main threats identified to the survival of birds were; habitat degradation, climate change, forest fire, deforestation, and illegal hunting. The species richness and composition are important parameters for the stability and functioning of an ecosystem. Therefore, there is an urgent need to protect avian diversity by protecting the natural habitat of the hill forest.

**Index Terms - Avian diversity, Resident Bird, Diversity Index, Anthropogenic Pressure, Line Transect.**

## I. INTRODUCTION

India is one of the mega biodiversity hot spots contributing to the World's biological resources from the long belt of Eastern Ghats on the East, the greater Himalayan range on the Northern Plains and the Western Ghats on the west (Lakra and Sarkar, 2006). Considering the perfection history and geographical features, the hills in southern India are grouped as two hill systems viz. The Western Ghats and Eastern Ghats (Mani, 1974). The Eastern Ghats range is unique in its own way to host much valuable flora and fauna from archaic.

Species diversity is an important component for the health of an ecosystem. Birds have an important place because they are visible and highly valued by humans. Birds, furthermore, play an illuminating role in attracting public attention to natural habitat. The abundance and diversity of avian species, therefore, in a specific habitat could serve as a useful parameter of the ecological status of that habitat. Ecologically, birds are of tremendous importance as they are important pollinators and play a key role in seed dispersal (Bibi and Ali, 2013).

Assessment of local biodiversity is important. The area with lower innate diversity may be more important than others with high diversity (World Conservation Monitoring Centre, 2012). Assessment is the main parameter for conservation and useful for ecological balance and sustainable development (IUCN, 2010).

Main causes for declination of biodiversity are deforestation, global climate change, forest fire, collection of firewood, illegal expansion of urban areas, etc. Global climate change and the ongoing anthropogenic mass extinction now imperil all life on Earth (Ceballos and Ehrlich, 2018; Ceballos et al., 2015; Ripple et al., 2017), including current human health and future human well-being (Blumm and Wood, 2017; Patz and Hatch, 2014). As a result of our activities, 12% of birds are threatened with extinction in the next century (UNEP FI, 2008).

India has a great diversity of avian fauna among other continents. India fosters 1200 species of birds, which is 13% of the total bird species of the world (Ali & Ripley, 1983). The avian fauna of Odisha comprises of 474 species out of which 1228 species of birds of India (Acharjyo, 2011). Avian fauna of Odisha is known from the works of Ball (1877, 1878), Biswas (1953), Mazumdar (1979, 1988), Dasgupta (1976) and Mohapatra (1998), Mukherjee (1952), Ripley (1979), Abdulali (1984), Sahu and Kar (1999), Sahu and Rout (2005), Gopi and Pandav (2007), and Das et al., (2010).

## II. MATERIALS AND METHOD

### 2.1 Study Area

Rukhi Hill Ranges are located in  $20^{\circ} 06' 56'' - 20^{\circ} 07' 40''$  N latitude and  $85^{\circ} 04' 52'' - 85^{\circ} 06' 15''$  E longitude with a maximum elevation of 200- 300 meters. It is placed in the southern side of Nayagarh Town. The district altitude varies in the range of 47-932m above Mean Sea Level (MSL). The hill is declared as the Reserve Forest (R.F.) by Nayagarh Forest Division with a total area of approximately 674 Acres. The Rukhi Hill Forest comprises of various types of flora and fauna. The forest mostly seen in the hill are South Indian moist mixed deciduous forest, deciduous forest, mixed tropical green forest, Miscellaneous forest, tropical moist deciduous forest, etc. The main soils are seen in this forest are (Forest & Hill soils) tropical brown forest soil, laterite soil, and red loam, etc. Three prominent seasons are observed in a year. These are hot and dry summers, hot and humid rainy season and moderate winter season. The highest temperature is varying from  $39^{\circ}\text{C} - 44^{\circ}\text{C}$  in summer. While in monsoon the temperature is  $30^{\circ}\text{C}$ . The average humidity is 70-90%. The winter temperature varies from  $11.5^{\circ}\text{C} - 27.5^{\circ}\text{C}$ . The annual rainfall in the hill varies from 1300mm- 1500mm out of which 80% is received during June-September. The floral diversity mainly composed of rich in Sal forest (*Shorea robusta*), Sisoo (*Dalbergia sissoo*), Indian Kino Tree (*Pterocarpus marsupium*), Teak (*Tectona grandis*), Cotton Tree (*Bombax ceiba*), Neem (*Azadirachta indica*), Banyan Tree (*Ficus benghalensis*), Indian Fig Tree (*Ficus racemose*), Asan (*Terminalia tomentosa*), Arjun (*Terminalia arjuna*) and Eucalyptus (*Eucalyptus globulus*) etc.

