*https://dx.doi.org/10.4314/dujopas.v10i1c.16*
*ISSN (Print): 2476-8316*
*ISSN (Online): 2635-3490*

**Dutse Journal of Pure and Applied Sciences (DUJOPAS),** *Vol. 10 No. 1c March 2024*

# Habitat Utilization and Niche Partitioning in Starling Birds at Federal University Dutse, Nigeria

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## Abstract

*The micro habitat or niche which a species occupies at a particular time in an ecosystem may give some clue to niche partitioning with regards to such species in that ecosystem. This study aimed to assess habitat utilization patterns as cue to niche partitioning in starling birds of Federal University Dutse. Point count bird census technique was used to survey starling bird at sixteen (16), randomly selected points, across various habitat types within the study location. All starling birds seen or heard were identified, counted and recorded. The habitat or niche where they were sited was also noted. The R Statistical software, version 3.3 was used for data analysis. The result showed that starling birds species diversity differed significantly by study area points ($p < 0.001$), habitat types ($p < 0.05$) and marginally by occurring niche ($p = 0.06$). Point 13 had the highest species diversity, habitat types consisting farmlands and buildings had the highest species diversity and the highest starling diversity was observed on trees. Starling bird abundance on the other hand, differed significantly across study points ($p = 0.05$) and marginally across occurring niches ($p = 0.06$). Starling bird abundance was highest at study area point 5 and on trees.*

**Keywords:** Habitat utilization, Niche partitioning, Species diversity, Starling birds

## INTRODUCTION

Niche partitioning is crucial in the minimization of inter and intraspecific competition among species (Roughgarden, 1976). Starlings are sympatric species of birds belonging to the family Sturnidea and are mostly omnivorous. Thus, they occupy similar habitats and feeding niches in the ecosystem. It is almost impossible for sympatric species to inhabit the same ecological niche, consequently, it is imperative that these birds would have evolved some kind of niche partitioning mechanism in their evolutionary life history (Polechová & Storch, 2008). Sympatric species exhibit some form of differential use of resources (Fossette et al., 2017), to moderate or avoid competition for food and space (Chapin Iii et al., 2000), through partitioning (Carstensen et al., 2011), otherwise the stronger competitor dominates the weaker one (Griffin & Silliman, 2011).

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Studies have investigated patterns and mode of niche partitioning in avian species because of its importance to their conservation, especially for threatened species. For example, reproduction in the endangered Gouldian finches may be constrained by their relatively specialized nesting niche and overlap with the Long-tailed finches which are generalist (Brazill-Boast et al., 2010). High tropic niche overlap has been reported among mixed-species colonies, although it is uncertain whether this can limit their coexistence (Gameiro et al., 2022). Habitat partitioning was also suggested to be important mechanism in of coexistence of Lewis's and Red-headed woodpeckers (Vierling et al., 2009). Kambai et al., (2021) observed that Sunbirds use resources in different ways as a form of niche partitioning.

This study aimed to examine Starling bird habitat utilization patterns as cue to niche partitioning, which would inform conservation methods.

## METHODOLOGY

### Study Area

The study was conducted at Federal University Dutse, Jigawa State Nigeria (Figure 1). The vegetation is savannah. The average annual rainfall is 650mm. The minimum and maximum temperature is 32$^{0C}$ and 41$^{0C}$ (Bidoli et al., 2012).

