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Species Diversity and Abundance of Starling Birds at Federal University Dutse, Nigeria

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Abstract

The biodiversity of an ecosystem can give information on the health of that ecosystem. This study examined starling bird species diversity and abundance, as well as the effects of vegetation and season of the year on starling birds at Federal University Dutse. Point count bird census technique was used to survey starling birds at sixteen (16), randomly selected points, within the study location, during the rainy and dry seasons of the year. Vegetation measurement was also taken. The number of trees were counted and percentage grass cover was estimated. Data analysis was carried out using the statistical software R version 3.3. A total of 607 individual birds of five (5) starling species; Chestnut-bellied starling, Greater blue-eared starling, Lesser blue-eared starling, Long-tailed glossy starling and Purple glossy starling were observed. There was a significant negative relationship between Starling species diversity and percentage grass cover ($p < 0.001$) as Starling species diversity decreased with increase in percentage grass cover. Starling species diversity also differed significantly by seasons of the year ($p < 0.001$), with higher diversity recorded during the dry season. Starling bird abundance on the other hand, also decreased marginally with increase in percentage grass cover ($p = 0.06$) and was higher during the dry season of the year ($p = 0.01$). The most abundant Starling bird species was the Chestnut-bellied starling ($p < 0.001$).

Keywords: Starling birds, Species diversity, Abundance, Vegetation, Season

INTRODUCTION

Species diversity is the number of unique individual species living in a habitat at a particular time, this shows the ecological health of the habitat, because higher diversity suggest better ecological health (Duelli & Obrist, 2003; Gaston, 1996; Huston, 1994).

Birds belong to the class Aves (van Tuinen, 2009) and are the most diverse of the existing pedigree of tetrapod vertebrates (Prum et al., 2015). They are greatly wide spread, with variations in their distribution and habitat selection (Callaghan et al., 2021) and are important bio-indicators of the state of an environment (Mekonen, 2017).

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Starlings are bird species belonging to the family Sturnidae. They are distributed across a wide range of habitat and are rarely migratory, although, some Starlings, especially hatching-year individuals, migrate up to several hundred miles (Johnson & Glahn, 1994). A plethora of studies have suggested decline in Starling bird population (Callaghan et al., 2021; Crick et al., 2002; Robinson et al., 2005; Stuart et al., 2023; Svensson, 2004).
This study aimed to determine Starling species diversity and abundance, along with vegetation and seasonal variations at Federal University Dutse.

METHODOLOGY

Study Area

The study was conducted at Federal University Dutse, Jigawa State Nigeria (Figure 1). There are mainly two seasons in one year; rainy and dry. The average annual rainfall is 650 mm. The minimum and maximum temperature is 32^0C and 41^0C (Bidoli et al., 2012).

