

# STUDY FOR THE DISTRIBUTION PATTERN OF AVIAN COMMUNITY RELATED WITH LOCAL INFLUENCES

<sup>1</sup>Lalita Mishra, <sup>2</sup>Dr. Amit Tiwari

<sup>1</sup>Research Scholar, Dept. of Zoology, Govt. Model Science College Rewa (M.P.), India

<sup>2</sup>Professor and Head, Dept. of Biotechnology, Govt. T.R.S. College, Rewa (M.P.), India

DOI: <https://doi.org/10.5281/zenodo.10218415>

Published Date: 29-November-2023

---

**Abstract:** Birds are a very important component in any ecosystem such as prey, predators, pollinators, scavengers, seed dispersals and ecosystem engineers. Decreasing numbers of birds are the sign of threatening the environment and bird population states that we are disturbing the ecosystem or not. An assessment of bird community is important tool in biodiversity conservation and identifications of conservation actions. Having knowledge on diversity and composition of bird communities is also crucial to determine the health status the local ecosystem or regional landscapes. Moreover, identifying the existing threats in a particular area is also essential for developing effective conservation efforts and management actions. So the conservation of the avian community is a too important aspect for maintaining the balance of the ecosystem. Some studies are conducted on the diversity; distribution and abundance of birds predominantly in protected areas such as National parks. However bird species composition, distribution, abundances and the threats that affect them are poorly understood in many regions of the country including the present study area.

**Keywords:** Environment, Avian Community, Ecosystem, Threatening, Conservation.

---

## 1. BIOTIC COMMUNITIES: AN INTRODUCTION

Ecologists have perceived communities as either 'organised' units or chance assemblages with the former view regarding communities are discrete, repeatable assemblages of species that are closely integrated and possess properties similar to those of individual organisms and the latter view considering communities as no more than fortuitous coincidences or random assemblages (1). Biotic communities are characterized by two properties, structure or organisation (called patterns) and function or dynamics (called processes). The former includes distribution of species in communities, their variety and abundance and the trophic structure, which connects different components of a community. The latter entails causal processes such as colonisation, competition, predation, parasitism, climate, history, and chance events (2).

## 2. AVIAN COMMUNITY ECOLOGY: CONTEXT OF THE PRESENT STUDY

The focus of bird community ecology has been on identifying patterns that characterise natural assemblages of species and processes that cause these patterns A pattern is 'a particular configuration of properties of the system under examination' and the process is the 'underlying causes' or 'factors that produce a particular relationship among observations'. The major focus of development in bird community ecology has been finding the 'true nature, stability and predictability of community structure' (4). The processes that shape or influence the communities have been categorized as deterministic (predictable) and stochastic (chance) processes. The important aspects addressed in the study of bird communities include patterns of bird species richness, distribution and abundance in an area and factors affecting these parameters. These include bird specieshabitat relationships, mechanisms of species co-existence (e.g. resource partitioning, foraging guilds and mixed-species flocks) and impacts of anthropogenic/natural disturbances on bird communities (5).

### 3. DETERMINISM AND LOCAL INFLUENCES

In the early phase of community ecology, local ecological processes (intrinsic factors) were mainly regarded of significance in determining the richness and composition of communities. Species co-existence was treated as an extension of the classical Darwinian perspective of survival by natural selection. The chief mechanisms considered responsible were morphological differences (bill size, wing length etc.), habitat segregation (including altitudinal segregation), foraging mode and diet differences. Competition and habitat (mainly vegetation structure) were regarded as the driving forces of community organisation. Higher vertical heterogeneity and productivity of tropical forests coupled with availability of specific resources was regarded to be responsible for high bird species richness of the tropics (6). This relationship between bird species diversity and habitat features was a central theme seeking deterministic processes underlying the observed patterns. Major ideas to emerge from such studies were that structural features of vegetation (7) determine the composition of bird communities. However, this relationship was shown not to remain constant temporally or spatially as shown by the influence of scale of the study on the conclusions drawn (8). This brought in the role of scale and regional factors in understanding composition and organisation of bird communities. Further, relationship between birds and habitat structure has been shown to be complex and variable in tropical areas with absence of any consistent pattern, especially in terms of relationship between BSD and habitat structure (9). Most studies concerned with organisation of communities considered the role of competition central in shaping these communities. These were regarded as the outcomes of competition between species in the past (10).