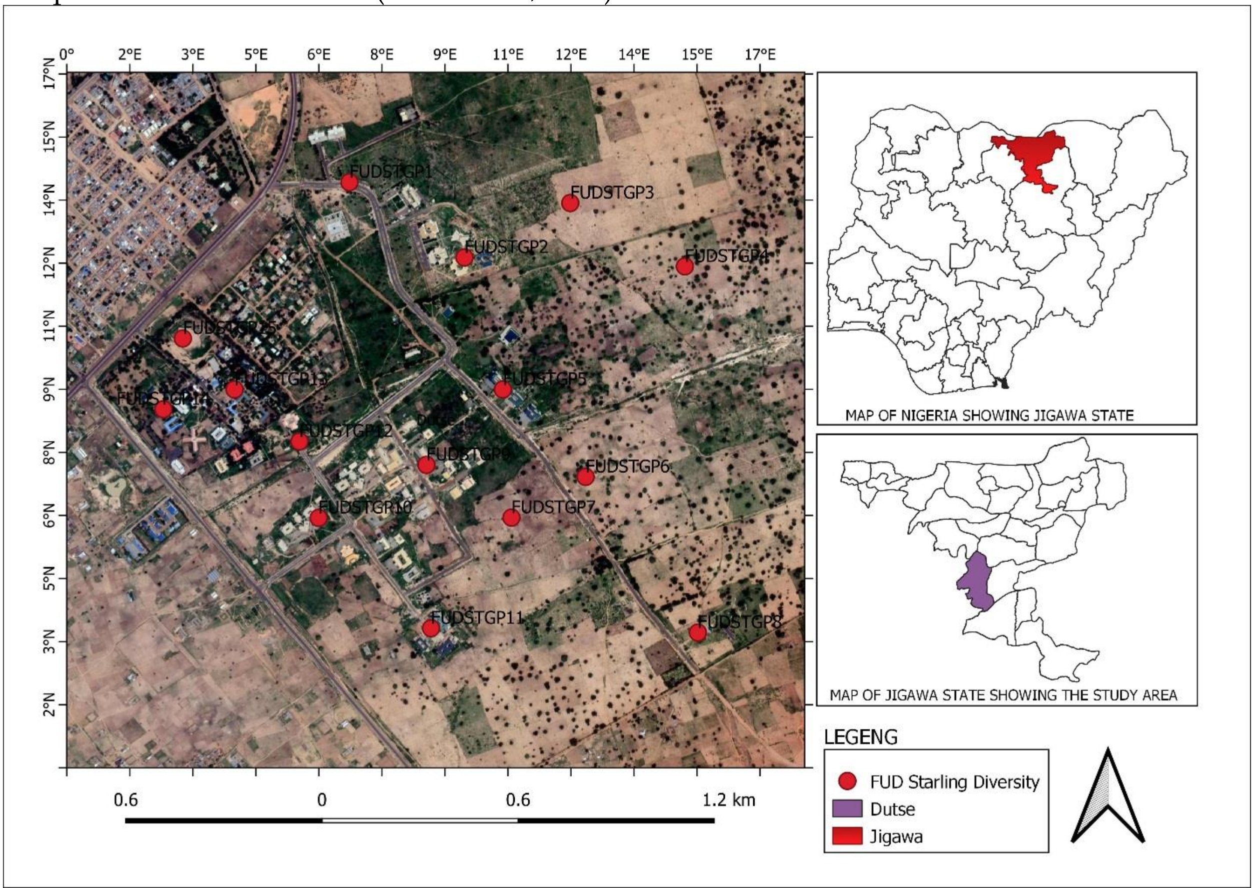


**Figure 1. Map of Dutse showing location and points**.

### Data Collection

Bird Census

Bird abundance was obtained using point count bird census technique (C. Bibby et al., 1998; C. J. Bibby et al., 1989). Birds were surveyed at sixteen (16) points, randomly selected across various habitat types within the university campus from 6.30am – 10.30am in the mornings. Points were at least 100m apart and marked with the aid of a Global Positioning System (GPS)

Unit. Within a 100m radius at each point, birds were observed for 20mins, and all birds encountered were identified and recorded. The micro habitat or niche at which birds were sited and their activities were also noted and recorded.

**Statistical Data Analysis**
The statistical software R (Team, 2012) was used for data analysis with Linear models (LM) and generalized linear model (GLM). Tukey (HSD) post hoc test was used to assess pairwise comparison of variables within groups. Graphs were plotted using the means and the standard error values obtained from the Linear and Generalized Linear Models.

