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A Review on Indian Avian Community Structure and its Related Factors

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Review Article

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ABSTRACT

In order to ascertain the impact of various factors on the avian community structure in India, elaborative analysis of relevant literature was carried out to extract the impact of real factors that affect the avian community structure. The prominent factors that have direct bearing on the birds include urbanization, extensive use of insecticides and pesticides, physio-chemical parameters, vegetation, type of habitat, climate change, environmental contamination, nesting pattern and weather. Avian abundance is also affected by other factors such as migration, natality and mortality or due to changes in habitat structure and distribution pattern of food resources. Research data has pointed out strong patterns of association between bird community structure and the physical configuration of the environment. For effective avian conservation management, multipronged approach needs to be undertaken to mitigate the adversity of these factors.

INTRODUCTION

Though Indian sub-continent contributes immensely to avian diversity and India alone accounts for 13% of world species richness and their taxonomy, distribution and general habitat characteristics are well documented in India. Contrary to well documented data, very scarce information is available regarding avian community structure and their dynamics in India. Bird community structure is considered as an inevitable component of vibrant ecosystem

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and is reflective of the quality of the habitats. Therefore any sort of fluctuation in avian community dynamics has serious ramifications for the entire ecosystem. Birds are truly considered as one of the best tools and parameters of environmental vitality of any ecosystem because of their sensitivity to various kinds of perturbances. Avian species diversity and richness varies greatly and not all species are uniformly distributed over a large ecological area because of varied nature of topography, vegetation composition and structure and availability of food and other factors influence species occurrence. Avian abundance is also affected by other factors such as migration, natality and mortality or due to changes in habitat structure and distribution pattern of food resources. Research data has pointed out strong patterns of association between bird community structure and the physical configuration of the environment. For thorough understanding of the bird community structure and niche relationships, in depth analysis of avian population in different habitats is akin not only to understand the avian community structure but it will be a catalyzing factor for effective management of avian populations [1-3].

LITERATURE REVIEW

Impact of urbanization

Urban habitats and geographical landscapes are variedly different from non–urban "natural" habitats. The major difference is the transformation of land, from natural green areas to anthropogenic structures and impervious surfaces. To survive in the urban habitat, birds are forced to either accept or avoid the new conditions. Urban areas have low species richness than non-urban habitats because the environmental stress factors such as chemical pollution, noise, artificial light at night and anthropogenic presence has rendered urban habitat as a major threat to avian diversity. In fact mass scale rapid urbanization along with climate change is regarded as one of the catastrophic threat to avifauna and their collective contribution has led to decline in the avian population in urban area at rampant pace. Urban habitats and landscapes are markedly different from non–urban "natural" habitats. The major difference is the transformation of land from natural green areas to anthropogenic structures and impervious surfaces. Besides, urban expansion has led to a highly fragmented landscape with islets of suitable bird habitat surrounded by highways and buildings that frequently act as barriers. These adverse conditions have changed the avifauna dramatically, with many species vanishing once an area is urbanized. In exceptional and rare cases, some species seem to thrive in the urbanized area and these urban–dwelling species often show prominent phenotypic differences e.g., marked change in behavior, physiological and morphological characteristics. Thus it is quite evident and ample clear that due to increased rate of urbanization and the rapid loss of wild habitats, urban areas are now viewed as challenging ecosystems for sustaining biotic communities [4]. Some researchers are even of the opinion which is also corroborated by research data reflected in the work. Urban areas normally have higher bird abundances in comparison with adjacent, more natural ecosystems. Higher bird abundance in urban areas is supported by the research and they documented in their published work that increased availability of food in urban settings is responsible for increase in bird densities. The urban environment should possess higher species density because urban habitat has the potential tendency to attract more individuals from the regional species pool. In total contrast to these research finding, most of the studies conducted on birds in urban settings have unanimously pointed out that urban areas are comparatively poor in species richness and diversity as compared with areas bestowed with more natural habitats such as rural areas and forest dwelling areas. Data available on avian diversity and richness in urban settings is contradictory and debatable and is truly a grey area in research that further needs to be explored by researchers to arrive at a unanimous conclusion regarding avifauna diversity in an