### 4. COMPOSITION AND ORGANISATION OF MIXED-SPECIES FLOCKS

Mixed-species foraging flocks of birds show a convergent community level pattern across the continents and a range of ecosystems (Diamond 1981) although there is a remarkable gradient in their organization from temporary associations to cohesive, permanent, territory-defending units (11). Several studies have addressed questions pertaining to structure, organization and evolution of mixed-species bird. Mixed-species flocks carry important implications at population and community levels in terms of reduced intraspecific and interspecific competition, increased species richness of communities and evenness of abundance of species (12). Avoidance of predation and foraging facilitation are the two major hypotheses to explain mixed-species flocking. Jullien and Clobert (2000) have shown that survival rates of obligate flock members are significantly higher compared to solitary and facultative flocking species. 75 Species participating in flocks have been classified as 'nuclear' and 'attendant' (13) depending on the roles of these species in terms of flock formation and cohesion. Flocknegative species are of lower body weight, fairly specialised in their morphology and substrate use and less capable of copying foraging locations of other species. Flockpositive species, on the other hand, are large-bodied, less specialized in morphology and substrate use and capable of copying foraging locations of other species. Both groups are probably equally vulnerable to predation pointed out that flock members derive differential benefits by joining mixed flocks. Research has shown that nuclear species seem to derive foraging benefits in terms of kleptoparasitism and copying of foraging locations, while most other species gain anti-predatory advantages by joining flocks. Various factors have been shown to play a role in influencing species composition of flocks. Local species pools and distribution patterns were regarded to play a major role in composition of mixed flocks of Southeast Asia (McClure 2001), central and south America and southern India (14). Studies on mixed-species flocks in the Neotropics, the Caribbean and Madagascar showed positive association between relative abundance of a species and its flocking propensity (15). Presence of sympatric congeneric species affects flock participation as shown by checkerboard patterns of flock participation of such species pairs in the Neotropics. Presence/absence of 76 nuclear species has also been shown to influence flock composition (16). Habitat fragmentation and the nature of surrounding matrix also influence species composition of mixed-species flocks.

### DISTRIBUTION PATTERNS

"The crisp edge of a standard field-guide range map often translates in the real world into a very fuzzy distributional boundary, where neither the presence nor the absence of a species is certain." - Robert MacArthur (2001)

### 5. BIRD DISTRIBUTION RECORDS IN CENTRAL INDIAN HIGHLANDS

As mentioned earlier very few studies of forest avifauna have been carried out in the central Indian highlands of the Indian peninsula. The existing information from the region dates back to pre-independence era and needs to be reviewed in the present context. Thus, information on bird species of this area with three major mountain ranges (17) is of high significance to understand Indian ornithogeography. Since Purna is located in the northernmost section of the Western

Ghats and Ratanmahal in the Vindhya-Malwa Plateau junction, information on presence/absence as well as abundance of forest bird species can provide vital information in this regard. Further, avifauna of Ratanmahal has also not been surveyed in the past. Most importantly, Ratanmahal and Purna form the westernmost patches of moist deciduous forests in the Indian peninsula, marking the global range boundaries of several species of forest birds (18). Thus, it was one of the aims of the study to document the avifauna of these two sites to improve knowledge on bird distribution in India.