**RESULTS**
Starling bird habitat utilization
Starling species diversity differed significantly by study points and habitat types (Table 1).

**Table 1: Starling species diversity across study points and habitat types**

| Variables | Df | Sum Sq | Mean Sq | F value | Pr (>F) |
|---|---|---|---|---|---|
| Point | 15 | 12.4257 | 0.8284 | 10.9318 | **< 0.001** |
| Habitat | 1 | 0.5046 | 0.5046 | 6.6590 | **< 0.05** |

The response variable is Starling Species Diversity Index. Significant differences are highlighted in bold. Adjusted $R^2$ = 0.59
Point thirteen (13) had the highest species diversity index while point twelve (12) had the lowest. (Figure 1).

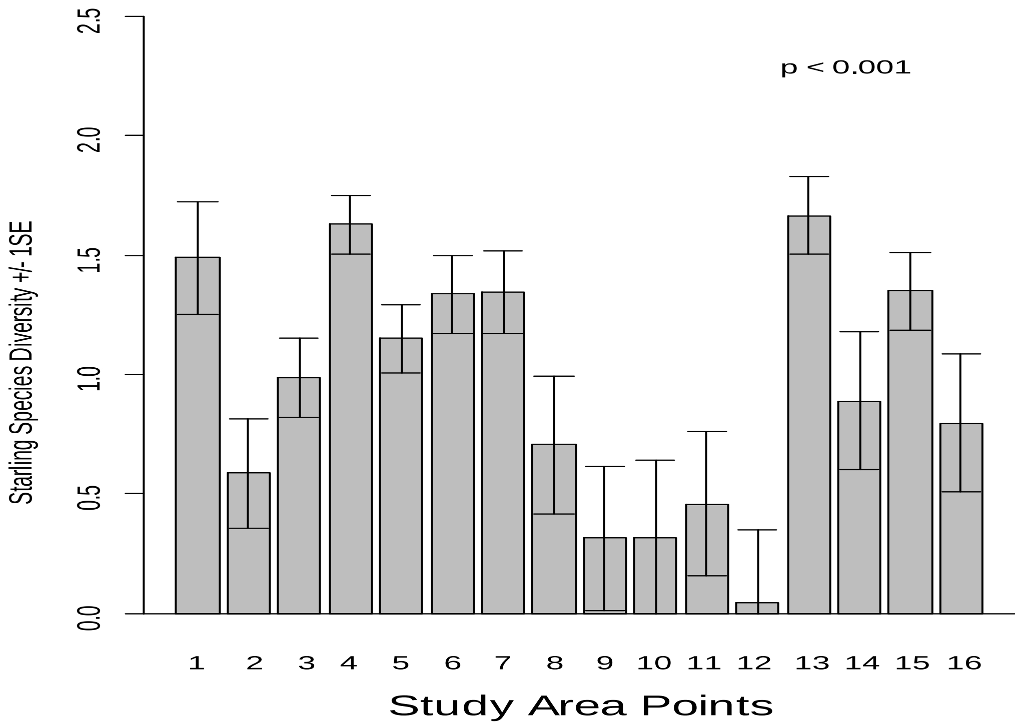


**Figure 2: Starling Species diversity across study area points**

Habitat with Farmland and Buildings had the highest Starling species diversity, while habitat with Farmland, Building and Woodland had the least (Table 2).

**Table 2: Starling species diversity across habitat types**

| Habitat type | Species diversity index |
|---|---|
| Buildings and Woodland | 0.823358 |
| Farmland | 0.618974 |
| Farmland and Buildings | **0.830537** |
| Farmland, Building and Woodland | **0.319048** |

Starling bird abundance differed significantly by study points but not by habitat types (Table 3)

**Table 3: Starling bird abundance by study points and habitat types**

| Variables | Df | Deviance | F value | Pr(>F) |
|---|---|---|---|---|
| Study Point | 13 | 268.56 | 1.8114 | **0.05** |
| Habitat | 1 | 227.07 | 2.4553 | 0.12 |

The response variable is Starling bird abundance. The error distribution is Poisson. Significant differences are highlighted in bold. Pseudo $R^2$ = 0.11

Point five (5) had the highest Starling bird, abundance while point eleven (11) had the lowest (Figure 3).

