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RESEARCH ARTICLE

Avian species of Sungai Sedim Forest Eco Park: Boost for ecotourism activities

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ABSTRACT

Sungai Sedim Forest Eco Park is a forest amenity situated within the Gunung Inas Forest Reserve in Peninsular Malaysia, known for its abundant biodiversity and ecotourism activities. The ongoing documentation of fauna richness in the amenity forest could be a crucial element for supporting conservation and promoting sustainable tourism development. Hence, this study aimed to document avian species richness and highlight its role in enhancing ecotourism activities at Sungai Sedim Forest Eco Park. Bird surveys were conducted over five sessions from July 2022 to October 2022, utilizing mist-netting, direct observation, and bird vocalizations. The surveys successfully identified a total of 61 species belonging to 30 families. The diversity indices consistently indicated high species diversity across sessions (Shannon index: 2.045 - 3.912), with peak richness occurring in the fourth session. These findings highlight that Sungai Sedim Forest Eco Park supports a rich and dynamic bird community, reinforcing its significance as a birdwatching destination. Continuous biodiversity monitoring is therefore essential, both to safeguard ecological integrity and to provide a scientific foundation for sustainable ecotourism planning in Malaysia.

1. INTRODUCTION

Tourism is a significant contributor to economic growth worldwide, including in Malaysia (Tamblyn et al., 2005). Each state in Malaysia offers its own distinctive attractions, ranging from natural landscapes to cultural experiences, which continue to draw both local and international tourists. The continuous entry of tourists fuels demand for various services and products, leading to the diversification of tourism offerings. According to Omar et al. (2018), tourism can be categorized into various types, including ecotourism, medical tourism, sports tourism, and educational tourism. According to The International Ecotourism Society (2015), ecotourism is defined as responsible travel to natural areas that conserves the environment, sustains the well-being of local people, and promotes education and interpretation. A prominent component of ecotourism in Malaysia is avitourism, also known as birdwatching tourism. Avitourism has gained widespread popularity due to increasing awareness of sustainable travel while promoting conservation and contributing to the national economic growth (Steven, 2015; Gertrude David et al., 2017).

The 6th National Report of Malaysia to the Convention on Biological Diversity (CBD) (2019) states that Malaysia has about 742 species of birds and 12 endemic bird species in total (Malaysia Endemic Birds Checklist, n.d.). The rich avian biodiversity and its varied ecosystems make Malaysia a popular destination for birdwatching enthusiasts from around the world (Tourism Malaysia, 2015). Malaysia hosts numerous birding events throughout the year, including Raptor Watch, Bird Race, and the Borneo Bird Festival, among others. These events not only promote environmental awareness and education but they also provide economic support, raise conservation awareness, and contribute to ecotourism development (Sanchez-Rivero et al., 2020; Agrusa et al., 1999). Among the popular ecotourism and bird watching hotspots is Sungai Sedim Forest Eco Park (SSFEP) in the Kulim District, Kedah (Aziz et al., 2021). SSFEP was selected as one of five selected destinations in the Asia Pacific due to its unique waterfall (Kulim District Office, 2011). SSFEP not only serves as a platform and product for ecotourism but is also crucial in conserving biodiversity. SSFEP is situated in the Gunung Inas Forest Reserve, which is categorized as Environmentally Sensitive Area (ESA) Level 2 in the Permanent Forest Reserve. This area is designated for ecotourism activities only, with no physical development or agricultural activities permitted (PLANMalaysia, 2017). SSFEP is well-known for its attractions, including waterfalls, white-water rafting, kayaking, and hiking (Kulim District Council, 2013). One of the most iconic features in SSFEP is the Tree Top Walk, the world's longest canopy walkway. The Tree Top Walk offers panoramic views of the lush tropical rainforest, providing a unique vantage point for observing forest-dwelling bird species.

Despite the abundance of information on bird species available through online databases and birdwatching activities, there is a lack of published scientific studies, particularly those addressing avian diversity in relation to ecotourism in SSFEP. Spear et al. (2017) highlighted that citizen science platforms have surpassed professionals and museums in terms of data collection. However, information from online databases and birdwatching records often provides only a partial picture of species presence/absence or potential species compared to systematic scientific studies (Lepczyk, 2005). In short, although citizen science generates a large volume of raw data, there remains a shortage of formal research that utilizes this information to address avian diversity for ecotourism in SSFEP. Without systematic analysis, validation, and peer-reviewed publication, such data cannot be effectively translated into ecotourism planning, biodiversity management, or conservation policy, ultimately resulting in missed opportunities to strengthen ecotourism development and inform long-term conservation strategies. To address this gap, our study provides an assessment of avian diversity in SSFEP, aiming to record species richness and highlight its potential contribution to ecotourism activities within the park.