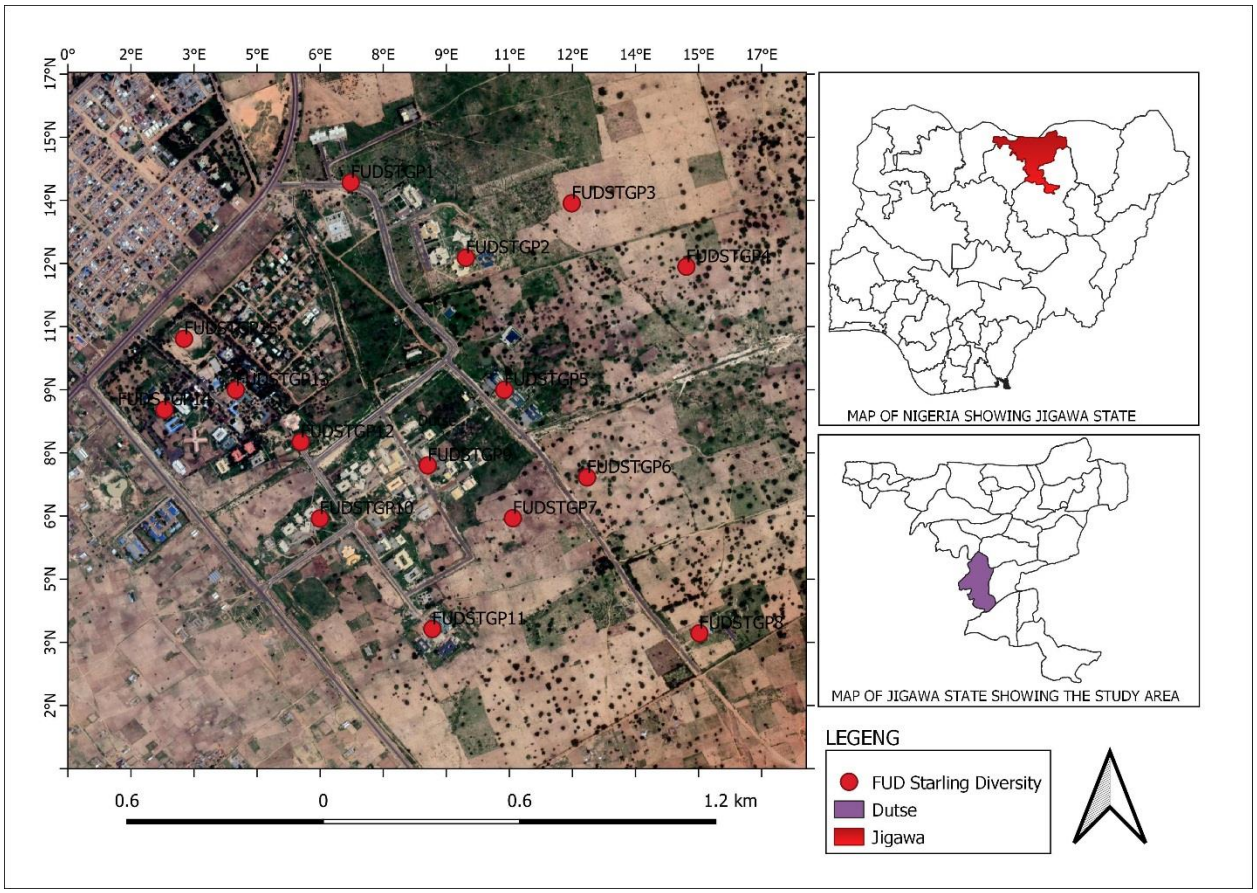

Figure 1. A Map showing the sampling Points in the Study Area

Data Collection

Bird Census

Bird abundance was obtained using point count bird census technique (Bibby et al., 2000b, 2000a) Bird was surveyed at sixteen (16) points, randomly selected within the university campus from 6.30am – 10.30am in the morning, during the rainy and dry seasons of the year. Points were marked with the aid of a Global Positioning System (GPS) Unit, with each point at least 100 Meters apart. Birds were observed within a 100 Meters radius, for 20 minutes at each point and all Starling birds seen or heard were identified and recorded. All points were visited once in each season.

Vegetation Measurements
Vegetation variables were measured within a 100 Meters radius at every point where bird was surveyed. The number of trees were counted and percentage grass cover was estimated by eye (Manu, 2003).

Statistical Analysis
Species diversity index was calculated using the Shannon wiener diversity index.

$$\text{Shannon} - \text{Weiner diversity index (H`)} = \sum_{n,=N}^{s} \text{pi ln (pi)}$$

Equation 1. Shannon – Weiner diversity index
Further analysis was carried out using the statistical software R (Team, 2012). The distribution of the data was determined and species diversity was normally distributed, while abundance was Poisson. Thus, Linear Models (LM) and Generalized Linear Model (GLM) was used for further analysis respectively. An analysis of covariate was used to check the effects of season of the year and vegetation measurements on species diversity and abundance. Tukey (HSD) post hoc test was used to assess pairwise comparison of variables within the group. Graphs were plotted using the means and the standard error values obtained from the models.

RESULTS
Starling species diversity and abundance
A total of six hundred and seven (607) individual birds, consisting of five (5) species, belonging to the family Sturnidae were recorded (Table 1).

Table 1: List of Starling bird species observed at the study area during the survey

Common Name	Scientific Name	Family	Feeding Guilds
chestnut-bellied starling	*Lamprotornis pulcher*	Sturnidae	Omnivorous
greater blue-eared starling	*Lamprotornis chalybaeus*	Sturnidae	Omnivorous
lesser blue-eared starling	*Lamprotornis chloropterus*	Sturnidae	Omnivorous
long-tailed glossy starling	*Lamprotornis caudatus*	Sturnidae	Omnivorous
purple glossy starling	*Lamprotornis purpureus*	Sturnidae	Omnivorous

Starling bird abundance differed significantly by species (Table 2).

Table 2: Starling bird abundance by species observed at the study area

Variables	Df	Deviance	F value	Pr(>F)
Starling species	4	256.79	4.39	**<0.001**

The response variable is Starling bird abundance. The error distribution is Poisson. Significant difference is highlighted in bold. Pseudo R^2 = 0.11.
Chestnut-bellied starling had the highest mean abundance while lesser blue-eared starling had the least. (Figure 2).