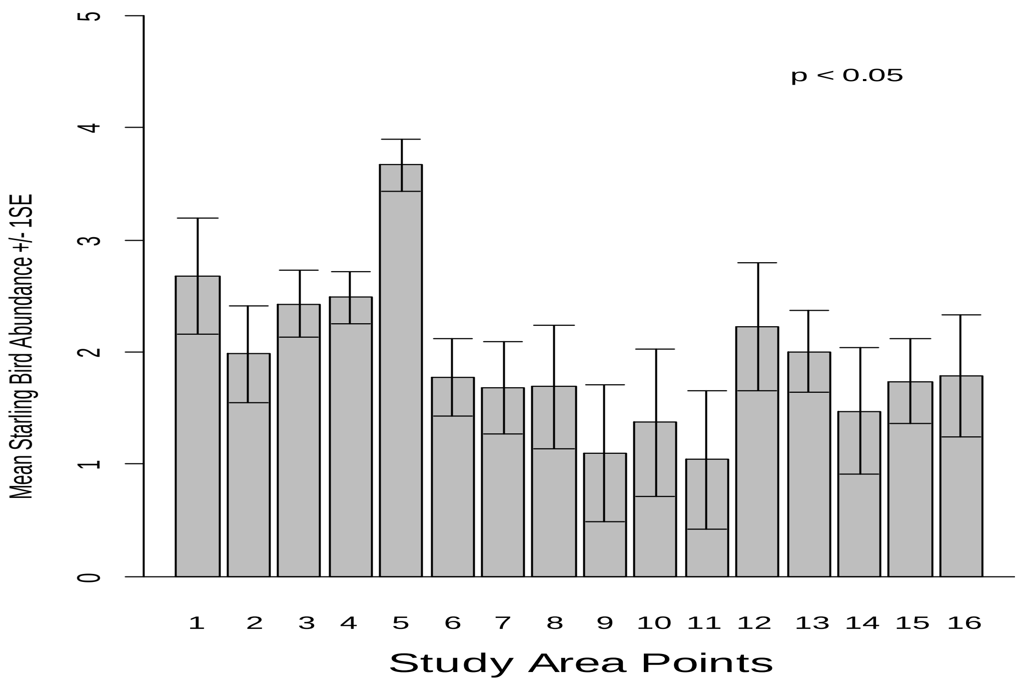


**Figure 3. Starling bird abundance across study area points**

## Niche Partitioning

Starling species diversity differed marginally by occurring niche (Table 4).

**Table. 4 Starling species diversity by occurring niche**

| Variables | Df | Sum Sq | Mean Sq | F value | Pr (>F) |
|---|---|---|---|---|---|
| Niche | 9 | 1.3091 | 0.14545 | 1.9195 | **0.06** |

The response variable is Starling Species Diversity Index. Significant difference is highlighted in bold. Adjusted $R^2$ = 0.59

Trees held the highest starling species diversity, while bare ground, telecom mast and water held the least (Table 5).

**Table. 5 Starling species diversity across occurring niche**

| Niche Sited | Species Diversity Index |
|---|---|
| Air | 1.1350 |
| Garbage | 0.6792 |
| Farmland | 0.6792 |
| Grass | 0.757 |
| Ground | **0.0** |
| Telecom Mast | **0.0** |
| Power Line | 0.6717 |
| Roof | 0.6365 |
| Tree | **1.4010** |
| Water | **0.0** |

Starling bird abundance differed marginally by occurring niche (Table 6).