2. MATERIALS AND METHODS

This study was conducted from July 2022 to October 2022, comprising five consecutive sessions. Each session consists of both active and passive sampling methods to record the presence of avian species in Sungai Sedim Forest Eco Park. Active sampling encompasses mist-netting techniques, whereas passive sampling involves direct observations and the study of bird's vocalizations. Statistical analysis and visualization were employed to assess avian diversity. All field surveys were conducted in accordance with relevant wildlife and forestry regulations. Research and data collection activities were carried out under permit approval from the Forestry Department of Peninsular Malaysia and the Department of Wildlife and National Parks (PERHILITAN), with reference number B-00298-15-22.

2.1. Sungai Sedim Forest Eco Park (SSFEP)

Sungai Sedim Forest Eco Park is a lowland dipterocarp forest located in Gunung Inas Forest Reserve (GIFR) (N5.4071º, E100.66146º). SSFEP is one of the top tourist attractions in Kedah, renowned for its water activities, hiking spots, and birdwatching opportunities. The study was conducted in an area classified as level 2 (300 m to 700 m a.s.l.) in the ESA of the Permanent Forest Reserve in the GIFR. SSFEP is also a popular birding hotspot that attracts a steady stream of visitors.

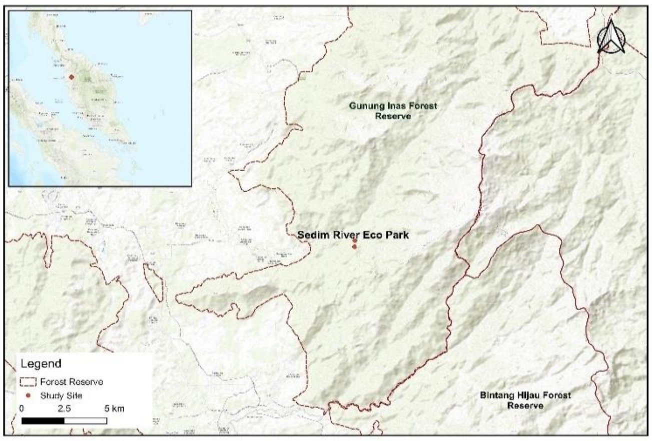

Figure 1: Map of Sungai Sedim Forest Eco Park (SSFEP) in Gunung Inas Forest Reserve, Kedah.

2.2. Avifauna sampling

2.2.1 Mist-netting

Ten mist nets were randomly distributed inside a 400 m x 200 m area. All nets were set up within or near the sampling plot, along potential bird flight paths, with a minimum spacing of 50 m between each net. All mist nets were deployed for five sessions, each comprising five consecutive days, resulting in a total of 25 days of sampling. Sampling utilised 5-meter and 3-meter poles. All nets were inspected every two hours until evening. All captured birds were meticulously extracted and temporarily housed in a cloth bag. The bird was subsequently examined, measured, and photographed for identification and future reference. Each released bird was affixed with a ring tag, and the corresponding tag number was recorded.

2.2.2 Direct observation

Observation was conducted from 7:00 am to 11:00 am and resumed in the evening from 4:00 pm until late evening. The observation period was standardized to cover the peak activity times of most bird species, with midday hours excluded. The exclusion of midday hours observation is due to lower bird activity during hotter periods, which limits detectability. Observations were conducted in SSFEP and along trails leading to the study plot, conducted by two to three observers using a Nikon D750 DSLR camera and Nikon Monarch binoculars. All observed avifauna were photographed, identified, and documented in the data sheet.

2.2.3 Bird call

A sound recorder was used to capture any bird calls heard during the study. The BirdNET tool (Kahl et al., 2021) was used to analyse each recorded call at the species level. Only calls with a score above 0.80 were accepted as valid observations. BirdNET's confidence score is based on multiple factors, including the sound's acoustic features, the quality of the recording, and the surrounding noise. The amount of confidence it provides in the suggested identified species is based on these criteria. A low confidence level means that fewer species are correctly suggested, and the converse is also true. Because of this, only the result exceeding the 0.80 confidence threshold was considered a true observation.

