

Bird Community Structure in Sumberdjati Resort, Sempolan, Perhutani, Jember Forest Management Unit

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Abstract. The Sumberjati Resort Area, Perhutani Forest Management Unit (KPH) Jember, is a production area and protected forest. Habitat decline, overexploitation, and hunting of bird species result in their classification as endangered. This research aimed to ascertain the Bird Community Structure within the Sumberjati Resort, located in the Sempolan area of the Perhutani Forest Management Unit (KPH) in Jember. The study period encompassed the months of December 2022 to January 2023. The research uses the point count method at twelve observation points. The data recording process encompassed the collection of morphological data and bird population counts. A total of 34 distinct species, comprising a population of 1,292 individuals, were documented. *Collocalia linchi* exhibited the highest population density among avian species in every surveyed area. *Spilornis cheela* and *Microhierax fringillarius* have a conservation status of least concern according to the IUCN Red List and are protected bird species under the National Regulation. Shannon-Wiener index analysis shows that bird diversity is in the medium category (pine forest $1.32 \leq$ jungle 1.33). The dominance index shows the medium category (pine forest $0.51 \leq$ jungle 0.52). Evenness e^H/S is low (pine forest $0.16 >$ jungle 0.14). The highest relative abundance was *Collocalia linchi* (0.7063).

1 Introduction

A community is a group of multiple species inhabiting the same specific region and area, supporting numerous populations [1]. Birds exhibit a significant level of biodiversity within their society [2]. Based on the statistics provided by Burung Indonesia [1], the total number of bird species recorded in Indonesia is 1818. Certain species, such as *Leucopsar rothschildi*, are considered endemic to Bali [3, 4]. Certain species, such as *Nisaetus Bartelsi*, are currently classified as being in a state of endangerment [5].

The presence of a diverse range of bird species is subject to numerous risks [6]. According to data from Burung Indonesia [1], a notable proportion of avian species, precisely 12%, face the imminent risk of extinction. One issue identified in the literature is the overexploitation of birds [7] and the negative impacts of hunting and disease on avian populations [8].

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According to Haryoko *et al.*, a study revealed that 67 species, including 2,080 individual organisms, were involved in trading activities [9]. Furthermore, the diminishment of habitats due to anthropogenic activities, such as agricultural land clearance, will impede avian habitats and restrict their movement [10].

The swift movement of avian species within a given ecosystem can contribute to their various ecological functions, such as serving as bioindicators of habitat quality owing to their heightened susceptibility to alterations in the surrounding environment [11]. Seed dispersal is another function performed by these organisms [12]. Moreover, they also serve as agents for flower pollination [13-14].

The Sumberjati Resort Area, located inside the Perhutani Forest Management Unit (KPH) in Jember, is known to be favored by a diverse range of avian species. Information regarding bird diversity data still needs to be expanded and recorded. The significant habitat of this species comprises pine forests and jungles. Previous studies have extensively examined the correlation between birds' abundance and food source availability in different forest environments [15-16]. Pine forest regions can support avian biodiversity [17]. Refer to [18] documented 33 avian species inside the pine forest region.

According to a study conducted by [19], the presence of bird species in pine forests was 19, with 161 individuals. In contrast, mixed forests were found to have 24 bird species, with a population of 184 individuals. Moreover, it has been observed that birds have a predilection for inhabiting plantation environments [20]. According to a study conducted by [21], 25 avian species were documented inside the confines of the plantation region. The primary determinants of species variety within a given habitat are the characteristics of the vegetation structure and the abundance of food resources, which must meet the necessary criteria in terms of quality and quantity to support successful breeding [22].

The above paragraph outlines the research undertaken on the bird community structure within the Sumberjati Resort, located in the Sempolan region of the Perhutani, Jember Forest Management Unit. The data, as mentioned above, has the potential to serve as foundational knowledge for policy development in the field of forest management.

2 Materials and Methods

This study was undertaken from December 2022 to January 2023. The study was conducted at the Sumberjati Resort Area near Sempolan, within the Perhutani KPH Jember (Fig. 1.). The data were gathered using the point count methodology [23]. The observation of avian species commenced in the morning (06.00–09.00 AM) and afternoon (3.00–6.00 PM), employing the Purposive sampling technique for determining the location. The observation duration at each observation point is 20 minutes. The location point comprised a combination of pine forest (points 1, 2, 3, 4, 11, 12) and jungle ecology (5, 6, 7, 8, 9, 10).

