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HABITAT UTILIZATION, FEEDING BEHAVIOR, AND DIET COMPOSITION OF THE BLACK MAGPIE *PLATYSMURUS LEUCOPTERUS* WITHIN GBOKO METROPOLIS IN BENUE STATE, NIGERIA

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Abstract

This study investigates the habitat utilization, feeding behavior, and diet composition of the Black-billed Magpie Platysmurus leucopterus within Gboko Metropolis, Benue State, Nigeria. Urbanization significantly alters biodiversity through habitat fragmentation and modification, yet some species, like the Black-billed Magpie, demonstrate remarkable adaptability to urban environments. Using the Timed Species Count (TSC) method, observations were conducted across five urban land-use types: residential areas, tertiary institutions, commercial zones, urban parks, and roadside vegetation. Results reveal significant variation in habitat preferences, with roadside vegetation being the most utilized habitat (60 observations), while commercial zones were the least (15 observations). Diet analysis highlights an insectivorous tendency (40%), supplemented by human food scraps (30%), fruits (20%), and other minor items (10%), demonstrating dietary plasticity. Feeding location preferences show a strong affinity for tree feeding (50%), followed by ground feeding (35%), with minimal reliance on garbage areas (15%). The findings underline the species' ecological adaptability, leveraging both natural and anthropogenic resources. This adaptability is attributed to their generalist behavior and omnivorous diet, allowing successful urban colonization.

Keywords: Habitat Utilization, Feeding Behavior, Diet Composition, Urban Ecology, Black-billed Magpie, Ecological Adaptability**.**

INTRODUCTION

Avian ecology and urbanization studies are essential for understanding how birds adapt to altered human landscapes, offering key insights into biodiversity conservation in rapidly urbanizing areas. Birds, with their mobility and adaptability, are vital indicators of ecosystem health (Aronson *et al*., 2014). The Black-billed Magpie (*Pica pica*) belongs to the Corvidae family. It is easily recognizable by its distinctive black and white plumage, long tail, and iridescent blue green markings on its wings. The species' sharp, inquisitive nature and robust bill reflects its adaptability and

opportunistic feeding habits, making it well-suited to a variety of environments, including urban settings. Black-billed Magpies are social and territorial, often forming small groups or pairs during breeding. They exhibit omnivorous feeding habits, consuming insects, fruits, seeds, small vertebrates, and even human food scraps. This diet makes them highly adaptable to urban environments where food sources can be unpredictable (Jokimäki *et al.*, 2017). Tree nesters, like the Magpie, find nest sites in urban woodlots, parks, private gardens, and rows of trees along streets. They likely take advantage of fragmented habitats and anthropogenic food sources, demonstrating their ability to thrive in human modified landscapes. The Black-billed Magpie is classified as Least Concern by the IUCN Red List, indicating stable global populations (IUCN Red List, 2021). However, localized threats such as habitat destruction, pollution, and climate change could impact certain populations, particularly in areas experiencing rapid urbanization or habitat degradation.

The Black-billed Magpie plays a significant role in maintaining ecosystem balance. Its foraging habits contribute to seed dispersal, pest control, and scavenging, which aids plant regeneration, regulates insect populations, and recycles organic matter (Castro *et al*., 2017). In urban environments, these ecological functions are particularly valuable, highlighting the species' role in promoting ecological resilience and fostering biodiversity in cities. Urbanization is widely recognized for its adverse effects on biodiversity, primarily through habitat loss, modification, or fragmentation (Elmqvist *et al*., 2016). However, certain wildlife species with high ecological and behavioral adaptability have demonstrated the capacity to thrive in urban and suburban environments. These areas may provide increased habitat heterogeneity, food resources, and milder microclimates, fostering high population densities for adaptable species (Šálek *et al*., 2015a). The shift of human populations from rural to urban areas has driven rapid urban expansion, resulting in extensive land-use alterations and significant changes in vegetation and species composition (UN, 2014; Francis and Chadwick, 2013). Urban environments differ markedly from natural landscapes, characterized by predictable anthropogenic food sources, frequent human disturbances, and fragmented habitats. Despite these challenges, many species have successfully colonized urban areas, exploiting novel ecological niches created by urbanization (Kaisanlahti-Jokimäki and Carbó-Ramirez, 2014).