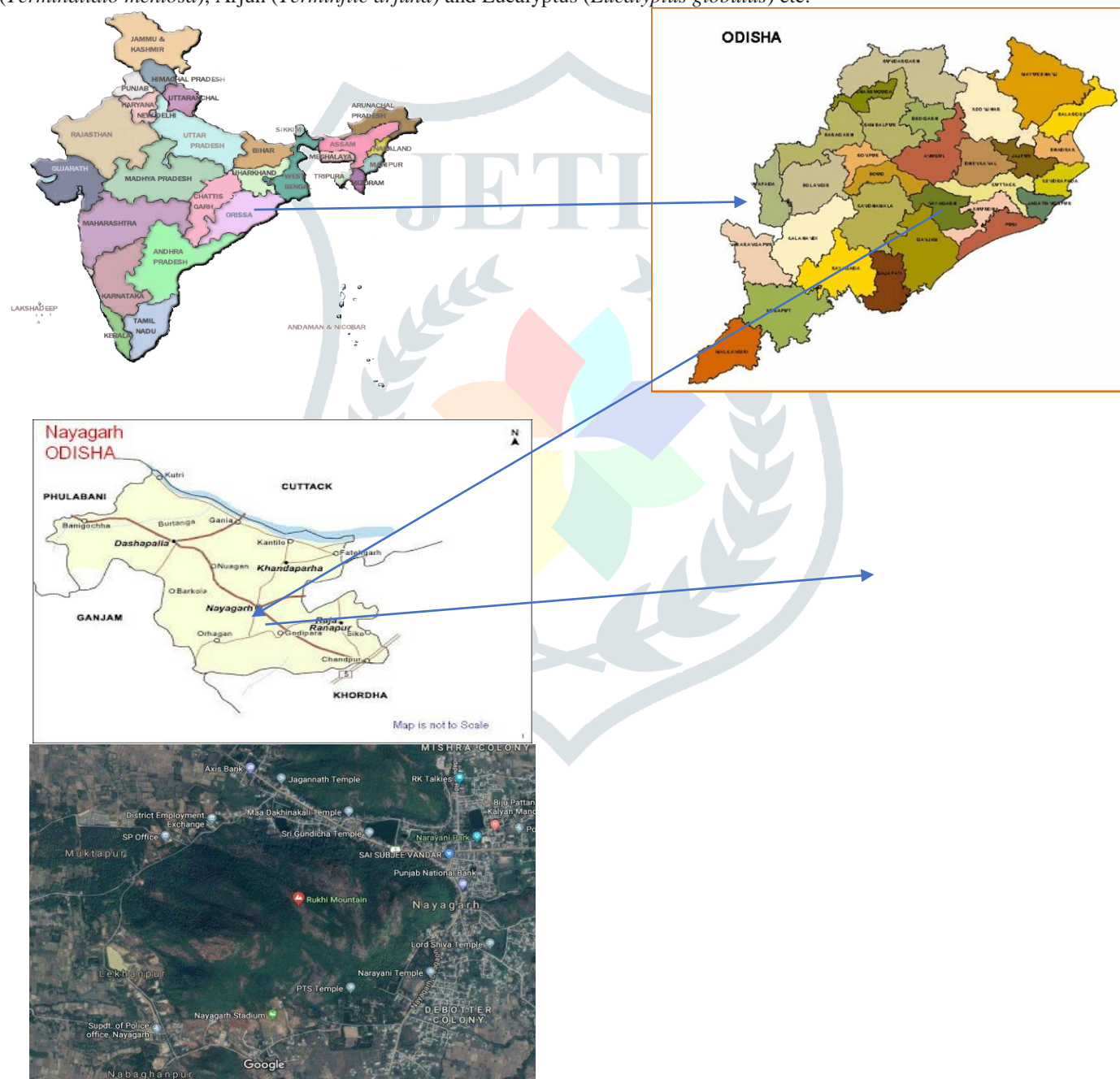


Figure.1- location of study area

## 2.2 Methodology

The study has been conducted from June 2018 to March 2019 regularly in 4-5 days every week. During morning 03 hours (06:00- 09:00) and evening 2.5 hours (16:00- 18:30) were devoted to the field study. Regular surveys were conducted by adopting the line-transect method (Burnham et al., 1980) throughout the study area. Fuller and Langslow (1984) recommend that point counts exceeding 10 min. are wasteful of field effort which could be used to improve other aspects of sampling. So, the point count method was also applied in different areas of the study area for 10 min. Birds were identified by vocal sounds, good photographs captured by DSLR Nikon D5300 with 70-300mm lens & Nikon Point and Shoot B700 and a binocular (10 x 50X). Spot identification and information on their residential status, basic food habits, etc., is based on Grimmett et al. (1999), and Kazmierczak et al. (2000). The checklist was prepared using the standardized common and scientific names listed in Manakadan and Pittie (2001), Ali and Ripley (1983).