2.3 Species diversity

To quantify avian diversity across sampling sessions, diversity indices including species richness (S), Simpson's Index (1-D), Shannon–Wiener Index (H), and Pielou's Evenness (J') were calculated. Species richness (S) represents the total number of species recorded and provides a straightforward measure of diversity. The Shannon-Wiener Index (H) incorporates both species abundance and evenness, providing an overall description of community diversity. Simpson's Index (1-D) assigns greater weight to common species, thereby highlighting dominance patterns within the community. Pielou's Evenness (J') measures how uniformly individuals are distributed across species, with higher values indicating a more even community structure. These indices were computed using RStudio software using the vegan package (Oksanen, 2015), which provides robust tools for ecological data analysis. Together, these complementary metrics enabled the assessment of species richness, dominance, and community evenness in each sampling session, providing insights into the structure and balance of the bird community in relation to our research objectives.

3. RESULTS AND DISCUSSION

A total of 61 bird species representing 30 families were recorded across five sampling sessions (Table 1). A total of 43 bird species were documented through direct observation, 22 species through mist-netting, and eight species through call identification. According to Figure 2, no species were identified utilising all three approaches. Only 12 species were detected through a combination of two applied methods, whereas the rest of the species were documented with a singular detection approach. The absence of species detected by all three methods is likely to reflect differences in detection sensitivity and species behaviour. According to Morelli et al. (2022), bird detectability is influenced by four key factors: species biology and behaviour, individual characteristics within the species, environmental conditions, and methodology and skills of observers. Each method used in this study highlights different components of bird detectability. Direct observation proved the most efficient, as it was rapid and less time-consuming compared to other methods. Mist-netting, although more labour-intensive and time-consuming, was effective in detecting ground-foraging, understory, and non-singing birds (Dunn & Ralph, 2004; Ramli & Hashim, 2009; Mahyudin et al., 2024). Identification through calling, on the other hand, facilitated the detection of vocally active and difficult-to-observe species. These complementary strengths and biases explain the limited overlap among the methods. Previous studies have also shown that employing multiple approaches provides a more comprehensive picture of bird diversity than relying on a single method.

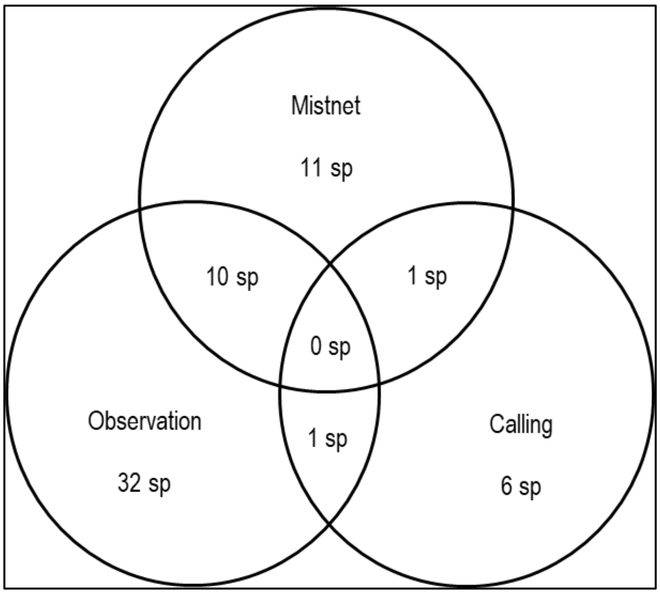

Figure 2: Venn diagrams of different methods of sampling with the number of species (sp) captured

The majority of species identified were understory birds, with a smaller proportion occupying the canopy layer. The Pycnonotidae family contributed the highest species richness, at 13%, followed by Muscicapidae with 10%. Each family, namely Nectariniidae, Picidae, and Timaliidae, accounted for 5% of the total species recorded. Based on the previous studies, Pycnonotidae is the most common family recorded in Peninsular Malaysia (Mahyudin et al., 2024; Fauzi et al., 2024; Appanan et al., 2023; Munian et al., 2023; Shahfiz et al., 2021; Shafie et al., 2018; Azman et al., 2011; Ramli et al., 2009). Many understory species are highly vocal and conspicuous, which increases their detectability during observations and facilitates the identification of their calls.