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urban habitat. Urban habitats witness increased anthropogenic disturbances. Anthropogenic disturbance is considered as an important parameter in determining the shape of the bird community which is supported by the research work conducted, who has pointed out through his research that when anthropogenic disturbance is extreme, synanthropic species dominate bird community and when disturbance is rare native forest species dominate but when disturbance is intermediate a rich diversity coexists [5]. Urbanized areas are a better habitat for those few species which are tolerant/acclimatized themselves to the disturbances. Such urban environments favor ground feeding granivorous or omnivores species and cavity–nesting species or need nesting sites resembling to cliffs or ledges whereas most of the bird species avoid urban habitat because of disturbance factors such as walking, driving, pollution, crowding, transportation, waste solid material etc. Another important reason being noise pollution because birds use vocalization to warn danger, defend their territory and also attract their mates so due to noisy surroundings which is main result of congested traffic, the birds are there by compelled to avoid urban dwellings [6]. In urban habitat though food is in abundance but not in good quality which thus severely affects the health and growth of the birds so most of the birds try to avoid urban settings and is considered one of the prime determining factor in low species diversity in urbanized areas. The huge abundance of food in an urban habitat attracts feral animals (predators of birds) such as cats and dogs. The piece of research conducted has been concluded that cats cause unprecedented damage to birds in an urbanized habitat. Another important factor that has direct bearing on low species density and richness in an urban setting is loss of vegetation in an urban habitat. Vegetation is important factor for bird community as birds perform majority of functions on it but scant and fragmented vegetation has severely impacted the urban ecosystem. Besides birds are highly sensitive to alterations in habitat structure and function: consequently they serve as excellent indicators of changes and stresses in urban ecosystems.

Impact of vegetation

Vegetation is the considered a major factor in determining bird community composition. Alteration in vegetation composition could impact the quality and quantity of habitat for birds in terms of food, water and cover which can further affect the diversity, abundance and distribution of birds. Due to vegetation changes along complex biological and environmental gradients, a particular bird species can appear, increase or decrease in number and vanish as the habitat change. Abundance of numerous bird species is highly influenced by the composition of the vegetation that forms the major element of their habitat. Increase in vegetation cover increases the species diversity. Analysis of varied research data on role of vegetation cover indicates an important trend that high vegetation cover in suburban and wild land areas supports rich avian diversity in comparison to urban landscape. In addition to vegetation cover, other habitat variables like number of vegetation layers, percentage of soil and percentage of leaf litter on land also plays important role in deciding the avian species richness of a habitat. In terms of habitat quality, variation in vegetation appeared to be more important determinant of bird diversity and richness. Increased number of vegetation layers, high percentage of soil and leaf litter on land in sub-urban area in comparison to wild land area and urban habitats creates a mosaic habitat which can attract non-native species to penetrate from the wild land and nearby urban areas and ultimately resulted in increased species richness and diversity as compared to urban and wild land habitat. Vegetation type in a particular habitat has direct bearing on occurrence of birds on a specific habitat. Occurrence and abundance of a species in a particular area is determined by biotic factors and different habitat variables such as food resources, habitat covers and relative abundance of other species. Foliage too plays significant role in determining the bird density as it provides roosting, feeding and

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shelter sites for the bird and at the same time it also protects birds from the potential predators. Habitat destruction has become a major factor in all the types of ecosystems due to the anthropogenic interference [7].

Impact of climate change

Climate change and anthropogenic activities are main causes for decline of avifauna. Climate change has innumerable implications on birds with slight changes in temperature, precipitation and humidity may cause shifts in breeding time, breeding success, migration schedules, changes in breeding and foraging ground, the destination of migration, distribution range across latitude and longitude. Climate exerts both direct and indirect effects on bird population. Direct effects such as late spring storms, may kill migrating birds as documented. Indirect effects are mediated by one or more other species. The conclusive data provided found that populations collapsed where climate warnings disrupted the synchrony between breeding pairs and the caterpillars they feed their nestlings. The potential effects of climate change on birds have highlighted: the relationship between bird distribution and climate; the effects of changes in precipitation on breeding productivity; phonological changes in the timing of migration and the onset of breeding; the relationship of global climate patterns to food supplies, breeding productivity and survival of migratory birds. Bio-geographical history and climate gradient also contribute to shape avian community composition at larger scales and is evidenced by the research work. The unprecedented ongoing alterations in bird community structure are driven to a larger extent by contemporary changes in climate.

Impact of environmental pollution

Environmental Protection Agency's report on birds published in 2006 has highlighted that exposure to pesticides has been reported to cause decrease in egg production and in viability in birds. The unabated mass scale use of pesticides, insecticides and fungicides to upscale agricultural production has severely affected avifauna. Pesticide residue is a principle provoke of declining population of several wild species of birds. The major problems in birds due to environmental contamination are reproductive dysfunction, eggshell thinning, metabolic changes, deformities and birth defects, cancers, physiological changes, abnormal thyroid activities, immune abolishment, feminization of males and masculinization of females [8].

Impact of cellular towers and HT wires

Significant data is available from various research works conducted from time to time on the impact of high voltage electric wires and mobile towers on the bird community and are considered as major contributors in the decline of population of some common birds like house sparrow (*Passer domesticus griseigulars*) and white cheeked bulbul (*Holpestes leucogenys*). Different bird surveys which have been carried out in different parts of India too project a grim picture. Installation of cellular towers in last one decade is regarded as one of the reasons for the decline of bird population in Kashmir. In addition, the electrical transmission lines including HT lines pose a great risk for electrocution of birds, with crows, eagles and swallow being particularly vulnerable. Swallows–the most revered birds in Kashmir is hardly spotted in and around human habitations. The concrete building construction and netted windows is major hurdle for these birds to build their nests, and had been a major cause for the decline of swallow population.

Impact of nesting sites

Nesting sites provide protection against predators offers adequate stability and materials to support and construct the nest and also influences the hatching success. The size, structure, shape and orientation of the nest are important in providing the shelter against adverse weather particularly high winds gales and storms nesting sites influence fledging success too. Multitude of factors like high rate of nest predation, predation at feeding tables (by

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cats and dogs), poor nutritional value of the food resources, exposure to high pollution levels, high incidence of collisions with windows and cars reduce the overall fitness of the population.

Impact of weather

Significant data from varied pieces of research on influence of weather on avian community points out that weather affects the metabolic rate of the birds. It also exerts either indirect or direct effects on bird's behavior. Weather also impacts breeding success of birds. The cyclonic storm and post cyclone restoration activities had destroyed most of the traditional houses and foliage cover. The sudden habitat loss might have led to the few nesting opportunities and reproductive failure. The urban avoiders are the species that immediately vanish when an area is urbanized. The main driver of this decline in avian biodiversity is habitat loss.

Impact of physio-chemical parameters

Physio–chemical properties of the aquatic habitat largely determine the water bird community of wetland habitats, mainly by their direct and indirect impact on the availability and abundance of the bird's prey. The water birds obtain important nutrients by feeding on benthic fauna and plankton, the availability of which is governed by physio-chemical dimensions. Physio-chemical parameters of water like salinity, pH, water temperature, water depth, dissolved oxygen, turbidity etc. play a pivotal role to regulate the bird community and their prey items. Salinity is the prime factor that determines the quality of the foraging habitats.

DISCUSSION

Avian community structure is considered as an inevitable component of vibrant ecosystem and is reflective of the quality of the habitats. Therefore any sort of fluctuation in avian community dynamics has serious ramifications for the entire ecosystem. Birds are truly considered as one of the best tools and parameters of environmental vitality of any ecosystem because of their sensitivity to various kinds of perturbances [9]. Avian species diversity and richness varies greatly and not all species are uniformly distributed over a large ecological area because of varied nature of topography, vegetation composition and structure and availability of food and other factors influence species occurrence. Avian abundance is also affected by other factors such as migration, natality and mortality or due to changes in habitat structure and distribution pattern of food resources. Research data has pointed out strong patterns of association between bird community structure and the physical configuration of the environment. Analysis of diverse avian literature points towards some starking revelations that have jeopardized the entire avian community structure. The negative consequences of urbanization has severely affected the urban avifauna in multifaceted ways, be it availability of unhygienic food, diminished nesting sites, noisy surroundings because of high scale vehicular movement which has direct bearing on their communication channels there by affecting their mating pattern leading to reduced reproductive success. These negative consequences of urbanization on urban avifauna are highlighted by majority of the researchers through their published research work [10]. The research work in an urbanized setting has also pointed out that most of the birds try to avoid urban habitat and those species of birds who prefer to live there, have marked phenotypic transition especially being aggressive towards other living beings and that seems to be a potential research gap which further needs to be thoroughly analyzed and examined.

CONCLUSION

For thorough understanding of the bird community structure and niche relationships, in depth analysis of avian population in different habitats is akin not only to understand the avian community structure but it will be a catalyzing factor for effective management of avian populations .Analysis of varied research data on role of

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vegetation cover indicates an important trend that high vegetation cover in suburban and wild land areas supports rich avian diversity in comparison to urban landscape. In addition to vegetation cover, other habitat variables like number of vegetation layers, percentage of soil and percentage of leaf litter on land also plays important role in deciding the avian species richness of a habitat. In terms of habitat quality, variation in vegetation appeared to be more important determinant of bird diversity and richness, increased number of vegetation layers. The relevant literature has pointed out some serious ramifications of excessive use of pesticides, insecticides and fungicides on birds. But the potential impact of environmental contaminants on birds needs further detailed investigative analysis and is truly a hot spot for further research to collaborate and authentic the already existing research data in the relevant field. To effectively safeguard avifauna, a multipronged strategy needs to be devised at every level to conserve these ecologically sensitive and fragile creatures and every stakeholder has to take onus of protecting and restoring the past glory of glorified reptiles (aves).

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