**Table 6. Starling bird abundance by occurring niche**

| Variables | Df | Deviance | F value | Pr(>F) |
|---|---|---|---|---|
| Occurring Niche | 9 | 255.78 | 1.8945 | **0.06** |

The response variable is Starling bird abundance. The error distribution is Poisson.
Significant difference is highlighted in bold. Pseudo $R^2$ = 0.11

There was variations in starling bird abundance by starling species across the various occurring niches, where they were observed. All starling species observed were sited on trees, while only single species were sited on bare ground, telecom-mast and water (Table 7).

**Table 7. Starling bird abundance across occurring niches**

| | Starling Birds | | | | | |
|---|---|---|---|---|---|---|
| Niche sited | Chestnut bellied | Greater blue-eared | Lesser blue-eared | Long-tailed glossy | Purple-glossy | TOTAL |
| Air | 68 | 5 | 0 | 37 | 25 | 135 |
| Garbage | 7 | 0 | 0 | 5 | 0 | 12 |
| Farm | 63 | 1 | 0 | 3 | 4 | 71 |
| Grass | 62 | 10 | 0 | 4 | 4 | 80 |
| Ground | 4 | 0 | 0 | 0 | 0 | 4 |
| Telecom-mast | 0 | 3 | 0 | 0 | 0 | 3 |
| Power line | 75 | 5 | 1 | 0 | 14 | 95 |
| Roof | 0 | 1 | 0 | 0 | 2 | 3 |
| Tree | 59 | 16 | 9 | 73 | 44 | 201 |
| Water | 0 | 0 | 0 | 3 | 0 | 3 |

## DISCUSSION

The difference in Starling species diversity observed at study points suggested, starling species distribution patterns (Blackburn & Gaston, 1996) as they occur and select habitats according to their ecological needs (Brotons et al., 2007). The species diversity observed across different habitat types, indicates some habitat preference by starling species (Leveau, 2019; Ozdemir et al., 2018). The highest diversity observed at the farmland and buildings could be because of habitat heterogeneity (Melles et al., 2003) or some resources which they obtain from such habitat types (Canterbury et al., 2000). Lower diversity observed when woodland occurred alongside farmlands and buildings may indicate less preference for woodland areas by starlings (Hedblom & Söderström, 2010; Mason, 2001; Robinson et al., 2005). However, woodlands are suggested to be important habitat for the conservation of birds (Antos & Bennett, 2005).

The highest diversity observed on trees may be an indication of some ecological benefits they provide (Gray & van Heezik, 2016; Pena et al., 2017) for starlings (Clergeau & Quenot, 2007; Czajka et al., 2011; Ingold, 1990; Sedgwick & Knopf, 1990). The least diversity at telecom-mast may be because, most times, birds cited here are only perched and not doing anything else, consequently they may prefer to do so with similar species (Cody, 1974; Ward & Zahavi, 1973). Starling species may also prefer not to drink in mixed flock (Fisher et al., 1972) although, a study suggested otherwise (Evans et al., 1985). This may also be associated to the abundance of water and thus less competition (Colorado Zuluaga, 2013; Ward & Zahavi, 1973) or the need for water (Czenze et al., 2020). Generally, low diversity observed could indicate some kind of niche partitioning (Green, 1998). Variations in Starling abundance across niches, gives a clue to some utilization patterns according to starling preference, habitat selection and need (Choudhary et al., 2023; Gameiro et al., 2022; Patterson et al., 2003).

## CONCLUSION

There was variation in starling bird habitat utilization and niche partitioning. Starling bird species diversity differed significantly by study area points with point 13 having the highest diversity and point 12 having the least. Starling species mostly utilize habitat types consisting, farmlands and buildings and use habitats with farmlands, buildings and woodlands the least. Highest starling diversity was observed on trees and the least on roof tops and telecom-mast. Starling bird abundance on the other hand, also differed significantly across study points. Point 5 had the highest abundance and point 11 had the least. The highest starling abundance was on trees and the least on telecom-mast and water.

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