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Table 1: Avian species checklist in SSFEP throughout sampling session

Family	Common Name	Species	IUCN[a]	WCA[b]
Accipitridae	Crested Serpent Eagle	*Spilornis cheela*	LC[c]	TP
Aegithinidae	Common Iora	*Aegithina tiphia*	LC	TP[g]
Alcedinidae	Oriental Dwarf Kingfisher	*Ceyx erithaca*	LC	NP[h]
Bucerotidae	Rhinoceros Hornbill	*Buceros rhinoceros*	VU[d]	TP
	Helmeted Hornbill	*Rhinoplax vigil*	CR[e]	TP
	Bushy crested hornbill	*Anorrhinus galeritus*	NT[f]	TP
Camphepagidae	Scarlet Minivet	*Pericrocotus flammeus*	LC	TP
Cisticolidae	Ashy Tailorbird	*Orthotomus ruficeps*	LC	NP
	Dark-necked Tailorbird	*Orthotomus atrogularis*	LC	TP
	Rufescent Prinia	*Prinia rufescens*	LC	TP
Columbidae	Emerald Dove	*Chalcophaps indica*	LC	P[i]
Cuculidae	Raffles Malkoha	*Rhinortha chlorophaea*	LC	NP
Dicaeidae	Yellow-breasted Flowerpecker	*Prionochilus maculatus*	LC	TP
Eurylaimidae	Black and Yellow Broadbill	*Eurylaimus ochromalus*	NT	TP
	Banded Broadbill	*Eurylaimus javanicus*	NT	TP
Falconidae	Black-thighed Falconet	*Microhierax fringillarius*	LC	TP
Hirundinidae	House Swallow	*Hirundo tahitica*	LC	TP
Irenidae	Asian Fairy-bluebird	*Irena puella*	LC	TP
Laniidae	Tiger Shrike	*Lanius tigrinus*	LC	TP
Meropidae	Red-bearded Bee-eater	*Nyctyornis amictus*	LC	TP
Monarchidae	Asian Paradise Flycatcher	*Terpsiphone affinis*	LC	NP
Motacillidae	Grey Wagtail	*Motacilla cinerea*	LC	TP
Muscicapidae	White-rumped Shama	*Copsychus malabaricus*	VU	NP
	Rufous-tailed Shama	*Copsychus pyrropygus*	LC	NP
	Brown-chested Jungle Flycatcher	*Cyornis brunneatus*	NT	NP
	Pale Blue Flycatcher	*Cyornis unicolor*	LC	TP
	Chestnut-naped Forktail	*Enicurus ruficapillus*	NT	TP
	Siberian Blue Robin	*Larvivora cyane*	LC	TP
Nectariniidae	Little spiderhunter	*Arachnothera longirostra*	LC	TP
	Purple-naped Sunbird	*Kurochkinegramma hypogrammica*	LC	NP
	Red-throated sunbird	*Anthreptes rhodolaemus*	NT	TP
	Temminck's Sunbird	*Aethopyga temminckii*	LC	TP
Pellorneidae	White-chested Babbler	*Pellorneum rostratum*	NT	NP
	Moustached Babbler	*Malacopteron magnirostre*	LC	TP
	Large Wren Babbler	*Turdinus macrodactylus*	NT	NP
Phylloscopidae	Eastern Crowned Warbler	*Phylloscopus coronatus*	LC	TP
Picidae	Buff-necked Woodpecker	*Meiglyptes tukki*	NT	TP
	Buff-rumped Woodpecker	*Meiglyptes grammithorax*	LC	NP
	Maroon Woodpecker	*Blythipicus rubiginosus*	LC	TP
	Orange-backed Woodpecker	*Chrysocolaptes validus*	LC	NP
Pycnonotidae	Black-headed Bulbul	*Brachypodius atriceps*	LC	NP
	Cream-vented Bulbul	*Pycnonotus simplex*	LC	TP
	Grey-bellied Bulbul	*Ixidia cyaniventris*	NT	NP
	Hairy-backed bulbul	*Tricholestes criniger*	LC	TP
	Ochraceous Bulbul	*Alophoixus ochraceus*	LC	TP
	Olive-winged Bulbul	*Pycnonotus plumosus*	LC	TP
	Spectacled Bulbul	*Ixidia erythropthalmos*	LC	TP
	Yellow-bellied bulbul	*Alophoixus phaeocephalus*	LC	TP
Ramphastidae	Blue-eared Barbet	*Psilopodon duvaucelli*	LC	NP
	Black-browed Barbet	*Psilopogon oorti*	LC	NP
	Brown Barbet	*Caloramphus hayii*	NT	NP
Sittidae	Velvet-fronted Nuthatch	*Sitta frontalis*	LC	TP
Stenostiridae	Grey-headed Canary-flycatcher	*Culicicapa ceylonensis*	LC	TP
Sturnidae	Asian Glossy Starling	*Aplonis panayensis*	LC	NP
Timaliidae	Chestnut-rumped Babbler	*Stachyris maculata*	NT	TP
	Grey-headed Babbler	*Stachyris poliocephala*	LC	TP
	Grey-throated Babbler	*Stachyris nigriceps*	LC	TP
	Pin-striped Tit-babbler	*Mixornis gularis*	LC	NP
Trogonidae	Red-naped Trogon	*Harpactes kasumba*	NT	NP
Vangidae	Black-winged Flycatcher Shrike	*Hemipus hirundinaceus*	LC	TP
	Rufous-winged Philentoma	*Philentoma pyrhoptera*	LC	NP