### 2.2.1 Shannon-Weiner Diversity Index

Species evenness, richness, and diversity indices as Shannon-Weiner (Shannon and Weaver, 1949) and Simpson Index (Simpson, 1949) were used to evaluate the bird species diversity. Shannon diversity is the very widely used index for comparing diversity between various habitats (Clarke and Warwick, 2001). It was calculated in order to know the species diversity in different habitat (Hutchison, 1970) based on the abundance of the species by the following formula:

$$H' = - [\sum P_i \ln P_i] \quad (2.1)$$

Where,  $H'$  = Diversity Index;  
 $P_i$  = is the proportion of each species in the;  
 $\ln P_i$  = natural logarithm of this proportion.

The value of Shannon Weiner Diversity Index usually falls between 1.5 and 3.5, only rarely it surpasses 4.5. A value of more than 4.5 would indicate that the numbers of individuals are evenly distributed between all the species. Higher is the  $H$  value, the species are more evenly distributed in the particular area. A community with only one species would have an  $H$  value of 0. So, the  $H$  value allows us to know not only the number of species but how the abundance of the species is distributed among all the species in the community.

### 2.2.2 Species Evenness

Evenness is a measure of the relative abundance of different species making up the richness of an area. This evenness is an important component of diversity indices (Hill, 1973; Turchi et al., 1995)

$$E = \frac{H}{H_{max}} \quad (2.2)$$

Where,  $E$  = Evenness  
 $H$  = The Shannon diversity index  
 $H_{max} = \ln(S) =$  Natural logarithm of No. of species encountered.

Species evenness ranges from 0 to 1, with 0 signifying no evenness and 1, a complete evenness.

## III. RESULT AND DISCUSSION

A checklist of avian fauna with IUCN Red list category is reported in Table-1. A total of 46 species of avifauna both migratory and residential were observed in the hill. Order Passeriformes enlisted highest numbers of species i.e. 20 species. Alexandrine Parakeet (*Psittacula eupatria*) inducts the Near Threatened Category of birds on IUCN Red list Category. Besides this Hill Myna (*Gracula religiosa*) and Indian Peafowl (*Pavo cristatus*) were listed under Schedule I Part III of WPA Status. There is only a migratory bird Green Sandpiper (*Tringa ochropus*) found from the study area. The observed species including the abundance of each species permit the calculation of specific diversity indices like Shannon-Wiener-Index (Shannon & Weaver 1963) and Evenness or Simpson-Index (Simpson 1949). From the above baseline data, it is concluded that birds have a great diversity in the study area and have complete evenness resulting that they are uniformly distributed having 3.84 and 1.00 Shannon Diversity Index and Evenness respectively.

During the survey, various problems including poaching of birds were observed. Peafowl, Spotted Dove, Red Jungle Fowl are trapped by local people for flesh. Parakeets and Hill Myna are trapped for pet purpose. Illegal expansion of urban area is the main problem for the declination of avian fauna. However natural calamities alter the ecosystem, but the loss of biodiversity is more in terms of anthropogenic pressure.