Birds, particularly those with specific ecological traits, have demonstrated remarkable adaptability to urban environments. Corvids, such as the Black-billed Magpie (*Pica*), exemplify this success due to their dietary and habitat plasticity, as well as cognitive attributes like large brain size, which enhance their capacity to navigate novel urban conditions (Evans *et al*., 2010). The urbanization process for bird species typically progresses through three stages: arrival, adjustment, and spread. These phases are influenced by factors such as population density in native habitats, ecological adaptability, and reproductive success (Clucas and Marzluff, 2012). Black-billed Magpie populations have grown significantly in urban areas over the past five decades (Jokimäki *et al*., 2017). Their generalist habitat preferences and omnivorous diet contribute to their urban colonization success. Understanding the habitat utilization, feeding behavior, and diet composition of the Black-billed Magpie is vital for exploring how adaptable species navigate the complexities of urban environments. This research provides valuable insights into the bird's ability to thrive amid urban pressures, highlighting its role in maintaining ecological balance through activities like seed dispersal, pest control, and scavenging. It also accentuates the interconnectedness of urban biodiversity and ecosystem services.

Despite the Black-billed Magpie's prominence in both natural and urban settings, little is known about its specific ecological adaptations in peri-urban areas like Gboko Metropolis. Key questions remain about how the species selects habitats, shifts feeding strategies, and adapts its diet to cope with habitat fragmentation, resource scarcity, and human activity while focusing on the Black-billed Magpie's unique ability to adapt to urban environments, with a specific emphasis on the under explored peri-urban context of Gboko Metropolis. Its species-specific approach dives into the intricate ways the Black-billed Magpie interacts with urban ecosystems, rather than generalizing patterns across multiple species. By investigating how this species utilizes habitats, adapts its feeding behavior, and modifies its diet to navigate urban challenges, the research provides insights into the ecological plasticity of birds in rapidly urbanizing regions. This study aims to assess the habitat preferences of the Black-billed Magpie in urban environments as well as investigate the feeding habits and diet

composition of the Black-billed Magpie across different urban habitats.

MATERIALS AND METHODS

Study area

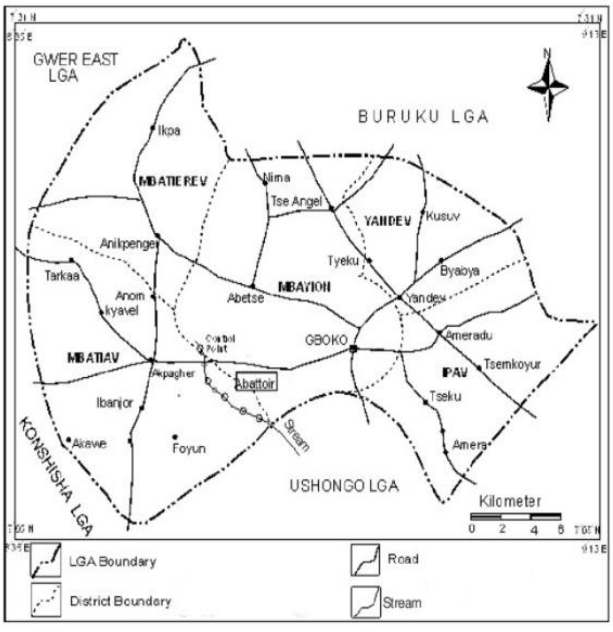
Gboko is one of the largest and most populous Local Government Areas (LGAs) in Benue State, Nigeria. It covers a land area of 1,835 km² and has a population density of 196.9 inhabitants per square kilometer, with a total population of 361,325 according to the 2006 National Population Commission census. Gboko is bordered by Tarka LGA to the north, Ushongo LGA to the south, Buruku LGA to the east, and Gwer LGA to the west. Geographically, it lies between latitudes 7°05′ and 7°31′ N, and longitudes 9°13′ and 9°35′ E, within Nigeria's savannah region, characterized by typical savannah vegetation and climate. (Ubwa *et al*., 2013).

Figure: 1. Map of Gboko Local Government Area

Source: Benue State Ministry for Lands and Survey

The study area encompasses a diverse range of habitats, including urban environments characterized by residential and commercial buildings, semi-urban areas with a mix of developed and undeveloped land, green spaces that provide roosting and nesting sites, and agricultural lands that may serve as supplementary feeding grounds.

The region experiences a savannah climate, with distinct wet and dry seasons, which may affect the availability of food resources and nesting sites. Vegetation predominantly consists of savannah grasslands interspersed with trees, shrubs, and urban greenery, such as parks and roadside vegetation (Ubwa *et al*., 2013). These ecological features play a crucial role in habitat selection and feeding strategies for the species, as they provide both food and shelter.