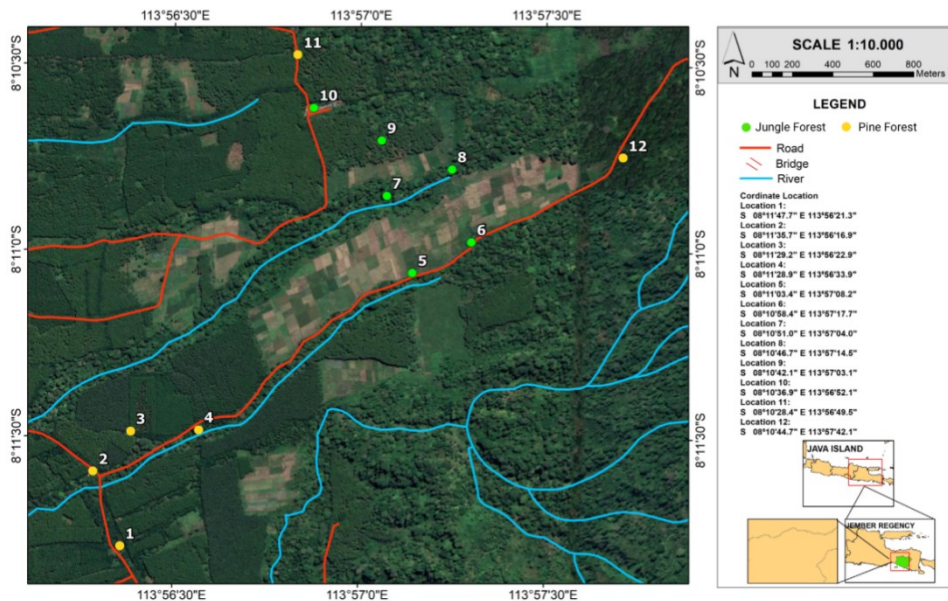


Fig. 1. Research location Sumberjati Area, Perhutani KPH Jember (*Source*: Google Maps).

The study utilized multiple pieces of equipment, including a Sony DSC H-300 digital camera, SVBONY brand monocular binoculars, Garmin GPSmap 60CSx, a voice recorder, the Burungnesia program for bird identification, and bird book by [24-25]. The data was analyzed using the PAST4.09 software, focusing on several ecological metrics, including the Shannon-Wiener diversity index (H'), species richness (R), dominance (D), species evenness (E), and relative abundance.

3 Results and Discussion

The study was conducted in the Sumberjati Resort Area, specifically in the Sempolan region of the Perum Perhutani KPH Jember. A total of 12 observation locations were established, further categorized into two distinct habitats: pine forest and jungle forest. A total of 1,292 avian specimens belonging to 24 distinct groups encompassing 34 species were documented. The pine forest habitat was observed to contain a total of 504 individuals; on the other hand, the jungle habitat exhibited a higher population of 788 individuals (Table 1).

Table 1. Results of bird species identification in Sumberjati FMU.

No	Famili	Species	IUCN Status	Total
1	Accipitridae	<i>Spilornis cheela</i>	Least Concern	9
2	Locustellidae	<i>Megalurus palustris</i>	Least Concern	2
3	Aegithinidae	<i>Aegithina tiphia</i>	Near Threatened	21
4	Alcedinidae	<i>Todiramphus chloris</i>	Least Concern	48
5	Alcedinidae	<i>Alcedo atthis</i>	Least Concern	3
6	Apodidae	<i>Collocalia lincti</i>	Least Concern	918
7	Bucerotidae	<i>Rhyticeros undulatus</i>	Vulnerable	4
8	Campephagidae	<i>Pericrocotus flammeus</i>	Least Concern	13
9	Campephagidae	<i>Pericrocotus cinnamomeus</i>	Least Concern	13
10	Campephagidae	<i>Lalage sueurii</i>	Least Concern	1