a – The International Union for Conservation of Nature's Red List of Threatened Species, b – Wildlife Conservation Act (2010), c – Least Concern, d – Vulnerable, e – Critically Endangered, f – Near Threatened, g – Totally Protected, h – Not Protected, i – Protected.

In addition, dense canopy cover in SSFEP also allows for their frequent use of the midstory and understory layers aligning with the coverage of mist-netting and further enhancing their chances of capture. The dominance of Pycnonotidae and other understory birds may be attributed not only to their generalist frugivorous habits, which allow them to exploit a wide range of food resources, but also to habitat structure and sampling biases (Kerdkaew et al., 2014; Mansor & Sah, 2012; Tan, 2001). The combination of ecological traits and methodological factors explains the higher representation of this bird group.

Throughout the five sampling sessions, species richness varied notably. The highest species richness was recorded in the fourth sampling session, with 34 species, followed by the third session, which had 29 species. The lowest species richness of avifauna was observed during the first sampling session, with only six species. Based on Figure 3, Shannon diversity supports this observation, where it shows low diversity in the early session (median below 1.0) and increases significantly in the third and fourth sessions (median around 2.0 to 2.25), suggesting a higher number of species and more balanced relative abundances. Then, it started to decline in the fifth session, coinciding with frequent rainfall and overcast conditions that reduced visibility and bird activity in the field. Similar to Robbins (1981), such weather conditions can suppress singing activity and limit foraging, thereby lowering detectability. Moreover, rainfall can indirectly affect food resource availability, particularly fruits and insects, which are critical for reproduction and moulting (Marini & Duraes, 2001; Karr et al., 1992). These weather-related constraints likely explain the lower number of species recorded during this period. Pielou's evenness was higher in the third, fourth, and fifth sessions (ranging from 0.975 to 1), indicating a uniform distribution of individuals among species and suggesting low dominancy. In contrast, the second session recorded the lowest evenness (0.89 to 0.975), reflecting a higher abundance of particular dominant species that skewed the community structure. Overall, the diversity metrics indicate that the SSFEP supports a dynamic bird community, with temporal variations influenced by ecological factors. The peak in species richness and diversity in the mid-sessions highlights the importance of multi-seasonal sampling to capture accurate biodiversity patterns. Anderson et al. (2015) reported that in tropical rainforest audio-visual surveys, wet weather and high shrub density significantly reduced detection distances (effective strip width) for most bird species, indicating that rainfall can directly impair detectability. Similarly, Ismail (2013) found that rainfall in Malaysian wetlands has a significant influence on the activity of birds. Such findings emphasise that seasonal and temporal factors are key drivers of avian diversity.