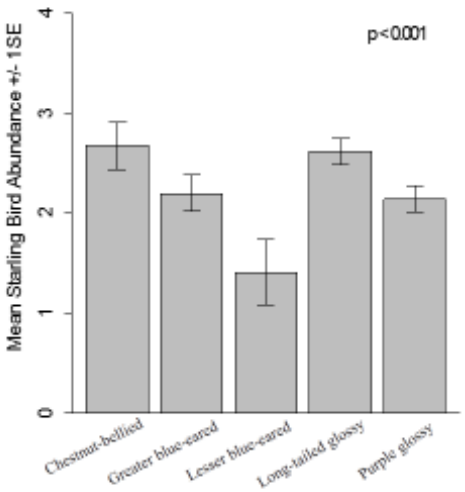

Figure 2. Mean Starling bird abundance by species

Effects of Vegetation Measurements

Starling species diversity differed significantly by percentage grass cover (Table 3).

Table 3: Starling species diversity by percentage grass cover

Variables	Df	Sum Sq	Mean Sq	F value	Pr (>F)
Percentage vegetation cover	1	1.37	1.37	18.07	**<0.001**

The response variable is Starling species diversity index. Significant relationship is highlighted in bold. Adjusted R^2 = 0.59.

There was a negative relationship between Starling species diversity and percentage grass cover. Starling species diversity decreased as percentage grass cover increased (Figure 3).

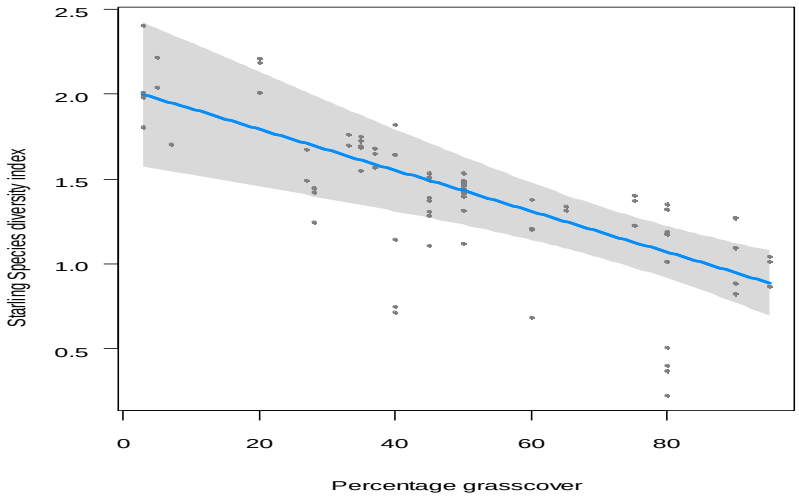

Figure 3. Relationship between Starling Species diversity and percentage grass cover

Starling bird abundance on the other hand differed marginally by percentage grass cover (Table 4).

Table 4: Starling bird abundance by percentage grass cover

Variables	Df	Deviance	F value	Pr(>F)
Percentage vegetation cover	1	228.99	3.43	**0.06**

The response variable is Starling bird abundance. The error distribution is Poisson. Significant relationship is highlighted in bold. Pseudo R^2 = 0.11.
There was a negative relationship between Starling bird abundance and percentage grass cover. Starling bird abundance decreased as percentage grass cover increased (Figure 4).

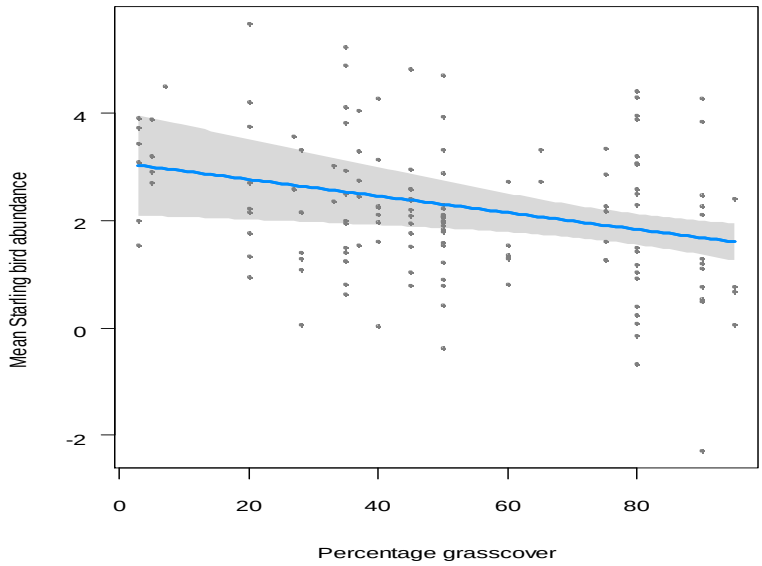

Figure 4. Relationship between Starling bird abundance and percentage grass cover
Seasons of the year

Starling species diversity differed significantly by seasons of the year (Table 5).