11	Cisticolidae	<i>Orthotomus atrogularis</i>	Least Concern	1
12	Cisticolidae	<i>Orthotomus sutorius</i>	Least Concern	20
13	Columbidae	<i>Streptopelia bitorquata</i>	Least Concern	2
14	Columbidae	<i>Spilopelia chinensis</i>	Least Concern	8
15	Columbidae	<i>Treron griseicauda</i>	Least Concern	2
16	Coraciidae	<i>Eurystomus orientalis</i>	Least Concern	3
17	Cuculidae	<i>Cacomantis merulinus</i>	Least Concern	11
18	Dicaeidae	<i>Dicaeum chrysorrheum</i>	Least Concern	3
19	Dicaeidae	<i>Dicaeum sanguinolentum</i>	Least Concern	2
20	Dicruridae	<i>Dicrurus leucophaeus</i>	Least Concern	2
21	Estrildidae	<i>Lonchura leucogastroides</i>	Least Concern	11
22	Falconidae	<i>Microhierax fringillarius</i>	Least Concern	2
23	Laniidae	<i>Lanius Schach</i>	Least Concern	4
24	Megalaimidae	<i>Psilopogon australis</i>	Least Concern	23
25	Megalaimidae	<i>Psilopogon haemacephalus</i>	Least Concern	19
26	Megalaimidae	<i>Psilopogon javensis</i>	Near Threatened	2
27	Nectariniidae	<i>Cinnyris jugularis</i>	Least Concern	4
28	Phasianidae	<i>Gallus varius</i>	Least Concern	1
29	Picidae	<i>Picoides moluccensis</i>	Least Concern	4
30	Pycnonotidae	<i>Pycnonotus goiavier</i>	Least Concern	2
31	Pycnonotidae	<i>Pycnonotus aurigaster</i>	Least Concern	130
32	Sturnidae	<i>Aplonis panayensis</i>	Least Concern	2
33	Timaliidae	<i>Pomatorhinus montanus</i>	Least Concern	1
34	Zosteropidae	<i>Zosterops melanurus</i>	Least Concern	1

The species *Collocalia linchi* exhibited the most significant population size, with 918 individuals recorded (Table 1). *Collocalia linchi* is a gregarious avian species with a broad range, encompassing elevated terrains, low-lying regions, and adornments [26] [27]. *Collocalia Linchi* encounters at each location. Good vegetation conditions are essential in supporting the existence of birds. Apart from that, insect habitat is a food source. The abundance of insects in pine forests and woodlands supports the existence of *Collocalia linchi*. Flies between trees to feed on insects [28]. Based on observations of insects found in the forest, including flies, bees, dragonflies, and butterflies. An additional avian species observed is *Cinnyris jugularis*, a bird that mostly consumes nectar. This bird usually moves between branches when trying to collect nectar from flowers through suction [29]. According to [30], the avian species under consideration possesses a beak that is characterized by its elongated structure, slender form, and gentle curvature, which facilitates the bird's ability to extract nectar efficiently.

Spilornis cheela and *Microhierax fringillarius* are avian species belonging to the order Accipitriformes, commonly called raptors, which inhabit the specified geographical region. *Spilornis cheela* is often seen flying here and there, occasionally perched in the forest's upper canopy. Meanwhile, *Microhierax fringillarius* was observed perching on an open branch. Documented that the raptors mentioned above fulfill an ecological function as apex predators within the ecosystem [31-32]. Refer to [33] indicating that raptors rely on the existence of undisturbed forest ecosystems. Raptors exhibit a preference for forested habitats, using them for various activities such as hunting, nesting, and roosting. Additionally, they also employ open regions for hunting.

The species known as *Spilornis cheela* is afforded legal protection under Law LHK P.106, 2018UU [34]. Additionally, it holds Appendix II classification under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), which signifies that any type of trade or possession, whether in live or deceased form, is strictly forbidden. According to [35], the avian species consumes a variety of prey items, such as lizards, frogs, small mammals, and reptiles. The dietary preferences of *Spilornis cheela* are predominantly

inclined towards reptiles, which constitute approximately 74% of its overall diet [36]. According to [37], this phenomenon is prone to disruptions.

According to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in 2018, the avian species known as *Microhierax fringillarius* has been classified under Appendix II. This categorization indicates that the species is now facing a significant risk of extinction. Nevertheless, the continued engagement in trade activities may threaten its current standing. Based on Presidential Decree No. P. 106 of 2018 [34], this type of bird is protected. *Microhierax fringillarius* is classified as a diminutive raptor species that fulfill the ecological roles of predator and population regulator. The avian species under consideration demonstrates active foraging behavior while in a perched position, characterized by swift head movements [38]. Its primary diet consists of diminutive mammals, such as mice, insects, and avian specimens of modest proportions [39].