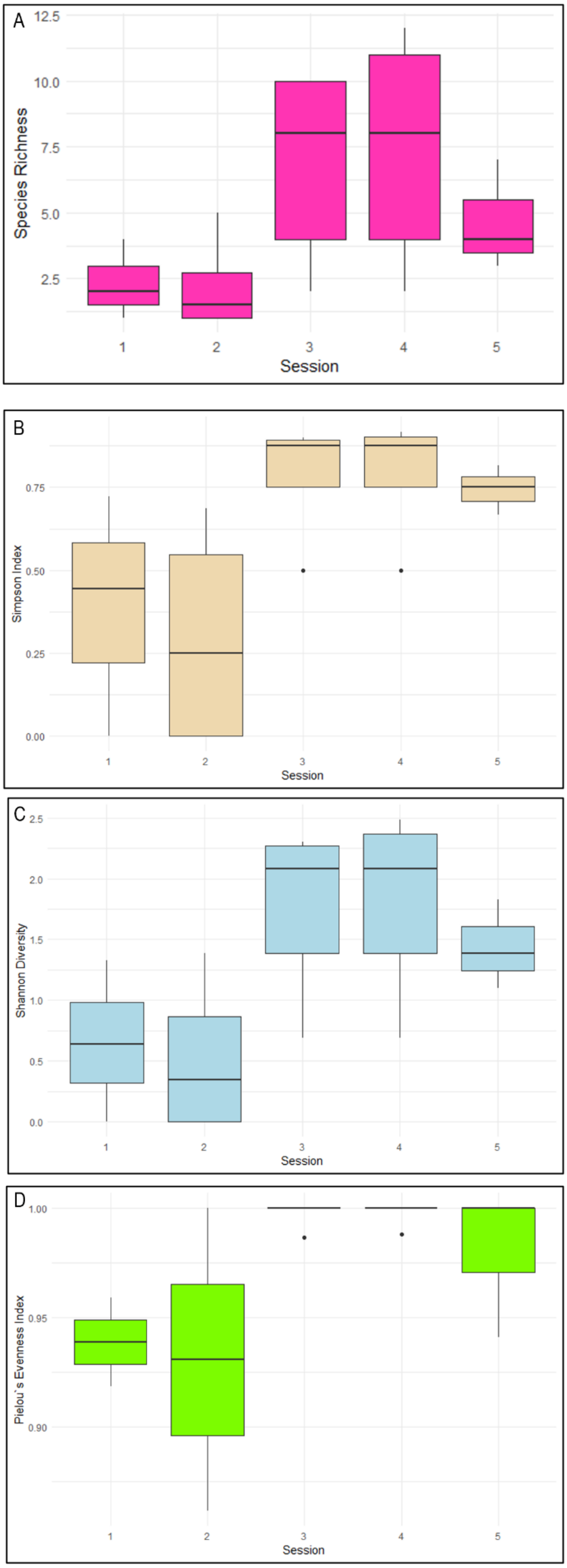

Figure 3: Diversity indices of avian species in SSFEP across sessions; A) Species richness (S), B) Simpson Index (1-D), C) Shannon Diversity (H), and D) Pielou's Evenness Index (J')

From an ecotourism perspective, birdwatching hotspots such as SSFEP play a crucial role in attracting nature-based tourists. The data collected through this study provides practical guidance for tour planning. For instance, species richness and Shannon diversity peaked in the third and fourth sessions, suggesting that birdwatching activities scheduled during these months (August and September) are likely to yield the highest diversity of sightings. Conversely, the fifth session coincided with the frequent rainfall, indicating that tours planned during wetter seasons may require alternative interpretive strategies, such as focusing on resident species or integrating indoor educational activities. A study by Graves et al. (2019) in Indonesia, for instance, identified birding hotspots using dynamic models that incorporated total species richness and seasonal changes, showing how biodiversity data can directly inform visitor planning. Habitat-specific findings can also inform the design of signage and trails. For example, the high representation of the Pycnonotidae family in SSFEP suggests that the surrounding area is a valuable observation point. The presence of charismatic species such as hornbills, trogons, and broadbills in SSFEP could also enhance visitor satisfaction, as these birds often serve as flagship species for ecotourism promotion (Steven et al., 2015; Patanduk et al., 2025). In addition, continuous monitoring of species presence offers helpful information for local guides, enabling them to adjust itineraries and manage visitor expectations more effectively.

4. CONCLUSION

This study successfully recorded 61 bird species from 30 families in Sungai Sedim Forest Eco Park. The fourth sampling session revealed the highest species richness, with the Pycnonotidae family dominating the assemblage at 13%. This diversity reflects the park's ecological health. Beyond ecological significance, the wide variety of birds also enhances the park's attractiveness for ecotourism in Sungai Sedim Forest Eco Park. They not only demonstrate the health of the environment but also attract visitors, making the park more appealing for ecotourism. The abundance of conspicuous and diverse species can enrich the visitor experience and strengthen its potential as a birdwatching destination. However, continuous monitoring and further evaluation are necessary because they form the foundation of a successful and sustainable ecotourism industry in Malaysia. Future efforts should include expanding surveys across different seasons to capture temporal variations in bird communities, as weather and seasonal changes were shown to influence species richness in this study. The use of automated acoustic recorders also provides continuous data on bird vocalisations, helping to detect elusive or nocturnal species that mist-netting or visual surveys may overlook. Combining all these approaches would strengthen biodiversity assessment, inform ecotourism planning, and ensure that management strategies remain adaptive to ecological changes. Ultimately, documenting and monitoring avifauna in SSFEP safeguards its ecological integrity and contributes to positioning the park as a model for integrating biodiversity conservation with sustainable ecotourism development in Malaysia.