The area is undergoing significant urbanization, leading to land-use changes such as the conversion of natural habitats into residential and commercial zones. Anthropogenic pressures, including pollution, habitat fragmentation, and increased human activity, impact the availability of nesting sites and food sources. However, the presence of anthropogenic food sources, such as garbage dumps and leftovers, also provide new opportunities for the Black-billed Magpie to adapt and thrive in these changing landscapes.

Experimental Method

Field work covered Five land use types in urban settlements, namely: (1) Residential areas (2) Tertiary institutions and (3) Commercial centres (4) Urban Park (5) Roadside Vegetation. The study sites were visited fortnightly for three months. The "Timed Species Count (TSC)" technique of bird's survey developed by (Pomeroy and Tengecho, 1989) and adopted by Isah *et al.*, 2024 was used. The Timed Species Count (TSC) technique was employed for its efficiency, standardization, adaptability to urban environments, ability to capture activity patterns, reduction of observer bias, and facilitation of habitat specific comparisons. The technique was employed to assess the habitat preferences of the Black Magpie in an urban environment and to investigate the feeding habits and diet composition of the Black Magpie in different urban habitats. Feeding Ecology was **o**bserved using direct observation, whereby diet composition (insects, fruits, human food scraps, etc.), and feeding locations (trees, ground, garbage areas) were recorded. Point counts or predetermined locations were established across various land use types sampled within urban settlements. A minimum distance of 500m was maintained between each counting point. A total of 50 counting points were utilized, comprising 10 stations per land use type. Upon reaching the sites, observed Black Magpie species were recorded within a predetermined time frame (10 minutes).

Data Analysis

Descriptive statistics and Chi square were used.

Results and Discussion

Results

Table 1 presents the chi-square analysis of habitat utilization by the Black-billed Magpie across five urban habitat types. Significant variation was observed ($\chi2$=35.72, df=4, p<0.001). Roadside vegetation showed the highest utilization (60 observations), while commercial zones were the least used (15 observations). Urban parks, residential areas, and tertiary institutions had intermediate usage patterns. These results indicate that the Black-billed Magpie prefers habitats with more vegetation cover or reduced human activity.

Table 1: Chi-Square Analysis of Habitat Utilization by Black Magpie

Habitat Type	Observed Frequency (O)	Expected Frequency (E)	(O - E)	$(O - E)^2$	$(O - E)^2 / E$
Urban Park	45	35	10	100	2.86
Residential Area	30	35	-5	25	0.71
Commercial Zone	15	35	-20	400	11.43
Roadside Vegetation	60	35	25	625	17.86
Tertiary Institutions	25	35	-10	100	2.86

Chi-Square Value ($\chi2$) = 35.72, **Degrees of Freedom (df)** = 4, **p-value** < 0.001

The Black-billed Magpie's diet composition highlights a predominantly insectivorous tendency, with insects comprising 40% of the diet. Human food scraps contribute significantly (30%), reflecting urban influences, while fruits (20%) and other items such as seeds, and small animals (10%) make up the remainder. These findings suggest that while urbanization affects diet composition, the Black-billed Magpie retains a substantial reliance on natural food sources.

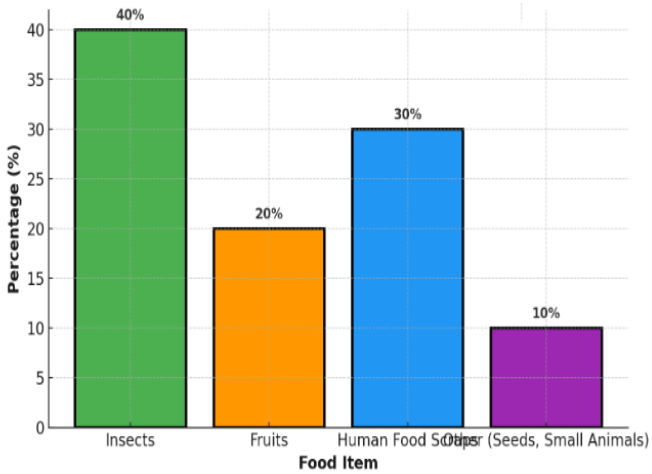


Figure 2: Diet Composition of Black Magpie in Gboko

The chi-square analysis of feeding location preferences (Table 2) revealed significant differences ($\chi2$=18.51, df=2, p<0.001). Magpies exhibited a marked preference for feeding in trees (50%), significantly exceeding expectations. Ground feeding accounted for 35% of observations, while garbage areas were the least used (15%). These preferences suggest ecological advantages to elevated feeding, such as better access to prey, reduced competition, and avoidance of urban threats.