Fig. 2. Raptors on the perch. (a) *Spilornis cheela* perched on a leafy branch (b) *Microhierax fringillarius* perched on a dry branch.

The analysis focused on the calculations demonstrated in Table 2. The Shannon-Wiener diversity index (H') for the pine forest is recorded as 1.32; on the other hand, the forest jungle has a diversity index of 1.33, indicating moderate diversity. The species richness index (R) is a metric used to quantify the number of species present within a given community. According to [40], a higher richness value indicates a greater abundance of species within the community. The species richness index value observed in pine forests is 3.69; on the other hand, in jungle forests, it is 4.05. These values fall within the range of $2.5 < R < 4.0$, which is considered to be in the medium group. The present study quantifies bird species inside the RPH Sumberjati area, revealing 34 species.

The pine forest's dominance index (D) is 0.51; on the other hand, the dominance index of the forest jungle is 0.52. In this context, a dominance index value between $0.5 < D \leq 0.75$ indicates a state of moderate dominance. According to [41], a species may be dominant when it has the greatest population size relative to other species. Furthermore, the evenness index (E) examination reveals a value of 0.16 in the pine forest and 0.14 in the jungle. The evenness of species in the two environments was determined using the criterion $E \leq 0.4$, indicating a low level of evenness. A lack of species evenness is indicative of the existence of dominant species within the habitat. The relationship between dominance and evenness values has been demonstrated by [16]. When the evenness index value is low, it can be observed that the dominance index value is high; conversely, when the dominance index value is high, the evenness index value tends to be low. The bird communities discovered were diversified, with 34 species exhibiting high abundance values in two habitats. The comprehensive relative abundance information for pine forests and jungles is demonstrated in Table 3.

Table 2. Data Analysis of Bird Communities in Pine Forest and Jungle Forest

	Pine Forest	Jungle Forest
Shannon H	1,32	1,33
Richness	3,69	4,05
Dominance D	0,51	0,52
Evenness $e^{H/S}$	0,16	0,14

Table 3. Relative Abundance of Bird Communities in Pine Forest and Jungle Forest

No	Species	Pine Forest %	Jungle Forest %
1	<i>Collocalia linchi</i>	0,7063	0,71320
2	<i>Pycnonotus aurigaster</i>	0,1071	0,09645
3	<i>Todiramphus chloris</i>	0,0417	0,03426
4	<i>Psilopogon australis</i>	0,0139	0,02030
5	<i>Orthotomus sutorius</i>	0,0119	0,01777
6	<i>Aegithina tiphia</i>	0,0179	0,01523
7	<i>Psilopogon haemacephalus</i>	0,0159	0,01396
8	<i>Pericrocotus flammeus</i>	0,0079	0,01142
9	<i>Pericrocotus cinnamomeus</i>	0,0099	0,01015
10	<i>Cacomantis merulinus</i>	0,0060	0,01015
11	<i>Lonchura leucogastroides</i>	0,0060	0,01015
12	<i>Spilopelia chinensis</i>	0,0040	0,00761
13	<i>Lanius Schach</i>	0,0000	0,00508
14	<i>Alcedo atthis</i>	0,0000	0,00381
15	<i>Spilornis cheela</i>	0,0139	0,00254
16	<i>Rhyticeros undulatus</i>	0,0040	0,00254
17	<i>Eurystomus orientalis</i>	0,0020	0,00254
18	<i>Dicaeum chrysorrheum</i>	0,0020	0,00254
19	<i>Acrocephalus orientalis</i>	0,0000	0,00254
20	<i>Streptopelia bitorquata</i>	0,0000	0,00254
21	<i>Dierurus leucophaeus</i>	0,0000	0,00254
22	<i>Psilopogon javensis</i>	0,0000	0,00254
23	<i>Pycnonotus goiavier</i>	0,0000	0,00254
24	<i>Aplonis panayensis</i>	0,0000	0,00254
25	<i>Picoides moluccensis</i>	0,0060	0,00127
26	<i>Treron griseicauda</i>	0,0020	0,00127
27	<i>Lalage sueurii</i>	0,0000	0,00127
28	<i>Gallus varius</i>	0,0000	0,00127
29	<i>Cinnyris jugularis</i>	0,0079	0,00000
30	<i>Dicaeum sanguinolentum</i>	0,0040	0,00000
31	<i>Microhierax fringillarius</i>	0,0040	0,00000
32	<i>Orthotomus atrogularis</i>	0,0020	0,00000
33	<i>Pomatorhinus montanus</i>	0,0020	0,00000
34	<i>Zosterops melanurus</i>	0,0020	0,00000