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REFERENCES

Agrusa, J., F., Guidry, J., (1999). Eco tourism and sustainable development of the Maya Rain Forest in Central America. First Pan-American Conference Proceedings 1, 34-37.

Appanan, M., Azman, M., S., Ruzman, N., H., A., Beri, A., Z., Z., Azahar, M., A., Fauzi, N., F., M., Kamaruzzaman, M., F., (2023). Distribution of Pycnonotidae at Padang Chong Forest Reserve, Perak. In BIO Web of Conf (Vol. 73, p. 01004). EDP Sciences.

Azman, N., M., Latip, N., S., A., Sah, S., A., M., Akil, M., A., M., M., Shafie, N., J., Khairuddin, N., L., (2011). Avian diversity and feeding guilds in a secondary forest, an oil palm plantation and a paddy field in Riparian areas of the Kerian River Basin, Perak, Malaysia. Trop. Life Sci. Res., 22(2), 45.

Aziz, R.,C., Marican, N., D., Hamzah, S., (2021). Peluang dan potensi Hutan Lipur Sungai Sedim sebagai produk eko pelancongan di Malaysia. Geografia, 17(1), 107-122.

Checklist of Endemic Bird Species. (n.d.). Living National Treasures. https://lntreasures.com/malaysiab.html

Dunn, E., H., Ralph, C., J., (2004). The use of mist net as a tool for bird population monitoring. Studies in Avian Biol., 29, 1-6.

Fauzi, N., A., Munian, K., Norazlimi, N., A., (2024). Population trend of Lesser Adjutant (Leptoptilos javanicus) in Muar, Johor using eBird data. In BIO Web of Conferences, 94 (04001), 1-11.

Gertrude, D., Roslan, A., Pesiu, E., M., R., Salam, Abdullah, M., T., Hamza, A., A., Clements, R., (2017). Bird Santuary: A Potential Ecotourism Activity in Lake Kenyir, Terengganu, in: Mariapan, M., Evelyn, L., A., L., Isa, S., S., Karim, M., S., Hakeem, K., R., (1st Eds.), Ecotourism Potential in Malaysia. Penerbit Universiti Putra Malaysia., Selangor.

Graves, R., A., Pearson, S., M., Turner, M., G., (2019). Effects of bird community dynamics on the seasonal distribution of cultural ecosystem services. Ambio, 48(3), 280-292.

Kahl, S., Wood, C., M., Eibl, M., Klinck, H., (2021). BirdNET: A deep learning solution for avian diversity monitoring. Ecol. Infor., 61, 101236.

Karr, J., R., Dionne, M., Schlosser, I., J., (1992). Bottom-up versus top-down regulation of vertebrate populations: Lesson from birds and fish, in: Hunter, M., D., Ohgushi, T., Price, P., W., (Eds.), Effects of resource distribution on animal-plant interactions. Academic Press, San Diego.

Kerdkaew, T., Gale, G., A., Bumrungsri, S., (2014). Preliminary diet analysis reveals the dispersal of an exotic plant by two native Bulbuls in an early successional habitat, Krabi, Southern Thailand. Trop. Nat. Hist., 14 (1), 35-42.

Kulim District Office., (2011). Pelancongan Kulim. Retrieved from: https://lamanwebpejabatdaerahkulim.blogspot.com/

Kulim District Council, (2013). Official Website of Kulim Municipal Council. Retrieved from: http://www.mpkk.gov.my/web/guest/kulim_district_tourism

Lepczyk, C.,A., (2005). Integrating published data and citizen science to describe bird diversity across a landscape. Jour. of Appl. Ecol., 42, 672-677.

Mahyudin, N., A., A., Munian, K., Fauzi, N., A., Ahmad, M., B., & Rosdy, F., N., (2024). Bird diversity in Gunung Tebu Forest Reserve: Biological data of environmentally sensitive area in east coast Peninsular Malaysia. In BIO Web of Conferences, 131(01007), 1-10.

Mansor, M., S., Sah, S., A., M., (2012). The influence of habitat structure on bird species composition in lowland Malaysian rain forests. Tropical life sciences research, 23(1), 1.

Marini, M., Â., Durães, R., (2001). Annual patterns of molt and reproductive activity of passerines in south-central Brazil. The Condor, 103(4), 767-775.

McKinley, D., C., Miller-Rushing, A., J., Ballard, H., L., Bonney, R., Brown, H., Cook-Patton, S., C., Soukup, M., A., (2017). Citizen science can improve conservation science, natural resource management, and environmental protection. Biol. Cons., 208, 15-28.

Munian, K., Mahyudin, N., A., A., Azman, S., M., (2023). Understorey bird assemblages in selected environmentally sensitive areas (ESA) of Selangor, Peninsular Malaysia. Biodiversity Data Journal, 11, e95670.

Morelli, F., Brlik, V., Benedetti, Y., Bussiere, R., Moudra, I., Reif, J. Svitok, M., (2022). Detection rate of bird species and what it depends on: Tips for field surveys. Frontiers in Ecol. and Evol., 9, 671492.

Oksanen, J., (2015). Vegan: community ecology package. R package version, 2, 3.

Omar, K., Halim, M., A., S., A., Samsudin, H., Nik, N., H., (2018). Potential of Avitourism in Taman Negara Malaysia. Advances In Business, Hospitality and Tourism Research, 247.

Patanduk, A., Wicaksono, G., Rahmawati, N., Sunarto, S., Widaryo, I., Sapari, I. (2025). A preliminary assessment of bird communities and their conservation status in two grand forest parks (Tahura) of Lamandau, Central Kalimantan. Journal of Tropic. Biodiv., 5(3), 190-201.

PLANMalaysia. (2017). Garis Panduan Perancangan Pemuliharaan dan Pembangunan Kawasan Sensitif Alam Sekitar (KSAS), 1st Ed. PLANMalaysia, 1- 207.

Ramli, R., Ya'Cob, Z., Hashim, R., (2009). Diversity of Birds in Kenaboi Forest Reserve, Jelebu, Negeri Sembilan, Malaysia. Malaysian Journal of Science, 28(4), 465-480.

Robbins, C., S., (1981). Bird activity levels related to weather. Studies in avian biology, 6(1), 64.

Sánchez-Rivero, M., Sánchez-Martín, J., Rodríguez-Rangel, M., C., (2020). Characterization of Birdwatching demand using a Logit approach: Comparative analysis of source markets (National vs. foreign). Animals, 10(6), 965.

Shafie, N., J., Ahmad, A., Ismail, N., A., David, G., Abdullah, M., T., (2018). Bird assemblages in lowland dipterocarp forests of Tasik Kenyir and Setiu, Terengganu. Journal of Sustainability Science and Management, 13 (2), 43-56.

Shahfiz, M. A., Munian, M., Hazwani, A., N., Faradiana, M., F., N., Syaridzwan, M., B., Zafirah, Z., A., B., Mahyudin, N., A., A., Manoshini, A., Asyraff, M., A., (2021). Notes on mammals and avifauna at FRIM Campus, Selangor, Peninsular Malaysia. IOP Conference Series: Earth and Environmental Science, 842(1), 012030.

Sixth National Report of Malaysia to the Convention on Biological Diversity (CBD). (2019). Ministry of Energy and Natural Resource, Malaysia.

Spear, D., M., Pauly, G., B., Kaiser, K., (2017). Citizen science as a tool for augmenting museum collection data from urban areas. Frontiers in Ecol. and Evol., 5.

Steven, R. (2015). The Relationship between Birders, Avitourism and Avian Conservation. Thesis of Doctor of Philosophy. Griffith University, Australia.

Steven, R., Morrison, C., Castley, J., G., (2015). Birdwatching and Avitourism: a global review of research into its participant markets, distribution and impacts, highlighting future research priorities to inform sustainable avitourism management. Journal of Sustainable Tourism, 23(8-9), 1257-1276.

Tourism Malaysia. (2015). Seminar on Malaysia as a Prefered Birding . Tourism Malaysia, 1-6.

Tamblyn, A., Turner, C., O'Malley, R., Hughes, T., Hardingham, S. Roberts, H., (2005). Malaysian Tropical Forest Conservation Project. Report of the Perhentian Phase. London: United Kingdom.

Tan, R. (2001). Mangrove and wetland wildlife at Sungei Buloh Nature Park. Retrieved from: http://www.naturia.per.sg/index.htm.

What is Ecotourism?. (2015). The International Ecotourism Society. Retrieved from: https://ecotourism.org/what-is-ecotourism/