Table 5: Starling species diversity differed by seasons of the year

Variables	Df	Sum Sq	Mean Sq	F value	Pr (>F)
Season of the year	1	0.87	0.87	11.45	**0.001**

The response variable is Starling species diversity index. Significant difference is highlighted in bold. Adjusted R^2 = 0.59.
Starling species diversity was higher during the dry season compared to the rainy season. (Figure 5).

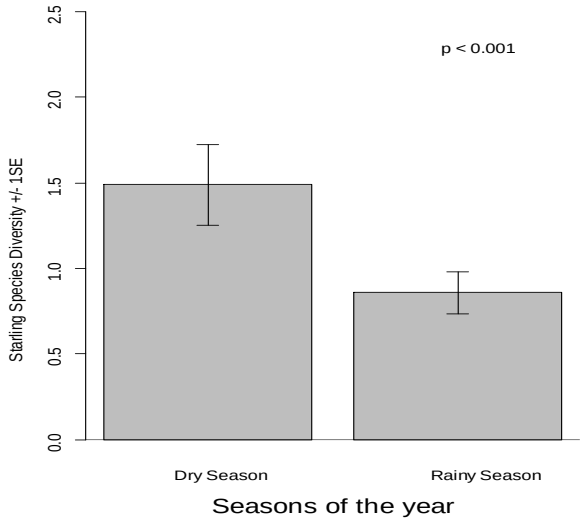

Figure 5. Starling species diversity by seasons of the year

Starling bird abundance also differed significantly by season of the year (Table 6).

Table 6: Starling bird abundance by season of the year

Variables	Df	Deviance	F value	Pr(>F)
Season of the year	1	237.78	7.90	**0.01**

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

Starling bird mean abundance was higher during the dry season compared to the rainy season. (Figure 6).

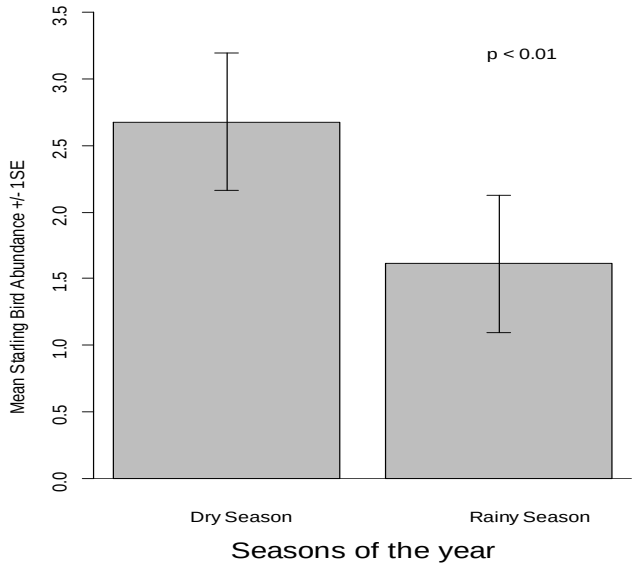

Figure 6. Starling bird abundance by seasons of the year

DISCUSSION

Four species of starling observed during the study, were within their distribution range (Borrow & Demey, 2008; Fry, 1966). Although, the research considered season of the year in order to account for migrants species, no seasonal migrant was observed (Borrow & Demey, 2008; Fry, 1966; Ringim et al., 2022). Variations in starling bird abundance by species may be as a result of some selection or behavioral differences (Fry, 1966). The highest abundance observed in Chestnut bellied starlings may be because, they are the most wildly distributed of their genus (Wilkinson, 1983) which has also been observed in previous study (Muhammad et al., 2018).

The negative relationship between percentage grass cover and starling species diversity and abundance may indicate their preference for less dense vegetation types (MacArthur, 1964), although previous studies have suggested that vegetation was important to birds (Adegbola et al., 2024). This may also be associated with their foraging behavior, as it would be easier for them to see and pick seeds and invertebrates in open areas (Chettri et al., 2005).
The higher diversity and abundance of starling observed during the dry season compared to the rainy season (Muhammad et al., 2018) may also be an indication that starling utilize the study area during this time of the year when food resources may be less available (Poulin et al., 1992).

CONCLUSION

Chestnut-bellied starling, Greater blue-eared starling, Lesser blue-eared starling, Long-tailed glossy starling and Purple glossy starling were the five species of starlings recorded during the study. Starling species diversity decreased with increase in percentage grass cover and was higher during the rainy season of the year. Starling bird abundance on the other hand, decreased marginally with increase in percentage grass cover and was higher during the dry season of the year. Chestnut-bellied starlings was the most abundant species recorded.

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