Table-1 checklist of avian fauna observed at rukhi hill

Sl. No.	Scientific Name	Common Name	IUCN Status	Resident / Migratory
1	<i>Corvus splendens</i>	Indian Crow	LC	Resident
2	<i>Corvus levaillantii</i>	Indian Jungle Crow	LC	Resident
3	<i>Gracula religiosa</i>	Hill Myna	LC	Resident
4	<i>Acridotheres fuscus</i>	Jungle Myna	LC	Resident
5	<i>Acridotheres tristis</i>	Common Myna	LC	Resident
6	<i>Gracupica contra</i>	Pied Starling (Pied Myna)	LC	Resident
7	<i>Leptocoma zeylonica</i>	Purple rumped sunbird	LC	Resident
8	<i>Passer domesticus</i>	House Sparrow	LC	Resident
9	<i>Amandava amandava</i>	Red Avadavat	LC	Resident
10	<i>Geokichla citrina</i>	Orange Headed Ground Thrush	LC	Resident
11	<i>Dicrurus macrocerus</i>	Black Drongo	LC	Resident
12	<i>Pycnonotus jocosus</i>	Red Whiskered Bulbul	LC	Resident
13	<i>Pycnonotus cafer</i>	Red vented Bulbul	LC	Resident
14	<i>Copsychus saularis</i>	Oriental Magpie Robin	LC	Resident
15	<i>Turdoides striata</i>	Jungle babbler	LC	Resident
16	<i>Oriolus kundoo</i>	Indian Golden Oriole	LC	Resident
17	<i>Ploceus philippinus</i>	Baya Weaver	LC	Resident
18	<i>Hirundo rustica</i>	Common Swallow	LC	Resident
19	<i>Hirundo smithii</i>	Wire tailed Swallow	LC	Resident
20	<i>Anthus trivialis</i>	Tree Pipit	LC	Resident
21	<i>Columba livia</i>	Rock Pigeon	LC	Resident
22	<i>Spilopelia chinensis</i>	Spotted Dove	LC	Resident
23	<i>Streptopelia decaocto</i>	Collared Dove	LC	Resident
24	<i>Ardeola grayii</i>	Indian Pond Heron	LC	Resident
25	<i>Bubulcus ibis</i>	Cattle Egret	LC	Resident
26	<i>Egretta garzetta</i>	Little Egret	LC	Resident
27	<i>Ardea intermedia</i>	Median Egret	LC	Resident
28	<i>Microcarbo niger</i>	Little Cormorant	LC	Resident
29	<i>Centropus bengalensis</i>	Lesser Coucal	LC	Resident
30	<i>Eudynamys scolopaceus</i>	Asian Koel	LC	Resident
31	<i>Centropus sinensis</i>	Greater Coucal	LC	Resident
32	<i>Coracias benghalensis indicus</i>	Indian Roller	LC	Resident
33	<i>Halcyon smyrnensis</i>	White throated Kingfisher	LC	Resident
34	<i>Merops orientalis</i>	Little Green Bee-eater	LC	Resident
35	<i>Merops philippinus</i>	Blue tailed Bee-eater	LC	Resident
36	<i>Anastomus oscitans</i>	Asian open billed Stork	LC	Resident

37	<i>Elanus caeruleus</i>	Black Winged Kite	LC	Resident
38	<i>Pavo cristatus</i>	Indian Peafowl	LC	Resident
39	<i>Gallus gallus</i>	Red Jungle fowl	LC	Resident
40	<i>Vanellus indicus</i>	Red Wattled Lapwing	LC	Resident
41	<i>Tringa ochropus</i>	Green Sandpiper	LC	Migratory
42	<i>Ocyrceros birostris</i>	Indian Grey hornbill	LC	Resident
43	<i>Psittacula krameri</i>	Rose ringed Parakeet	LC	Resident
44	<i>Psittacula eupatria</i>	Alexandrine Parakeet	NT	Resident
45	<i>Aerodramus unicolor</i>	Indian Swift	LC	Resident
46	<i>Dinopium javanense</i>	Flameback Woodpecker	LC	Resident

### Number of Species observed from each order

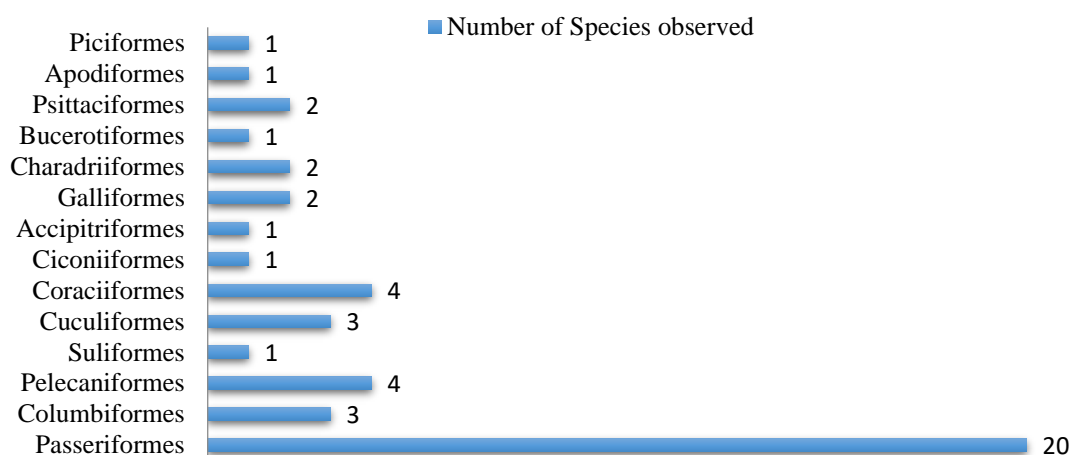


Figure.2- bar chart showing number of species observed from each order

#### IV. ACKNOWLEDGMENT

I am thankful to all the faculties of the Department of Zoology, Centurion University of Technology and Management, Bhubaneswar for their continuous support during my study.

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