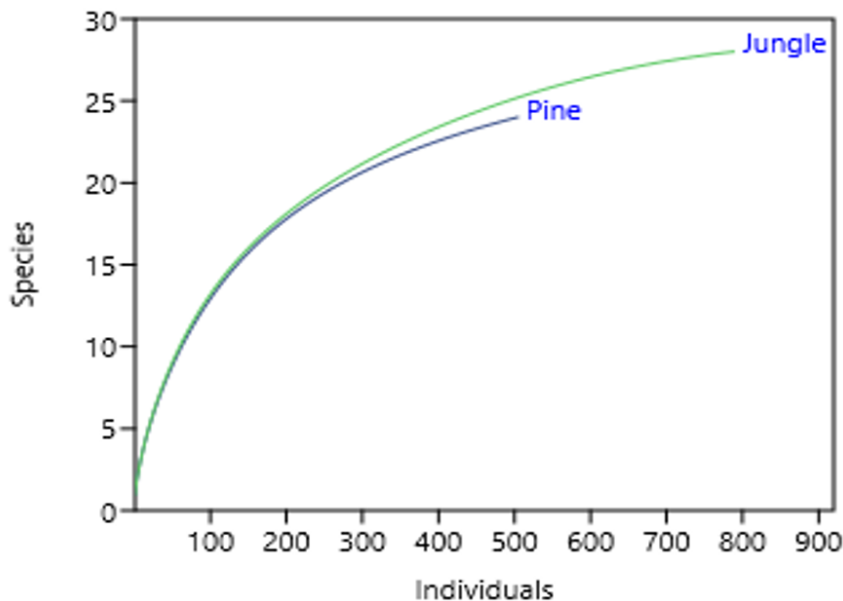


Fig. 3. Bird species rarefaction curve.

The study of relative abundance data (Figure 3) reveals that 24 species exhibit a range of relative abundance values within pine forests at 504 total individuals, ranked from highest to lowest. The Figure labeled "Figure 3" displays the hierarchical arrangement of 28 avian species found in the jungle with 788 total individuals based on their respective levels of abundance. According to (Table 3), *Collocalia linchi* has the highest relative abundance value of 0.7063; on the other hand, *Zosterops palpebrosus* and several other bird species possess the lowest value of 0.0020 in the pine forest. Moreover, in the jungle forest, *Collocalia linchi* exhibits the highest recorded value of 0.71320; on the other hand, *Gallus varius*, a bird species, demonstrates a comparatively low value of 0.00127. The avian species rated second and third in both habitats exhibited similarities, namely *Pycnonotus aurigaster* and *Todiramphus chloris*, with comparable values of relative abundance. The relative abundance index value signifies the elevated level of species detected. Furthermore, it can be utilised to assess the level of biodiversity within a given ecosystem. Habitats characterized by favorable conditions have the capacity to sustain a diverse array of avian species.

4 Conclusion

A total of 34 avian species belonging to 24 famili, comprising a population of 1,292 individuals, were recorded during the observation period at Sumberjati Resort, located in the Sempolan region of the Perhutani Jember Forest Management Unit. *Collocalia linchi* had the highest abundance. The Shannon-Wiener diversity index (H') yielded findings indicating a modest level of diversity. The examination of community structure data reveals that the jungle forest exhibits much higher index values than the pine forest habitat.

The Conservation Biology research group appreciate Perhutani for their valuable support. Furthermore, we express our gratitude to the Head of KPH Jember, the staff, and the field officers for permitting us and providing assistance during field data collection. Finally, the research team from Sumberjati Resort and the biology education students of the 2019 class have assisted in collecting samples.

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