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Full Length Research Article

Birding and Avitourism: Potential Analysis of Birds in the Buffer Villages Around Conservation Area

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ABSTRACT

The development of avitourism in villages around the conservation area still needs optimal support to increase welfare and reduce illegal practices like bird hunting. Birds are wild animals that play an essential role in the ecosystem. One of the efforts that have been developed in the buffer village to improve the welfare community and the conservation of birds is avitourism. This study aimed to analyze birds that have the potential as objects and attractions in avitourism. The bird species recorded were 82 species from 39 families. The results of key informants' perception analysis revealed that 55 bird species (67.07%) have the potential as objects and attractions of avitourism, showing the nocturnal birds, top 50 birds of Way Kambas National Park, and parrot species as the top classification (> 75%). The colorful, raptor, and protected criteria are second with the favorite classification (51-75%). Endemic and migrant criteria are in the third position with the impressive classification (25-50%), and the songbird criteria are the lowest with the interesting classification (< 25%). The existence of birds that have the potential as objects and attraction of avitourism in the villages around Way Kambas National Park indicates that areas can be used in locations for avitourism, including bird photography, to improve welfare.

1. Introduction

The Greater Sunda region is recognized globally as a biodiversity hotspot with a high level of endemicity (Lee et al. 2016). Indonesia occupies the fourth position in the world, with the wealthiest bird species after Colombia, Peru, and Brazil, and the country with the highest endemicity rate reaching 17% of the total bird species in the world (Iskandar et al. 2019; Iswandaru et al. 2020; Rintelen et al. 2017). Other records reported that Indonesia has 1,818 bird species consists of 532 endemic species, 557 protected species, 30 critical endangered species (CR), 51 endangered species (EN), 96 vulnerable species (VU), 239 near threatened species (NT), 1376 least concern species (LC), and 12 data deficient species (DD) (Junaid et al. 2022). It is very potential to be developed, considering that birds have ecological functions as pest controllers, pollinators, seed dispersers, and bio-indicators of environmental change (Deng and Yimam 2020; Wenny et al. 2011; Whelan et al. 2008). In addition, birds play a role in the social culture of the

Indonesian people as symbols of customs and beliefs as well as myths (Iskandar et al. 2016). However, due to rapid sociocultural changes caused by economic pressures and the value of birds in the market (Iswandaru et al. 2022), beliefs and myths are starting to be abandoned (Iskandar et al. 2021). As a result, Indonesia is the second country with the highest threatened bird species in the world after Brazil (Lee et al. 2016). Hunting and illegal trade significantly threaten many bird species, including songbirds, forest birds (beautiful colors), parrots, raptors, owls, and waterbirds. Jepson and Ladle (2005) and Rentschlar et al. (2018) reported that in a year, an average of 614,180 songbirds are caught from their natural habitat to be traded on the islands of Java and Sumatra, and this should be a lesson learned for conservation areas to increase conservation efforts in securing the site and empowering communities, including in Way Kambas National Park and the surrounding villages.

Based on data in the Zulham et al. (2021), Way Kambas National Park (WKNP) consists of various ecosystems, including lowland rainforest, swamp forest, coastal forest, mangrove forest, and riparian forest. Wildlife in WKNP consists of large mammal groups and keystone species such as the Sumatran elephant (*Elephas maximus sumatranus*), Sumatran tiger (*Panthera tigris sumatrae*), Sumatran rhinos (*Dicerorhinos sumatrensis*), tapir (*Tapirus indicus*), and sun bear (*Helarctos malayanus*). WKNP is an essential habitat for primates (6 species), herpetofauna (17 species of amphibians and 13 species of reptiles), fishes (48 species of freshwater), and insects (77 species of butterflies) (Zulham et al. 2021). Besides that, WKNP is also a habitat for various types of birds. Holmes (1996) reported 315 bird species in WKNP, while the latest study (Zulham et al. 2021), reported 302 bird species within the last five years. Based on research that has been reported, WKNP is the best location in Asia for night birding (Olah and Simay 2007). In addition, public perception supports the development of birdwatching ecotourism as an alternative tourist attraction other than elephants in WKNP (Kamaludin et al. 2019). However, birdwatching tourism potential has been developed in the WKNP (Kamaludin et al. 2019) with the involvement of local community as a tour guide, and provider for accommodation, consumption, transportation services (Olah and Simay 2007). Avitourism development in rural areas directly adjacent to the conservation area has received little attention, so there are only a few sources of information about the importance of avitourism for the local economy. Based on WKNP Regulation Number 1765 of 2022 (SE 1765/T11/TU/HMS/12/2022), this area is temporarily closed for all nature tourism activities, including avitourism. It makes the buffer village require sustainable economic development to meet the community's needs (Schwoerer and Dawson 2022). One of the community's needs is activities that support economic sustainability and maintain the ecological integrity of the rural environment (Pereira et al. 2023). At the moment, the development of avitourism is an opportunity and a strategic choice to answer this challenge. On the other hand, the buffer village around the conservation area like WKNP is an important area to be developed to support the community's welfare so that illegal practices and activities in the WKNP can be stopped (Wiratno 2013) through nature-based and sustainable tourism activities for the growth and development of the local economy to increase income sustainability (Bintoro et al. 2022; Wiratno et al. 2022).

Therefore, further research is needed to develop new tourism objects, especially in the buffer villages around WKNP, such as avitourism. Avitourism is nature-based tourism to observe birds in their natural habitat using binoculars or, in other words, nature-based tourism that is explicitly focused on birds for recreational and educational purposes (Biggs et al. 2011; Nicolaides 2014; Omar et al. 2019). There are several studies explain that avitourism economically can create jobs

and educationally build human capacity and develop local communities through knowledge about the benefits of conservation (Aditya et al. 2020; Afanasiev 2022; Biggs et al. 2011; Steven et al. 2014, 2017) so that it becomes part of empowering communities around conservation areas (Mubarik et al. 2020). In Alaska-USA, the total value of economic activity from avitourism amounted to USD 584 million, creating 4,378 jobs in all sectors (Schwoerer and Dawson 2022). The contribution of avitourism in South Africa is reached USD 7.8 billion, or 2.8% of the country's gross domestic product and 4.2% of total employment in 2018 (BirdLife South Africa 2020) and showed an increase in income from USD 114 to USD 362 after starting work as a birding guide (Biggs et al. 2011). Avitourism activities in Colombia generated a profit of USD 9 million and generated around 7,516 new jobs (Ocampo-peñuela et al. 2017). In Peru, the annual gross revenue from avitourism activities is USD 89 million (Lacouture 2017).

As mentioned above, avitourism could be a promising way to maintain animal diversity and increase income for the people living in buffer villages around conservation areas (Liu et al. 2021). However, to date, there have also been no studies that identify and analyze birds as avitourism objects and attractions in buffer villages around WKNP. Therefore, this study is essential to contribute information on the analysis of the potential of birds as avitourism attractions in buffer villages around WKNP. This study also shows the role of buffer villages around the WKNP in reducing the loss of biodiversity and bird conservation and supporting increased community welfare (Liu et al. 2021; Ocampo-peñuela et al. 2017).

2. Materials and Methods

2.1. Study Area

The buffer area around WKNP consists of 38 villages. Administratively, 23 villages are located in East Lampung Regency, 12 in Central Lampung Regency, and 3 in Tulang Bawang Regency. This research is focused on Labuhan Ratu IX (LR IX) and Labuhan Ratu VII (LR VII) Villages, East Lampung Regency. The two villages were chosen by considering the various ecosystems with various land cover (**Fig. 1**) and the community's response to be more active and open in accepting development towards better changes. Geographically, LR IX is located at 5°04'45" S 105°42'04" E, and LR VII is located at 5°08'06" S 105°43'06" E. The land cover of the two villages consists of settlements and yards (agroforestry), rice fields, and plantations: *Hevea brasiliensis* and *Manihot utilisima*. The land cover condition in the yard is an agroforestry system. The vegetation in the agroforestry system built is multipurpose tree species (MPTS), forest trees, and crops, such as fruit-producing trees: *Mangifera indica, Nephelium lappaceum, Psidium guajava, Durio zibethinus, Syzygium malaccense, Garcinia mangostana, Dimocarpus longan, Theobroma cacao, Chyszygium aqueum, Parkia speciosa, Archidendron pauciflorum, Caliandra* sp., *Artocarpus heterophyllus, Gnetum gnemon, Cocos nucifera, Chrysophyllum cainito, Manilkara zapota, Spondias dulcis, Manilkara kauki*; forest trees: *Schima wallichii, Alstonia scholaris, Paraserianthes falcataria, Neolamarckia cadamba, Acacia mangium, Ceiba petandra, Peronema canescens, Acacia auriculiformis, Pterospermum javanicum, Lagerstroemis speciosa, Cassia siamea, Tectona grandis, Swietenia macrophylla, Anthocephalus chinensis*; and agricultural crops: *Capsicum annuum, Solanum lycopersicum, Solanum melongena, Musa paradisiaca, Carica papaya, Ocimum sanctum, Cosmos caudatus, Amaranthus* spp.

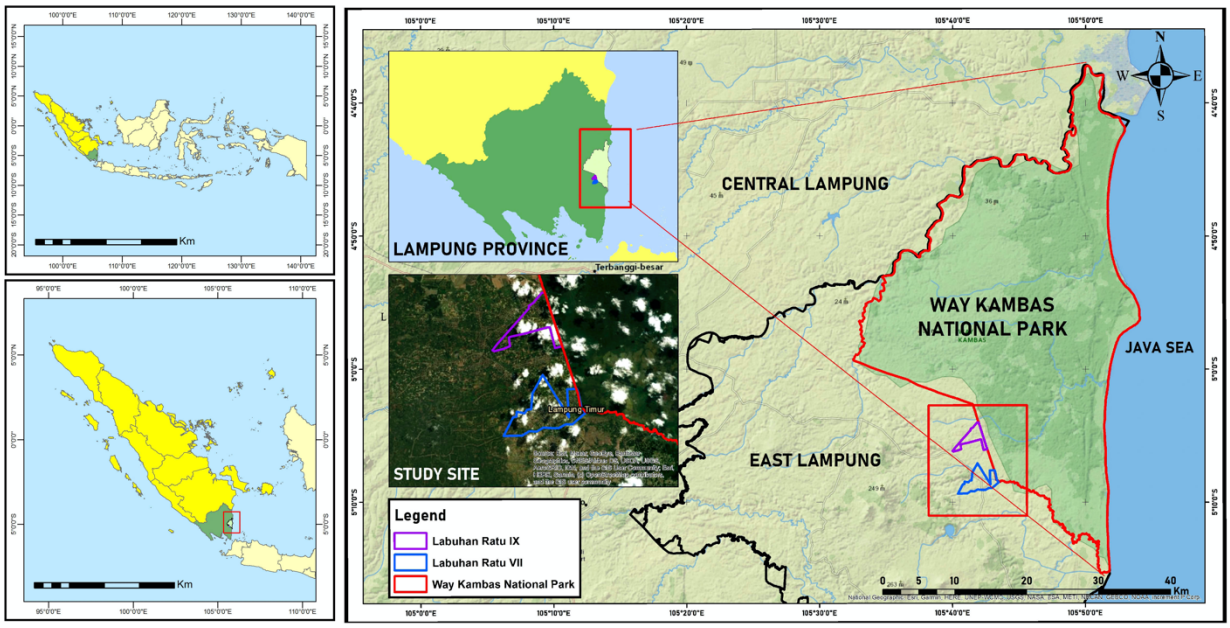

Fig. 1. Maps of the study site in the villages around WKNP.

2.2. Data Collection

Data collection was carried out in November 2021 and November 2022, considering that in that month, birds migrated to the tropics (southward migration) to get a chance to detect migratory birds at the study site. Data were collected using the transect method and point count (Bibby et al. 2000). The transect method was carried out by exploring paths to detect birds using binocular and camera in the vegetation around the settlement. The point count method was used at ten observation points in three habitat types. Habitat types at the research site include rice fields, fields, and plantations. Each observation used a radius of 50 m with a distance between points of 150 m (**Fig. 2**). Observers recorded every direct encounter for 30 minutes at each point.

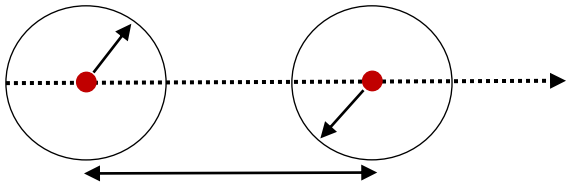

Fig. 2. Illustration of the observation plot using the point count method.

Observations were made three times, in the morning (06.00–09.00 am), afternoon (3.00–6.00 pm), and evening (7.00–10.00 pm and 03.00–04.30 am) to increase the possibility of detecting the presence of birds based on the time of their activity. Diurnal birds are generally most active in the morning and evening, but typically rest at night, while nocturnal birds most active during the night (MacKinnon et al. 2010). Observations were made when the weather was not raining. The bird sounds were recorded using the Android mobile phone (Xiaomi Redmi Note 11 Pro, Xiaomi Communications Co., Ltd, Beijing, China) (Odewumi et al. 2017), then adapted to bird sounds from an internet website (www.xeno-canto.org) to aid in bird identification. All bird species were recorded and labeled at every direct encounter, either with the naked eye or using binoculars (Kiros 2018). The photos were taken using a digital camera with a telephoto lens of 160-500 mm (Nikon D500, NIKON CORPORATION, Bangkok, Thailand) to help identify the bird details (Iswandaru

et al. 2018; Jhenkhar et al. 2016). Identification of bird species was based on MacKinnon et al. (2010), and the common name and scientific name of species were based on the Handbook of the Birds of the World and BirdLife International (2020).

The data collection used qualitative and quantitative methods through in-depth interviews with key informants (Iswandaru et al. 2022). Key informants were chosen deliberately with the snowball technique (Albuquerque et al. 2017). Qualitative methods were used to explain the phenomenon (Iskandar et al. 2021), like the criteria for the potential of birds as objects and the attraction of avitourism. Quantitative methods were used to quantify the results of in-depth interviews on a percent scale (Jien et al. 2021). In-depth interviews were conducted with key informants, including 2 local guides, 5 communities, 2 NGOs, and 12 visitors. The information collected include bird population dynamics in buffer villages, criteria for attractive birds based on experience, knowledge of bird conservation, and the development of avitourism in the future. For the determination of superior species, 9 criteria of birds as avitourism objects and attractions was developed based on the previous studies (Garnett et al. 2018; Green and Jones 2010; Jien et al. 2021; Lišková and Frynta 2013; Zulham et al. 2021) which are raptor, migrant, parrot, protected, songbird, nocturnal, endemic, colorful, and top 50 birds in WKNP.

2.3. Data Analysis

Literature analysis investigated and classified observed bird data based on family and conservation status. In addition, this analysis is also used to track residence status (migrant or resident). The data were then analyzed descriptively and qualitatively to provide an overview of the condition of the research object based on the facts found and explain its relationship to all aspects and current needs of the research location.

Quantitative data were analyzed by simple static computation following the formula (Newing et al. 2011).

$$P = \frac{f}{N} \; x \; 100\% \qquad (1)$$

where P is the percentage of the total answer of the informant, f is the number of informant answers, and N is the total informant.

Furthermore, the results of quantitative data analysis (P) were used to classify the criteria of birds as avitourism objects with a scale: P > 75% = top; 51% ≤ P ≤ 75% = favorite; 25% ≤ P ≤ 50% = impressive and P < 25% = interesting.

3. Results and Discussion

3.1. Results

3.1.1. Birds variation and conservation status

During the observations, 82 species from 39 families were recorded (**Table 1**). The conservation status based on the International Union for Conservation of Nature (IUCN) was 2 species with vulnerable (VU) status: *Leptoptilos javanicus* and *Acridotheres javanicus*, 6 species with near threatened (NT) status: *Prinia familiaris, Psittinus cyanurus, Psilopogon rafflesii, Hierococcyx vagans, Chloropsis cyanopogon*, and *Batrachostomus auratus*, and 74 species with least concern (LC) status. Based on the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), 7 species are listed in Appendix II (AII), meaning that their

trade is controlled to prevent the species from being endangered in the wild. Based on the Regulation of the Minister of Environment and Forestry of Indonesia (MoEF) Number 106 of 2018 (P.106/MENLHK/SETJEN/KUM.1/12/2018), 12 species are protected status, which means that they are prohibited from being traded or kept.

Table 1. List of bird species in the buffer village of WKNP

No.	Family	Common Name	Scientific Name	Conservation Status		
				IUCN	CITES	Indonesian Regulation
1	Acanthizidae	Golden-bellied Gerygone	*Gerygone sulphurea*	LC	-	-
2	Accipitridae	Changeable Hawk-eagle	*Nisaetus cirrhatus*	LC	AII	D
3	Accipitridae	Black-winged Kite	*Elanus caeruleus*	LC	AII	D
4	Accipitridae	Chinese Sparrowhawk	*Accipiter soloensis*	LC	AII	D
5	Accipitridae	Crested Goshawk	*Accipiter trivirgatus*	LC	AII	D
6	Accipitridae	Shikra	*Accipiter badius*	LC	AII	D
7	Accipitridae	Oriental Honey-buzzard	*Pernis ptilorhyncus*	LC	AII	D
8	Alcedinidae	White-breasted Kingfisher	*Halcyon smyrnensis*	LC	-	-
9	Alcedinidae	Collared Kingfisher	*Todiramphus chloris*	LC	-	-
10	Alcedinidae	Cerulean Kingfisher	*Alcedo coerulescens*	LC	-	-
11	Alcedinidae	Blue-eared Kingfisher	*Alcedo meninting*	LC	-	-
12	Apodidae	Glossy Swiftlet	*Collocalia esculenta*	LC	-	-
13	Ardeidae	Cinnamon Bittern	*Ixobrychus cinnamomeus*	LC	-	-
14	Ardeidae	Javan Pond-heron	*Ardeola speciosa*	LC	-	-
15	Ardeidae	Little Egret	*Egretta garzetta*	LC	-	-
16	Ardeidae	Cattle Egret	*Bubulcus ibis*	LC	-	-
17	Artamidae	White-breasted Woodswallow	*Artamus leucorynchus*	LC	-	-
18	Campephagidae	Pied Triller	*Lalage nigra*	LC	-	-
19	Campephagidae	Bar-bellied Cuckooshrike	*Coracina striata*	LC	-	-
20	Caprimulgidae	Large-tailed Nightjar	*Caprimulgus macrurus*	LC	-	-
21	Chloropseidae	Lesser Green Leafbird	*Chloropsis cyanopogon*	NT	-	D
22	Ciconiidae	Lesser Adjutant	*Leptoptilos javanicus*	VU	-	D
23	Cisticolidae	Ashy Tailorbird	*Orthotomus ruficeps*	LC	-	-
24	Cisticolidae	Rufous-tailed Tailorbird	*Orthotomus sericeus*	LC	-	-
25	Cisticolidae	Bar-winged Prinia	*Prinia familiaris*	NT	-	-
26	Cisticolidae	Yellow-bellied Prinia	*Prinia flaviventris*	LC	-	-
27	Columbidae	Grey-capped Emerald Dove	*Chalcophaps indica*	LC	-	-
28	Columbidae	Zebra Dove	*Geopelia striata*	LC	-	-
29	Columbidae	Pink-necked Green-pigeon	*Treron vernans*	LC	-	-
30	Columbidae	Eastern Spotted Dove	*Spilopelia chinensis*	LC	-	-
31	Coraciidae	Oriental Dollarbird	*Eurystomus orientalis*	LC	-	-

No.	Family	Common Name	Scientific Name	Conservation Status		
				IUCN	CITES	Indonesian Regulation
32	Corvidae	Slender-billed Crow	*Corvus enca*	LC	-	-
33	Corvidae	Malay Black Magpie	*Platysmurus leucopterus*	LC	-	D
34	Cuculidae	Lesser Coucal	*Centropus bengalensis*	LC	-	-
35	Cuculidae	Greater Coucal	*Centropus sinensis*	LC	-	-
36	Cuculidae	Black-bellied Malkoha	*Phaenicophaeus diardi*	LC	-	-
37	Cuculidae	Chestnut-breasted Malkoha	*Phaenicophaeus curvirostris*	LC	-	-
38	Cuculidae	Large Hawk-cuckoo	*Hierococcyx vagans*	NT	-	-
39	Cuculidae	Little Bronze-cuckoo	*Chrysococcyx minutillus*	LC	-	-
40	Cuculidae	Western Koel	*Eudynamys scolopaceus*	LC	-	-
41	Cuculidae	Plantive Cuckoo	*Cacomantis merulinus*	LC	-	-
42	Dicaeidae	Scarlet-headed Flowerpecker	*Dicaeum trochileum*	LC	-	-
43	Dicaeidae	Yellow-vented Flowerpecker	*Dicaeum chrysorrheum*	LC	-	-
44	Dicaeidae	Orange-bellied Flowerpecker	*Dicaeum trigonostigma*	LC	-	-
45	Dicruridae	Greater Racquet-tailed Drongo	*Dicrurus paradiseus*	LC	-	-
46	Estrildidae	White-headed Munia	*Lonchura maja*	LC	-	-
47	Estrildidae	Javan Munia	*Lonchura leucogastroides*	LC	-	-
48	Estrildidae	White-capped Munia	*Lonchura ferruginosa*	LC	-	-
49	Estrildidae	Scaly-breasted Munia	*Lonchura punctulata*	LC	-	-
50	Falconidae	Black-thighed Falconet	*Microhierax fringillarius*	LC	-	-
51	Glareolidae	Oriental Pranticole	*Glareola maldivarum*	LC	-	D
52	Hirundinidae	Asian House Martin	*Delichon dasypus*	LC	-	-
53	Laniidae	Brown Shrike	*Lanius cristatus*	LC	-	-
54	Laniidae	Long-tailed Shrike	*Lanius schach*	LC	-	-
55	Laniidae	Tiger Shrike	*Lanius tigrinus*	LC	-	-
56	Megalaimidae	Red-crowned Barbet	*Psilopogon rafflesii*	NT	-	-
57	Meropidae	Blue-throated Bee-eater	*Merops viridis*	LC	-	-
58	Meropidae	Blue-tailed Bee-eater	*Merops philippinus*	LC	-	-
59	Motacillidae	Australasian Pipit	*Anthus novaeseelandiae*	LC	-	-
60	Muscicapidae	Yellow-rumped Flycatcher	*Ficedula zanthopygia*	LC	-	-
61	Nectariniidae	Brown-throated Sunbird	*Anthreptes malacensis*	LC	-	-
62	Nectariniidae	Olive-backed Sunbird	*Nectarinia jugularis*	LC	-	-
63	Oriolidae	Black-naped Oriole	*Oriolus chinensis*	LC	-	-
64	Picidae	Sunda Pygmy Woodpecker	*Dendrocopos moluccensis*	LC	-	-
65	Picidae	Banded Woodpecker	*Chrysophlegma miniaceum*	LC	-	-
66	Podargidae	Sunda Frogmouth	*Batrachostomus cornutus*	LC	-	-
67	Podargidae	Large Frogmouth	*Batrachostomus auritus*	NT	-	-

No.	Family	Common Name	Scientific Name	Conservation Status		
				IUCN	CITES	Indonesian Regulation
68	Psittacidae	Blue-rumped Parrot	*Psittinus cyanurus*	NT	AII	D
69	Psittacidae	Blue-crowned hanging-parrot	*Loriculus galgulus*	LC	-	D
70	Pycnonotidae	Sooty-headed Bulbul	*Pycnonotus aurigaster*	LC	-	-
71	Pycnonotidae	Olive-winged Bulbul	*Pycnonotus plumosus*	LC	-	-
72	Pycnonotidae	Yellow-vented Bulbul	*Pycnonotus goiavier*	LC	-	-
73	Rallidae	White-breasted Waterhen	*Amaurornis phoenicurus*	LC	-	-
74	Rhipiduridae	Sunda Pied Fantail	*Rhipidura javanica*	LC	-	D
75	Strigidae	Sunda Scops-owl	*Otus lempiji*	LC	-	-
76	Sturnidae	Javan Myna	*Acridotheres javanicus*	VU	-	-
77	Timalidae	Pin-striped Tit-babbler	*Macronous gularis*	LC	-	-
78	Timalidae	Chestnut-winged Babbler	*Stachyris erythroptera*	LC	-	-
79	Turnicidae	Barred Buttonquail	*Turnix suscitator*	LC	-	-
80	Tytonidae	Common Barn-owl	*Tyto alba*	LC	-	-
81	Vangidae	Black-winged Flycatcher-shrike	*Hemipus hirundinaceus*	LC	-	-
82	Rallidae	Slaty-breasted Rail	*Gallirallus striatus*	LC	-	-

Notes: VU = vulnerable; LC = least concern; AII = appendix II; D = protected.

This study also found that among the 82 bird species, 5 species (6.09%) have a high potential to be traded. Referring to the report of Chng et al. (2015) who listed the ten most common bird species in the Jakarta market, the 5 species found in the buffer villages around WKNP are *Geopelia striata, Pycnonotus goiavier, Pycnonotus aurigaster, Lonchura punctulata,* and *Acridotheres javanicus.* In addition, referring to Nijman et al. (2022), 6 raptors (85.71%) found in the buffer villages around WKNP, namely *Accipiter soloensis*, *Accipiter trivirgatus*, *Elanus caeruleus*, *Microhierax fringillarius*, *Nisaetus cirrhatus*, and *Pernis ptilorhyncus* potentially traded online through social media such as facebook and instagram. The results of this study also revealed the existence of several birds with VU conservation status, but their trade is not regulated and not restricted in Indonesia. Birds that have the potential to be traded online illegally can be diverted as a source of avitourism development in villages that support conservation areas. However, it needs to be backed by regulations at the village level that are agreed upon by village officials, the community, and other parties (Nainggolan et al. 2019). Thus, the potentially profitable avitourism with 82 species of objects recorded in the buffer villages around WKNP need to be pursued to avoid hunting birds with the motive of economic pressure.

Migratory birds influence the variety of bird species in the buffer villages around WKNP from the northern (winter migrants). Nine species of migratory birds (10.97%) were recorded (**Table 2**). The 9 migratory birds are annual winter visitors in tropical areas, including Indonesia (Atlas Burung Indonesia 2020; Eaton et al. 2021; MacKinnon et al. 2010). In addition, the variety of birds is also influenced by land cover conditions. It is located adjacent to the condition of land cover, which is directly connected to the WKNP forest, so it functions as a natural corridor supporting wild bird life. This study also revealed the yard's condition with various trees that could be a source of food, perches, and resting and nesting areas. Feroz and Hadi (2016) and Iswandaru

et al. (2020) studies also reinforce these results, stating that the more vegetation covered, the more birds occupy it.

The composition of birds based on family (**Fig. 3**) shows that the Cuculidae family has the highest number of species, consisting of 8 species (9.88%), and the Accipitridae family consists of 6 species (7.41%). Furthermore, the families of Alcedinidae, Ardeidae, Cisticolidae, Columbidae, Dicaeidae, and Estrildidae each have 4 species (4.94%). The families of Laniidae and Pycnonotidae each have 3 species (3.70%), 8 families each consist of 2 species (2.47%), and the other 10 families each comprised of 1 species (1.23%).

Table 2. List of migratory birds in the buffer village of WKNP

No.	Species	Scientific Name	Geography Distribution	
			Breeding Habitat	Wintering Habitat in Indonesian
1	Brown Shrike	*Lanius cristatus*	Japan, Kazakhstan, South Korea, North Korea, China, Mongolia, Russia	Sumatra, Java, Bali, Nusa TenggaraBorneo, Sulawesi
2	Tiger Shrike	*Lanius tigrinus*	North Korea, South Korea, China, Japan,	Sumatra, Java, Kalimantan
3	Chinese Sparrowhawk	*Accipiter soloensis*	South Korea, North Korea, China, Russia, Vietnam	Sumatra, Java, Bali, Nusa Tenggara, Celebes, North Moluccas, Papua
4	Shikra	*Accipiter badius*	China, Kazakhstan, Kyrgyzstan, Liberia, Tajikistan, Uzbekistan, Vietnam	Sumatra
5	Yellow-rumped Flycatcher	*Ficedula zanthopygia*	China, South Korea, North Korea, Mongolia, Russian	Sumatra and Java
6	Oriental Honey-buzzard	*Pernis ptilorhyncus*	Japan, North Korea, South Korea, Russia	Sumatra, Java, Bali, Nusa Tenggara, Borneo, Moluccas
7	Oriental Pratincole	*Glareola maldivarum*	Mongolia, Eastern China, Hongkong, Myanmar, Thailand, Cambodia, Vietnam	Sumatra, Java, Bali, Nusa Tenggara, Celebes, Sulawesi, Papua
8	Western/Asian Koel	*Eudynamys scolopaceus*	Bangladesh, India, Pakistan, Srilanka, Maldive, China	Sumatra, Java, Bali, Nusa Tenggara, North Moluccas
9	Large Hawk-Cuckoo	*Hierococcyx vagans*	Himalaya, South Asia, Southeast Asia, East Asia, Northeast Asia, South China	Sumatra, Borneo, Java, Bali and North Celebes

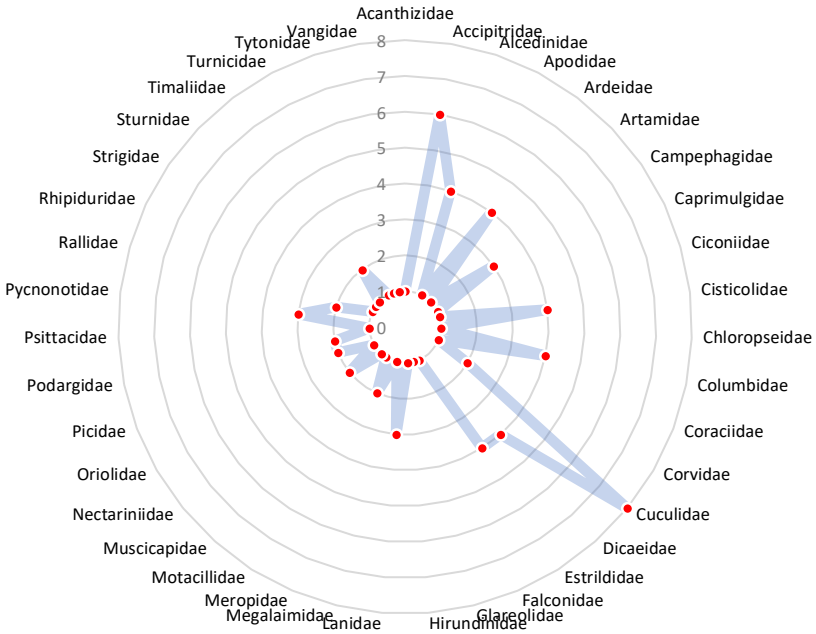

Fig. 3. Composition of birds based on family.

3.1.2. The potential of birds as object and attraction of avitourism

The result of in-depth interviews with all informants explained 9 criteria for birds that has potential as avitourism objects and attractions in villages around WKNP (**Table 3**). Informants' perceptions of the 9 criteria were different (**Fig. 4**). These results indicated that collecting perceptions from various parties is very important in supporting the development of avitourism. In addition, combining information based on perceptions is helpful to accommodate the multiple interests of the parties in building and developing avitourism around conservation areas to avoid conflicts of interest.

Table 3. Criteria of birds as objects and attractions of avitourism

No.	Criteria	Explanation
1	Raptor	Birds with a reputation as hunters. Size of bodies from small to large. It has a distinctive and exciting morphology, including sharp and sturdy beaks and toenails, a large and stocky wingspan, and the best eye focus to see prey from a distance. Birds with unique habits and behaviors when hunting game, such as flying in circles (soaring) and swooping sharply from the air to pounce on their prey. With a morphological appearance that is stocky and powerful, making it a charismatic bird.
2	Migrant	Birds whose existence is strongly influenced by the seasons, especially in the tropics, cannot be observed every time. Birds originate from the Northern and are immigrants to Indonesia. What's interesting is that migratory birds are commonly observed when traveling to their wintering habitat or when carrying out activities in their wintering habitat.
3	Parrot	Birds with unique and distinctive morphological features in the beak. The shape of the beak is crooked or curved downwards and solid and thick. The beak functions like a pair of scissors or a knife to cut, split and peel the skin and thick flesh of the fruit. It has various sizes, and some species also have bright and attractive fur colors.
4	Protected	Birds with sparse populations in nature and rare status, so seeing them in nature is a worthwhile experience. In addition, observing protected bird species will increase knowledge and awareness through several questions, such as "Why is it protected?"; "What are the contributing factors?"
5	Songbird	Birds with melodious voices, forming a tone like singing so that they can hear their voices directly and observe their activities in nature, is very pleasant and calming compared to seeing and hearing in a cage.
6	Nocturnal	Birds that carry out activities such as hunting fly silently at night, so for some people, it is fascinating to observe. Owls: birds with distinctive morphological characteristics, namely large eyes, rounded faces, and sharp beaks. Nightjar: small body and short beak. Frogmouth: medium-sized body with a beak like a frog's mouth.
7	Endemic	Birds with limited geographic distribution only exist in Indonesia and will not be found in other countries (except for the introduction). Seeing and observing this type of bird is an experience and a high-value prestige, especially for foreign tourists who like bird watching or bird photography.
8	Colorful	Birds with striking plumage colors contrast with the color of the surrounding vegetation. Sometimes there are birds with a combination of 3 to 5 colors, creating awe for those who see them.
9	Top 50 birds in WKNP	Birds are on the list of requests from a birder, especially from outside Indonesia. This bird list results from several years of birdwatching activities at WKNP.

The criteria for birds as avitourism objects and attractions included in the top classification are nocturnal birds (86.67%), followed by the top 50 birds in WKNP (83.33%) and parrot birds (81.33%). The favorite classification consists of colorful birds (75%), raptor birds (66.67%), and protected birds (61.67%). The impressive classification includes migrant birds (51.33%) and endemic birds (44.67%). The interesting classification only has one, namely songbird (23.33%).

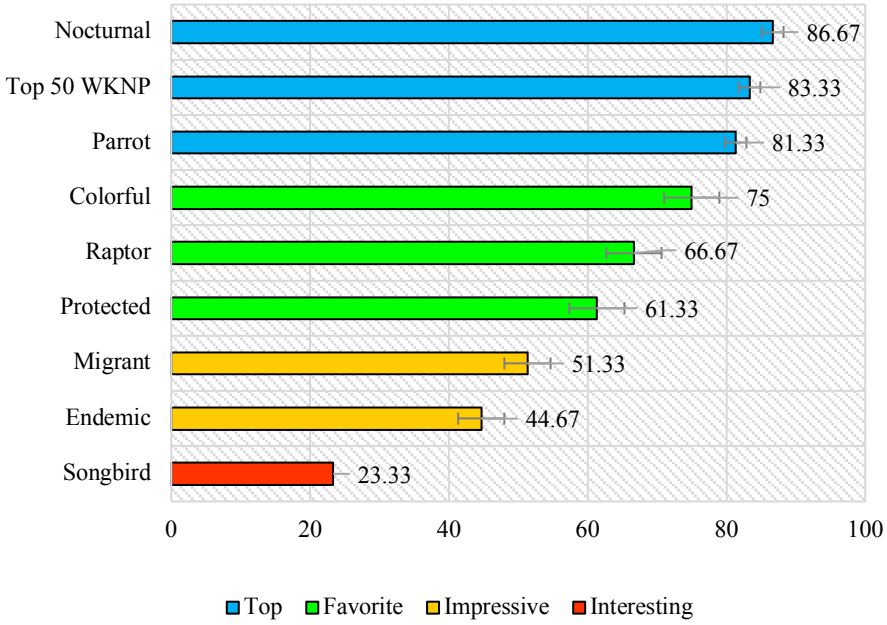

Fig. 4. Percentage of perceptions of the criteria and classification of birds as objects and attractions of avitourism.

Based on the 9 potential criteria (**Table 4**), 3 bird species have at least 4 criteria and at least 1 criteria. Of the 82 species recorded, 3 bird species (*Pernis ptilorhyncus*, *Psittinus cyanurus*, and *Loriculus galgulus*) met 4 criteria. Six species have 3 criteria, and 10 have 2 criteria. Furthermore, 36 species had only 1 criteria, and 27 species were not included in the 9 criteria.

3.2. Discussion

This study shows that 55 species (67.07%) of the 82 bird species recorded are potential avitourism attractions (**Table 4**). It means that these 55 bird species are vital objects or assets that become essential capital in the development of avitourism in the buffer villages around WKNP.

Based on the list of the top 50 birds in WKNP, 10 of these species can be found in buffer villages. Three species of the raptor group are *Microhierax fringillarius*, *Elanus caeruleus*, and *Pernis ptilorhyncus*. The 3 of them are usually seen flying in the plantation area. One species of the waterbird, *Leptoptilos javanicus*, was recorded foraging in the rice fields. Two species are brood parasitism birds, namely *Phaenicophaeus diardi* and *Phaenicophaeus curvirostris*. *Phaenicophaeus diardi* was observed flying low and hiding in the *Mangifera indica* tree while *Phaenicophaeus curvirostris* was eating insects. Two species of the parrot group are *Psittinus cyanurus* and *Loriculus galgulus*, the 3 are usually seen visiting a fruiting tree to eat. Two other species are nocturnal birds, namely *Batrachostomus auritus* and *Batrachostomus cornutus*, in great demand by night birding enthusiasts.

Table 4. Potential birds as objects and attractions of avitourism in the buffer village of WKNP

No.	Species	*Scientific Name*	Potential Criteria								
			R	M	PR	P	S	N	E	C	T
1	Black-thighed Falconet	*Microhierax fringillarius*	√			√					√
2	Lesser Adjutant	*Leptoptilos javanicus*				√					√
3	Brown Shrike	*Lanius cristatus*		√			√				
4	Long-tailed Shrike	*Lanius schach*					√				
5	Tiger Shrike	*Lanius tigrinus*		√			√				
6	Javan Munia	*Lonchura leucogastroides*							√		
7	White-capped Munia	*Lonchura ferruginosa*							√		
8	Orange-bellied Flowerpecker	*Dicaeum trigonostigma*								√	
9	Scarlet-headed Flowerpecker	*Dicaeum trochileum*							√	√	
10	Yellow-vented Flowerpecker	*Dicaeum chrysorrheum*								√	
11	Large-tailed Nightjar	*Caprimulgus macrurus*						√			
12	Sunda Scops-owl	*Otus lempiji*						√			
13	Lesser Green Leafbird	*Chloropsis cyanopogon*				√	√			√	
14	Ashy Tailorbird	*Orthotomus ruficeps*					√				
15	Rufous-tailed Tailorbird	*Orthotomus sericeus*					√				
16	Pin-striped Tit-babbler	*Macronous gularis*					√				
17	Sooty-headed Bulbul	*Pycnonotus aurigaster*					√				
18	Grey-capped Emerald Dove	*Chalcophaps indica*								√	
19	Chinese Sparrowhawk	*Accipiter soloensis*	√	√		√					
20	Crested Goshawk	*Accipiter trivirgatus*	√			√					
21	Shikra	*Accipiter badius*	√	√		√					
22	Changeable Hawk-eagle	*Nisaetus cirrhatus*	√			√					
23	Black-winged Kite	*Elanus caeruleus*	√			√					√
24	Black-winged Flycatcher-shrike	*Hemipus hirundinaceus*					√				
25	Black-bellied Malkoha	*Phaenicophaeus diardi*									√
26	Chestnut-breasted Malkoha	*Phaenicophaeus curvirostris*									√
27	Large Hawk-cuckoo	*Hierococcyx vagans*		√							
28	Pied Triller	*Lalage nigra*					√				
29	Black-naped Oriole	*Oriolus chinensis*					√				
30	Bar-bellied Cuckooshrike	*Coracina striata*					√				
31	Javan Myna	*Acridotheres javanicus*					√				
32	Sunda Pied Fantail	*Rhipidura javanica*				√	√				
33	Blue-throated Bee-eater	*Merops viridis*								√	
34	Blue-tailed Bee-eater	*Merops philippinus*								√	
35	Olive-winged Bulbul	*Pycnonotus plumosus*					√				
36	Yellow-vented Bulbul	*Pycnonotus goiavier*					√				
37	Blue-rumped Parrot	*Psittinus cyanurus*			√	√				√	√
38	Large Frogmouth	*Batrachostomus auritus*						√			√
39	Sunda Frogmouth	*Batrachostomus cornutus*						√	√		√
40	Banded Woodpecker	*Chrysophlegma miniaceum*								√	
41	Bar-winged Prinia	*Prinia familiaris*					√				
42	Yellow-bellied Prinia	*Prinia flaviventris*					√				
43	Zebra Dove	*Geopelia striata*					√				
44	Pink-necked Green-pigeon	*Treron vernans*								√	
45	Blue-eared Kingfisher	*Alcedo meninting*								√	
46	Golden-bellied Gerygone	*Gerygone sulphurea*					√				
47	Common Barn-owl	*Tyto alba*						√			
48	Blue-crowned Hanging Parrot	*Loriculus galgulus*			√	√				√	√
49	Yellow-rumped Flycatcher	*Ficedula zanthopygia*		√			√				
50	Oriental Honey-buzzard	*Pernis ptilorhyncus*	√	√		√					√
51	Greater Racquet-tailed Drongo	*Dicrurus paradiseus*					√				
52	Red-crowned Barbet	*Psilopogon rafflesia*								√	
53	Oriental Pranticole	*Glareola maldivarum*		√		√					
54	Oriental Dollarbird	*Eurystomus orientalis*					√				
55	Western Koel	*Eudynamys scolopaceus*		√							

Notes: R = Raptor; M = Migrant; P = Protected; S = Songbird; N = Nocturnal; E = Endemic C = Colorful; T = Top 50 in WKNP.

Birds from forest birds and songbirds such as *Dicrurus paradiseus* and *Coracina striata. Coracina striata* were nesting in the *Alstonia scholaris* tree around the yard with one individual of juvenile (**Fig. 5**). Adult individuals were also found eating insects on the *Acacia auriculiformis* tree (**Fig. 5**). Generally, the primary habitat of these 2 species is lowland tropical forests (BirdLife International 2016a, b; Eaton et al. 2021). It is an essential and valuable record so that it can attract visitors to come. