

Bird Diversity in Mangroves of Palaes Village, West Likupang District, North Sulawesi Province

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Abstract: Bird diversity is an important indicator of ecosystem health because it is closely related to the availability of food sources, habitat structure, and stability of ecological processes. Palaes Village, West Likupang Subdistrict, has a mangrove habitat but scientific information on bird communities in this area is still limited. This study aims to evaluate the abundance and diversity of bird species in this habitat type and analyze their relationship with habitat characteristics. Data collection was conducted in mangrove forests consisting of five randomly selected plots with a distance of 150 m between plots. The method used was point count with a radius of 10 m and an observation time of 15 minutes per plot, which was carried out twice a day in the morning and evening. All individual birds observed were recorded and identified using the Wallacea bird guidebook and supporting online sources. Data were analyzed using the PAST 5.2.2 application to calculate the Shannon index (H'). The results recorded 13 bird species, with the most dominant species being *Collocalia esculenta* with a relative abundance of 33.75%. The total Shannon index (H') value of 2.18 is included in the medium category, mangrove habitats with more heterogeneous vegetation structures tend to support higher species diversity. The results of this study indicate that mangrove habitats in Palaes Village still have an important carrying capacity for bird communities and have the potential to be utilized as a basis for environmental management planning and the development of community-based bird watching ecotourism.

Keywords: bird diversity; *Collocalia esculenta*; habitat; Palaes Village

Introduction

Bird diversity is one of the key indicators for assessing the health and stability of an ecosystem. High bird diversity reflects an ecosystem's capacity to provide adequate resources and perform its ecological functions, thereby enabling the organisms living within it to form reciprocal relationships and dependencies with their environment (Kusumahadi, 2020). Factors such as vegetation diversity, food availability, and habitat type and extent significantly influence the presence of birds in a given area (Harrison et al., 2014).

Indonesia is recorded as having more than 1,539 bird species, with approximately 17% of them being endemic species (Alberto, 2023). Of this total, 104 species are categorized as globally endangered, while another 152 species fall into the near-threatened category (Apriliano, 2023). The presence and number of bird species in a given location are significantly influenced by physical environmental factors, such as soil conditions, water availability, temperature, and sunlight intensity, as well as biological factors including vegetation structure and composition and the presence of other organisms in the habitat (Alberto, 2023). Therefore, the level of bird diversity in a region can reflect the ecosystem's ability to support the lives of various other organisms.

Within ecosystems, birds play various important roles that contribute to the stability and sustainability of ecological processes. As seed dispersers, birds aid in vegetation regeneration and maintain the dynamics of plant communities. Many bird species also play a role in pollination processes that support the sustainability of flora (Wulan et al., 2024). Additionally, birds function as natural predators of insects and pests, thereby playing a role in controlling the populations of other organisms (Ramadhan et al., 2021). Some bird species are even classified as keystone species—organisms whose presence can indirectly influence the survival of various other species through their role in maintaining the balance of ecosystem structure and function.

Palaes Village, Likupang Barat Subdistrict, North Sulawesi Province, possesses various habitat types with the potential to support high bird diversity, including mangrove forests, areas around waterfalls, and plantation zones. Preliminary studies in the North Sulawesi region, such as the research by Saleh et al. (2023) which identified several important species in mangrove forests, indicate that areas with a combination of coastal and terrestrial habitats generally have high potential for bird diversity. Similar conditions are likely present in Palaes Village, given the existence of a diverse mosaic of habitats that still relatively supports the ecological needs of various bird species.

However, to date, there has been no comprehensive study specifically mapping the species composition, diversity levels, and environmental factors influencing bird distribution in Palaes Village. Quantitative information on bird species diversity in this area remains very limited, making it difficult to undertake conservation planning and habitat management based on scientific data. Based on the above, research on bird diversity in Palaes Village is essential to analyze the structure of the bird community and its relationship with environmental factors, thereby providing a foundation for bird conservation and habitat preservation efforts at both the local and regional levels.

Methods

Time and Place of Research

This study was conducted in Palaes Village, West Likupang District, North Sulawesi Province (**Figure 1**), during September–October 2025, using the point count method. Observations were made at five randomly selected plots spaced 150 m apart, with each plot observed for 15 minutes within a 10-meter radius. Bird observations were conducted twice daily: in the morning from 5:30–5:45 a.m. WITA and in the afternoon from 4:00–4:15 p.m. WITA. All bird species observed in each plot were recorded.

Data analysis

The data obtained were analyzed quantitatively to determine the levels of diversity and abundance of the bird community.

Species Diversity Index. Species diversity was analyzed using the Shannon Index (H'), calculated using Paleontological Statistics (PAST) software version 5.2.2 based on the Shannon index formula (Hammer, 1999–2024).

$$H = -\sum_i \frac{n_i}{n} \ln \frac{n_i}{n}$$

Description:

H : Shannon Diversity Index

n_i : Number of individuals of species i

n : Total number of individuals of all species in the community

n_i/n : Proportion of individuals of species i

$\ln$: Natural logarithm

Criteria:

$H' \leq 1$: Diversity is classified as low

$1 < H' < 3$: Diversity is at a moderate level

$H' \geq 3$: Diversity is classified as high

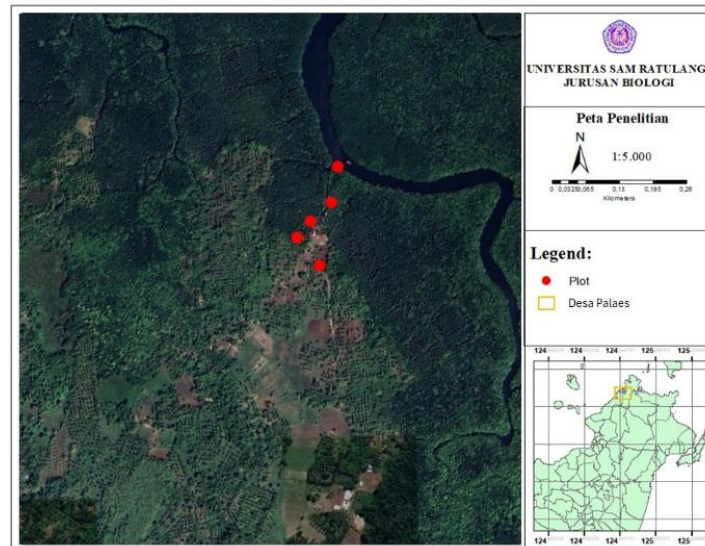


Figure 1. Research location

Relative abundance index. The relative abundance index was calculated using the relative abundance formula to determine the proportion of individuals of each species relative to the total number of observed individuals.

$$KR = \frac{n}{N} \times 100\%$$

KR : Relative Abundance

n : Number of individuals of each species

N : Total number of individuals

The relative abundance index values are then classified into three categories:

High : > 20%

Moderate: 15–20%, and

Low : < 15%

Results and Discussions

Bird Species Abundance

Based on research conducted in Palaes Village, West Likupang District, North Sulawesi Province, the relative abundance of birds and the number of individuals of each bird species found in the mangrove area are shown in **Table 1**.

Table 1. Relative Abundance of Bird Species

No	Species	Local Name	Abundance	%
1	<i>Corvus enca</i> (Horsfield, T 1821)	Gagak Hutan	10	12.5
2	<i>Collocalia esculenta</i> (Linnaeus, C 1758)	Wallet Sapi	27	33.75
3	<i>Egretta alba</i> (Linnaeus, C 1758)	Kuntul Besar	7	8.75
4	<i>Ixobrychus cinnamomeus</i> (Gmelin JF, 1789)	Bambangan Merah	1	1.25

No	Species	Local Name	Abundance	%
5	<i>Artamus leucorhynchus</i> (Linnaeus, C 1771)	Kekep Babi	7	8.75
6	<i>Coracina leucopygia</i> (Bonaparte, CLJL 1850)	Kepudang-sungu tunggir-putih	4	5
7	<i>Geopelia striata</i> (Linnaeus, C 1766)	Perkutut Jawa	6	7.5
8	<i>Eurystomus orientalis</i> (Vieillot, LJP 1819)	Tiong-lampu Biasa	1	1.25
9	<i>Phaenicophaeus calyrorhynchus</i> (Temminck, CJ 1825)	Kadalan Sulawesi	1	1.25
10	<i>Centropus bengalensis</i> (Gmelin, JF 1788)	Bubut alang-alang	1	1.25
11	<i>Porphyrio indicus indicus</i> (Horsfield, 1821)	Mandar Besar	2	2.5
12	<i>Actitis hypoleucos</i> (Linnaeus, C 1758)	Trinil Pantai	8	10
13	<i>Acridotheres javanicus</i> (Cabanis, JL 1851)	Jalak Kerbau	5	6.25
Total			80	32.26

A total of 13 bird species, comprising 80 individuals, were observed at the study site. The species with the highest relative abundance was *Collocalia esculenta* (33.75%), followed by *Corvus enca* (12.50%) and *Egretta alba* (8.75%). The dominance of *C. esculenta* in mangrove habitats is associated with the high availability of flying insects as the primary food source, as well as the canopy structure of mangrove vegetation, which provides adequate flying space, perching sites, and shelter opportunities. Research by Febrina & Faizah (2022) states that swiftlets are a group of abundant aerial insectivores in coastal areas due to their ability to adapt to the open environments surrounding mangrove ecosystems. This finding aligns with the results from Palaes Village, where *C. esculenta* was able to utilize the airspace above the mangrove canopy for intensive foraging activities. The combination of insect availability, ample flying space, and supportive vegetation structure makes *C. esculenta* the ecologically most advantaged species at this station.

In contrast, only a single individual of *Ixobrychus cinnamomeus* was found. This indicates that this species is highly dependent on shallow water areas and dense vegetation for foraging and shelter (Iswandaru et al., 2025). The mangrove habitat in Palaes Village provides only marginal habitat for *I. cinnamomeus*, so its presence more likely represents a local vagrant or occasional habitat user rather than a resident population with a large number of individuals. The low abundance of *I. cinnamomeus* indicates that while the mangrove ecosystem in Palaes Village is still capable of supporting this species, the quality and availability of the specific microhabitats it requires (such as calm pools with dense clump vegetation) are not yet fully optimal. This is important to consider in a conservation context, as species with highly specialized habitat preferences tend to be more vulnerable to environmental changes.

Bird Species Diversity

Based on the results of the study, the findings indicate that the level of bird diversity in the mangrove forest has a Shannon index value of 2.18, which, according to Magurran (1988), falls into the moderate category. This value reflects a fairly diverse bird community with a relatively balanced distribution of abundance among species. This finding aligns with research results from several other mangrove ecosystems, such as the Yenanas Village Mangrove Forest in Raja Ampat Regency, which recorded a moderate diversity value ($H' = 2.17$), and the mangrove area of the BPBIG Biosite Pangpang Bay Ijen Geopark, which also falls into the moderate category ($H' = 2.02$). This comparison indicates that bird diversity in mangrove ecosystems is generally at a moderate level, although each location may exhibit variations in diversity values depending on local ecological conditions.

Biodiversity is influenced by various environmental factors that support bird populations, particularly the availability of food sources and habitat structure. The mangroves in Palaes Village provide a variety of food sources, including fruits, seeds, nectar, insects, zoobenthos, and small fish. This diversity of food sources allows bird communities—both forest and waterbirds—to utilize resources according to their respective dietary preferences (Green & Elmberg, 2014; Tapp & Webb, 2015; De Dios Arcos et al., 2020; Liordos & Kontsiotis, 2020).

In addition to food availability, the structure of mangrove prop roots, trunks, and canopies also provides perching sites, shelter from predators, and nesting areas that are vital for various bird groups. The combination of diverse food sources and complex habitat structures makes mangrove ecosystems a critical habitat for both coastal bird communities and birds that utilize the terrestrial-marine transition zone.

Thus, the moderate diversity value indicates that the mangrove ecosystem in Palaes Village still plays an important ecological role as a habitat for various bird species, although it must be protected from anthropogenic pressures and land-use changes that could degrade habitat quality in the long term.

Conclusion

A study of bird diversity in the mangroves of Palaes Village, West Likupang District, recorded 13 bird species. The bird community is dominated by *Collocalia esculenta*, a generalist species with the highest relative abundance, while several other species have very low abundances and tend to have more specific habitat preferences.

The Shannon index (H') value of the bird community in the Palaes Village mangrove area falls into the moderate category, indicating that this habitat is still capable of supporting a relatively diverse and balanced bird community. This condition reflects the important role of mangroves as a habitat with complex and heterogeneous vegetation structure, thereby providing adequate food sources, shelter, and activity space for various bird species.

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