## 6. PATCHY DISTRIBUTION OF FOREST AVIFAUNA IN INDIA

It is well known that bird species have patchy distributions at both local and regional scales. Tropical bird species in particular show highly patchy distribution (19) This has been attributed to tighter species packing through narrow habitat choices and heterogeneity of habitats. In India too, many species of forest birds show disjunct ranges. In most cases of range disjunction among forest avifauna of India, species show two distinct areas of occurrence – first, the forest belt extending from the western lower Himalayas to northeastern India and second, the peninsular hills, mainly the Western Ghats but also the Eastern Ghats. Mani argued that the range discontinuity is apparently there for Indochinese and Malayan forms only (20), this phenomenon being absent for Mediterranean and Ethiopian forms. He also added that the observed pattern of discontinuous distribution of Indo-chinese and Malayan derivatives is of relatively recent origin and at least with such mammals, it is a relic of former continuous distribution. Surveys and studies of Ali (1954- 55), Hence, documenting and monitoring the occurrence and status of these species in the eastern forest belt is crucial for their conservation.

## 7. DISTRIBUTION-ABUNDANCE RELATIONSHIP

It has been shown for birds that their abundance generally rises as one moves from the edges of their ranges towards the center of distribution (21). In several cases, there are many such locations (hotspots) where these species show the highest abundance. They found unimodal, multimodal and sharply truncated abundance-distribution relationships among various taxa, thus ruling out any single pattern for such a relationship among tropical and temperate birds. In the present study, there was a scope for exploring this pattern for some bird species, which showed range boundaries at District. Apparently, many such species are also patchily distributed in India. Based on this information, I then look at the factors responsible for the observed distribution patterns. Specifically, I differentiate between historical factors and recent range dynamics (or both) that have played a role in present day distribution patterns of forest bird species (22). I intensively surveyed the two areas for new species not yet documented from the state or from either of the two study areas. Throughout the sampling, stress was laid on forest bird species with patchy, disjunction and unexplained distribution patterns in India or with documented sensitivity to habitat fragmentation and other anthropogenic changes.

## 8. AVIFAUNAL IMPOVERISHMENT

**“Biogeographically India may largely be described, as a land of vanishing relicts.”**

– M. S. Mani

The study of species-area relations is one of the oldest areas of interest in plant and animal ecology. This association between the size of sampled area and number of species implied that a certain rise in the sampled area would lead to a corresponding increase in the number of species recorded. Conversely, reduction in the extent of area should lead to loss of species. The theory of ‘Island Biogeography’ (23) was a fall-out of species-area relation studies. The relationship between number of species and the extent of area is expressed by the equation  $S=cAz$ , where S is the number of species, A is area and c and z are constants. This theory, initially based on the study of colonisation of islands by main land taxa was later extended to ‘habitat islands’ in a terrestrial context. In this way, it found utility in planning the design and management of nature reserves (24).

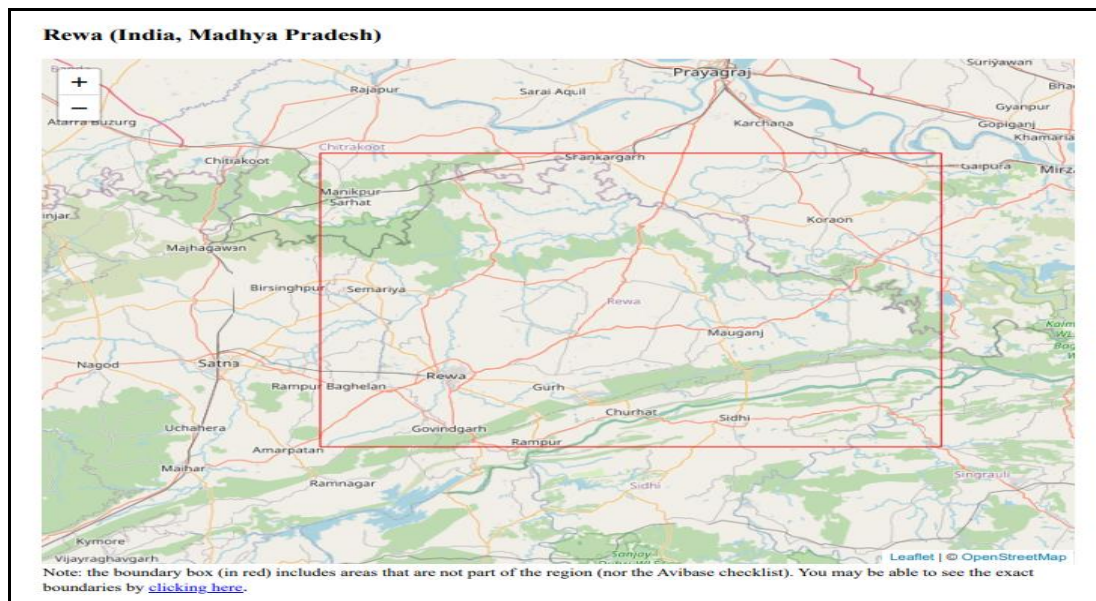
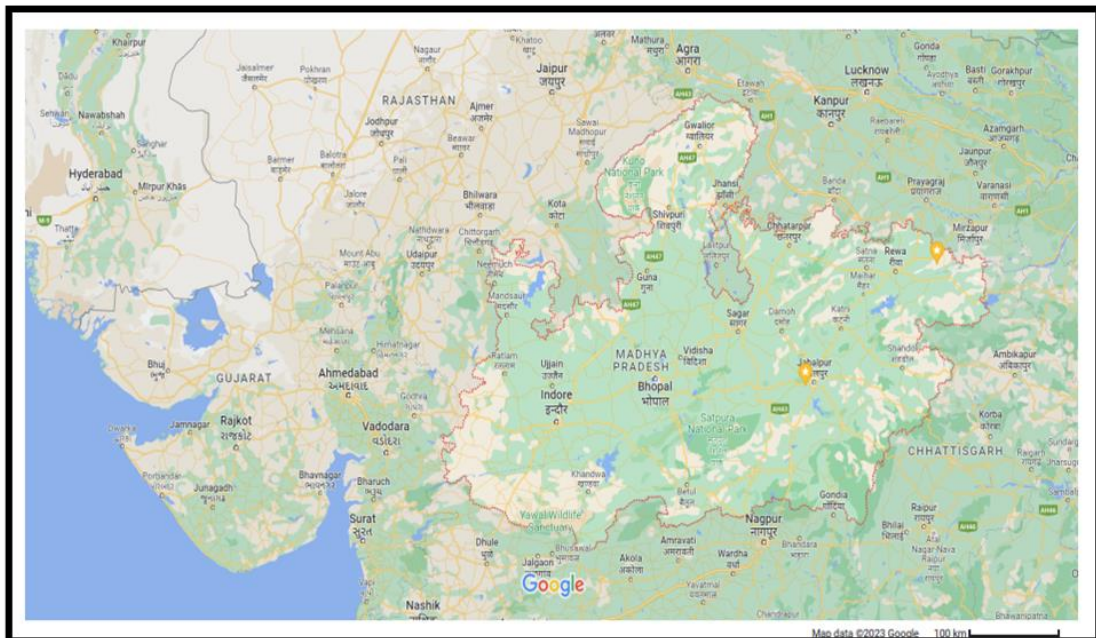
## 9. IMPACTS OF HABITAT FRAGMENTATION AND LOSS ON AVIFAUNA

Loss, fragmentation and degradation of habitat caused by humans have been regarded as important factors for species extinctions and impoverishment of biota of a region. Several studies have been conducted to assess the impacts of fragmentation on birds. In spite of the discrepancies and variations in the results, a clear indication is that fragmentation leads to impoverishment of the local species pool of birds. Although influences of habitat size and quality, nature of the matrix and isolation are important; not all bird species respond in similar fashion to these factors. Evidence points at the role of several ecological and biogeographic traits of bird species such as body size, foraging guild, habitat specificity, rarity and endemism, population size and population dynamics in determining vulnerability of species to fragmentation (25). Besides, there is a time lag before the responses to fragmentation are manifested. This time lag between

fragmentation and extinction (relaxation time) has been shown to be roughly 25 to 75 years for loss of 50 % of local bird species pool . The effects of fragmentation vary temporally between species. This means that patches do not lose all species, but some species go early, others in medium time frame and some species do not disappear.

## 10. GEOGRAPHY OF STUDY AREA

Rewa is formerly the capital of the princely state of Rewa and former state of Vindhya Pradesh in central India. It is an important city in the North Eastern part of Madhya Pradesh state of India bordering Allahabad, Mirzapur and Banda Districts of Uttar Pradesh and Satna and Sidhi Districts of Madhya Pradesh. It is the administrative center of Rewa District and Rewa Division. The City lies about 420 kilometres (261 mi) northeast of state capital Bhopal and 130 kilometres (81 mi) south of the city of Allahabad. Rewa derives its name from another name for Narmada River. Rewa lies between 24'18 and 25'12 north latitudes and 81'2 and 82'18 east longitudes in the north-east of the division of the same name. The district is bounded on the north and east by the state of Uttar Pradesh, in the south Sidhi district and in the west with Amarpatan and Raghurajnagar tahsils of Satna district. In shape the district can be compared to an isosceles triangle, with its base along the Satna border and the two longer arms converging towards Mauganj in east. The district derives its name from Rewa town, the district headquarters, which is another name for Narmada river.



Rewa is a historical city located in the Indian state of Madhya Pradesh. This verdant land is blessed with delightful vistas of nature and is the home of the big wild cat - The elegant white tiger. The first white tiger of this region was spotted by Maharaja Martand Singh while on his way to Govindgarh jungle. He put in a lot of effort to increase the white tiger population.

Rewa district is important tourist places given below:

1. Rewa Fort in city
2. Rewa Fort Museum from which Movie Asoka's weapons were loaned
3. Venkat Bhawan and Shiva temple in city
4. Rani Talab Temple and Water Tank, in city.
5. Shilpi Plaza one of the best shopping complex in whole Madhya Pradesh
6. Govindgarh Lake and Fort, 20 km away
7. Chachai Water Falls, Near Sirmour 40 km Away
8. Keonti Water Falls, Near Lalgaon 40 km Away
9. Purwa Water Falls, 200 feet high (nearly 67 m) and present heck of a robust view.
9. Big statue of GOD shiva called "Bhairom BaBa" at Gurh 30 km away and nearby the statue there is a natural lake called "Kudia", there is also famous temple of "shiv ji & alliad gods"

### 11. CHACHAI WATERFALL

Chachai falls are more than 130 meters in height and are situated on River Bihad, near Rewa, Madhya Pradesh. These falls are the second highest waterfalls in Madhya Pradesh and is counted amongst one of the highest single-drop waterfalls in India. It was once praised by former Indian Prime Minister Sh. Jawahar Lal Nehru for its breathtaking charisma and beauty.



Chachai water fall is in Rewa district of Madhya Pradesh in India. It is just 40kms North of Rewa city. It is counted among Rewa tourist attractions. Chachai fall is a very beautiful water fall. It comes from Beehad River. It is the **2nd highest fall of Madhya Pradesh** and 23rd in India. The Chachai falls are a classic example of a nick point, which is

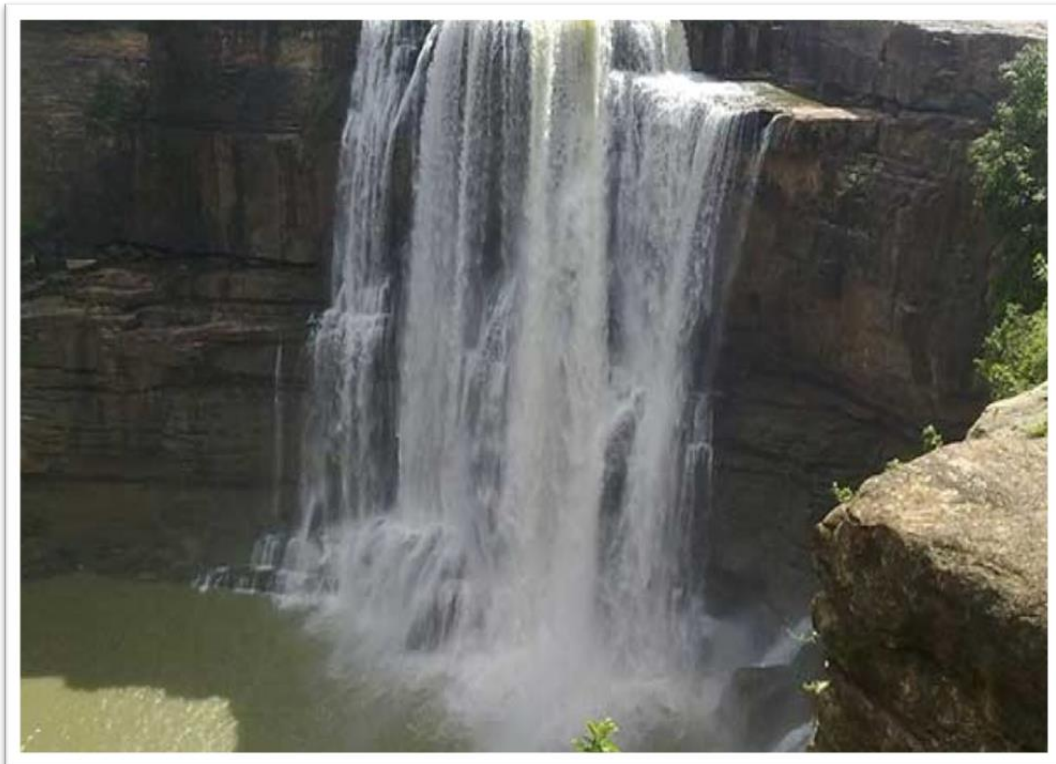
caused by renewal. Knick or nick point or casually called as just 'nick' is the break in the slopes of the waterfall. The break results in the vertical fall of water, creating a cascade. These falls have a unique water formation. It is 130 mtrs high. The waterfalls get the water from Bihad River which is a tributary of the Tamsa River. The river originates from the Rewa plateau. The waterfall is located at a distance of about 46 kilometre from the main city of Rewa. The waterfall is famous as it is situated at the edge of the famous Chitrakoot Hills. The Chitrakoot Hills have a great mythological and also religious value for Hindus. Due to these all features of the waterfall so many people visited this place every year. This is the major attraction in the Rewa district. The fall has very panoramic environments. It is unique due to its nick point. In the rainy season it looks more beautiful due to plenty of water in fall and greenery. Chachai waterfall is one of the 4 beautiful cascades of the Rewa district. Chachai waterfalls bear resemblance to the Keoti Falls and the Bahuti Falls of MP state. The grand canyon of Chachai falls is visible from a distance, especially when the water flow is low. There are a few rest houses for tourist accommodation near the Chachai Falls and only Rewa Retreat is a hotel in the vicinity.

However, that time is long gone as a river diversion has been constructed on this river, which splits all of the water of Bihad river in two halves, one for generation of Electricity at Toans Hydroelectric Power Plant and another half for irrigation in nearby villages, leaves absolutely no water for the waterfalls. The coarse of the river has been changed and since then, the waterfalls are dry, which flood once during the rainy season when excess water is discharged from the dam.

## 12. PURWA WATERFALL

### DIRECTION

The Falls are 200 feet high (nearly 67 m) and present one heck of a robust view. The falls are intense and an enormous volume of water falls every second. The Falls are on River Toans, descending the cliff of Rewa Plateau. However, the Falls gain or lose their majesty with season and are best to visit when the rains are in full swing.



## 13. KEONTI WATER FALLS

It is the 24th highest waterfalls in India and is a really popular tourist destination. The view from the falls during sunset and sunrise is something one shouldn't miss during the trip. A great way to have some intimate time with loved ones. Keoti Waterfall is a place in Rewa that will blend you with the locals as it is usually crowded with people be it tourists or the localities.



#### 14. TONS WATERFALL, SIRMAUR, REWA

The Tons waterfall is among all the less-known waterfalls near the Rewa district, which makes this place beautiful. The waterfall is near Dabrauhi, around 38 km away from Rewa, Madhya Pradesh. The Tons waterfall is one of the most beautiful waterfalls present in the Rewa district. If you are planning on visiting Rewa, then visiting Tons Waterfall will be one of the best decisions you can ever make. This place is interesting, and there are few visitors, so it is a great place if you want to escape reality. Trekking is one of the most adventurous activities to do near a waterfall. The trek to this waterfall is around 1 km, and after covering the trekking distance, one needs to go downstairs. After a long journey and trekking, the next fun activity to do at the waterfall is to take a bath. The showering water and the pond in which water comes from a significant height are where you can take a bath near the waterfall. The water at this place is cold and soothing, and people living near the waterfall often visit here for swimming during weekends. The Tons waterfall is 38 km away from Rewa district. You can cover the distance on a two-wheeler. After covering some distance, you'll find narrow and kaccha roads. The Ton waterfall is open throughout the year except during the monsoon. During the rainy season, the water level of the waterfall is high, which might be risky for visitors, so it is closed during the monsoon.

#### 15. CONCLUSION

During the study of literature for the avifaunal community, we have observed that various distribution patterns of species in communities, their variety and abundance and the trophic structure, which connects different components of a community. The latter entails causal processes such as colonisation, competition, predation, parasitism, climate, history, and chance events. In several cases, there are many such locations (hotspots) where these species show the highest abundance. They found unimodal, multimodal and sharply truncated abundance-distribution relationships among various taxa, thus ruling out any single pattern for such a relationship among tropical and temperate birds. Several studies have been conducted to assess the impacts of fragmentation on birds. In spite of the discrepancies and variations in the results, a clear indication is that fragmentation leads to impoverishment of the local species pool of birds. Although influences of habitat size and quality, nature of the matrix and isolation are important; not all bird species respond in similar fashion to these factors.

## REFERENCES

- [1] Ali, S. and Ripley, S. D. 2013. A Pictorial Guide to the Birds of the Indian Subcontinent. BNHS Centenary Publication. Oxford University Press, Delhi.
- [2] Anderson, S. H. 2011. Correlating habitat variables and birds. *Studies in Avian Biology* No. 6: 538-542.
- [3] Beier, P., Drielen, M. V., and Kankam, B. O. 2018. Avifaunal collapse in West African forest fragments. *Conservation Biology* 16(4): 1097-1111.
- [4] Brooks, T. M., Pimm, S. L. and Oyugi, J. O. 2019. Time lag between deforestation and bird extinction in tropical forest fragments. 13: 1140-1150.
- [5] Brown, J. H. 2014. On the relationship between abundance and distribution of species. *The American Naturalist* 124(2): 255-279.
- [6] Brown, J. H., Mehlman, D. W. and Stevens, G. C. 2015. Spatial variation in abundance. *Ecology* 76(7): 2028-2043.
- [7] Butler, E. A. 2015. Notes on the avifauna of Mount Aboo and Northern Guzerat. *Stray Feathers* 3: 437-500.
- [8] Butler, E. A. 2016. Notes on the avifauna of Mount Aboo and Northern Guzerat. *Stray Feathers* 4: 1-41.
- [9] Butler, E. A. 2017. Notes on the avifauna of Mount Aboo and Northern Guzerat. *Stray Feathers* 5 (3 & 4): 207-236.
- [10] Castelletta, M., Sodhi, N. S. and Subaraj, R. 2010. Heavy extinctions of forest avifauna in Singapore: Lessons for biodiversity conservation in Southeast Asia. *Conservation Biology* 14 (6): 2010-1880.
- [11] Chazdon, R. L., Peres, C. A., Dent, D., Sheil, D., Lugo, A. E., Lamb, D., Stork, N. E., & Miller S. (2009). The potential for species conservation in tropical secondary forests. *Conservation Biology*, 23, 1406–1417.
- [12] Clarke, K.R., 2013. Non-parametric multivariate analyses of changes in community structure. *Aust. J. Ecol.* 18: 117–143.
- [13] Cody, M. L. 2011. Habitat selection in birds: the roles of vegetation structure, competitors and productivity. *Bioscience* 31 (2): 107-113.
- [14] Cody, M. L. 2013. Bird diversity and density in South African forests. *Oecologia* 59:201-215.
- [15] Crooks, K. R., Suarez, A. V., Bolger, D. T. and Soule, M. E. 2011. Extinction and colonization of birds on habitat islands. *Conservation Biology* 15(1): 159-172.
- [16] Croxall, J. P. 2015. The composition and behaviour of some mixed-species birdflocks in Sarawak. *Ibis* 118: 333-346.
- [17] D'Abreau, E. A. 2015. A list of the birds of the Central Provinces. *Journal Bombay Natural History Society* 38: 95-116.
- [18] Daniels, R. J. R. 2019. A conservation strategy for the birds of Uttar Kannada district, south India. Ph. D. thesis submitted to the Indian Institute of Science, Bangalore, India.
- [19] Daniels, R. J. R., Hegde, M., and Gadgil, M. 2010. Birds of the man-made ecosystems: The plantations. *Proc. Indian Acad. Sci. (Anim. Sci.)*, Vol. 99 (1): 79-89.
- [20] Dasgupta, J. M., Roy, S. B. and Datta, B. K. 2012. Endemic birds of India, *Rec. zool. Surv. India, Occasional Paper No. 200*: 1-44. Director, Zoological Survey of India, Calcutta.
- [21] Davidar, P. (2019) Synecological studies on the specialised nectar-feeding birds and bird-flowers in the Nilgiris. Ph. D. dissertation submitted to Bombay University.
- [22] Desai, I. V., Suresh, B., and Pilo, B. 2013. Birds of Shoolpaneshwar Wildlife Sanctuary. *Pavo* 31 (1&2): 55-72.
- [23] Desai, I. V., Suresh, B., and Pilo, B. 2013. Birds of Shoolpaneshwar Wildlife Sanctuary. *Pavo* 31 (1&2): 55-72.
- [24] Dharmakumarsinhji, K. S. 2015. The Black Eagle *Ictinaetus malayensis* TEMM. and LAUG at Sawai Madhopur (Rajasthan). *Journal Bombay Natural History Society* 82(3): 655.



- [25] Diamond, J. M. 2018. Biogeographic kinetics: Estimation of relaxation times for avifaunas of Southwest Pacific Islands. *Proc. Natl. Acad. Sci. USA*. 69: 3201-3202.
- [26] Dolby, A. S. & Grubb, T. C. Jr. 2019. Functional roles in mixed-species foraging flocks: a field manipulation. *Auk* 116 (2): 557-559.
- [27] Emlen, J. T., DeJong, M. J., Jaeger, M. J., Moermond, T. C., Rusterholz, K. A. and White, R. P. 2016. Density trends and range boundary constraints of forest birds along a latitudinal gradient. *Auk* 103: 791-803.
- [28] Gadgil, M. and Rao, P. R. S. 2018. Nurturing Biodiversity: An Indian Agenda. Environment and Development series. Centre for Environment Education, Ahmedabad.
- [29] Gaston, A. J. 2015. Is habitat destruction in India and Pakistan beginning to affect the status of endemic passerine birds? *Journal Bombay Natural History Society* 81(3): 636-641.
- [30] Gibson, L., Lee, T. M., Koh, L. P., Brook, B. W., Gardner, T. A., Barlow, J., Peres, C. A., Bradshaw, C. J. A., Laurance, W. F., Lovejoy, T. E., & Sodhi, N. S. (2011). Primary forests are irreplaceable for sustaining tropical biodiversity. *Nature*, 478, 378–383.
- [31] Gleason, H. A. 2014. The individualistic concept of plant association. *Bulletin of the Torrey Botanical Club* 53: 7-26.