Table 2: Chi-Square Test Table for Feeding Locations

Feeding Location	Observed Frequency (%) (O)	Expected Frequency (%) (E)	(O - E)	$(O - E)^2$	$(O - E)^2 / E$
Ground	35	33.33	1.67	2.79	0.08
Trees	50	33.33	16.67	278.09	8.34
Garbage Areas	15	33.33	-18.33	336.49	10.09

Chi-Square Value ($\chi 2$) = 18.51, **Degrees of Freedom (df)** = 2, **p-value** < 0.001

These findings highlight the Black-billed Magpie's adaptability to urban environments, with clear habitat and feeding preferences reflecting a balance between natural behaviors and urban influences.

Discussion

The results reveal significant variations in habitat preferences and feeding strategies, highlighting the species' ecological adaptability and responses to urbanization. The chi-square analysis demonstrated significant variation in habitat utilization ($\chi 2$=35.72, df=4,p<0.001), with roadside vegetation showing the highest preference. This suggests that roadside areas, often characterized by vegetation strips and reduced human interference, may provide favorable conditions for nesting, foraging, and safety. In contrast, commercial zones were the least utilized, likely due to high levels of anthropogenic disturbances and limited availability of natural resources. These findings are consistent with previous research indicating that urban birds favor areas with structural complexity and reduced disturbance (Francis and Chadwick, 2013). The intermediate usage of urban parks, residential areas, and tertiary institutions further supports the notion that habitat heterogeneity in urban landscapes plays a critical role in accommodating adaptable species such as the Black-billed Magpie.

The Black-billed Magpie's diet composition reflects a predominantly insectivorous tendency (40%), coupled with substantial reliance on anthropogenic resources, as evidenced by the significant contribution of human food scraps (30%). These results align with studies by Šálek *et al.*, (2015a), which suggest that urban birds exploit readily available food resources while maintaining connections to their natural foraging habits. The moderate presence of fruits (20%) and other items such as seeds and small animals (10%) indicate dietary flexibility, a key trait enabling the species to thrive in diverse urban habitats. Such dietary adaptability may be a response to the heterogeneous resource distribution typical of urban landscapes (Evans *et al.*, 2010).

The chi-square analysis of feeding location preferences ($\chi 2$=18.51, df=2, p<0.001) highlight a marked preference for tree feeding (50%), significantly exceeding expected proportions. Elevated feeding sites likely confer ecological advantages such as reduced predation risk, better access to insect prey, and decreased competition. This is consistent with findings by Clucas and Marzluff (2012), who noted the importance of foraging height in urban bird populations. Ground feeding, accounting for 35% of observations, indicates continued use of terrestrial resources, while minimal use of garbage areas (15%) highlights a limited reliance on waste despite the urban setting. These preferences suggest that the Black-billed Magpie retains behavioral strategies closely tied to its natural ecology, even in urbanized environments.

The Black-billed Magpie's ability to exploit urban habitats and maintain a varied diet illustrates its ecological plasticity and resilience to anthropogenic pressures. Urban environments, while presenting challenges such as habitat fragmentation and increased human disturbances, also create novel ecological niches that benefit species with adaptive traits.

Urban environments enhance ecological niches that support species with adaptive traits, such as the Black-billed Magpie, by modifying habitat structure, resource availability, and microclimatic conditions, often leading to increased insect abundance a critical food source. Anthropogenic activities, including artificial lighting, attract nocturnal insects, while organic waste and improperly managed refuse sites provide breeding grounds for flies, beetles, and other detritivorous insects. Urban landscaping practices, characterized by ornamental vegetation and year-round flowering plants,

sustain populations of pollinators and herbivorous insects, while reduced predator pressures in cities further facilitate insect proliferation. The Magpie's generalist behavior, omnivorous diet, and preference for vegetation-rich areas showcase their success as an urban colonizer. This study contributes to the growing body of research on urban ecology by emphasizing the complex interactions between urbanization and wildlife, particularly for species with high ecological adaptability.

Conclusion and Recommendations

This research highlights the Black-billed Magpie's remarkable adaptability in urban settings, driven by habitat and dietary flexibility. However, further studies are needed to examine the long-term ecological and evolutionary implications of urbanization on this species. Investigating reproductive success, survival rates, and interspecific interactions in urban and peri-urban areas could provide deeper insights into the mechanisms underlying urban colonization.

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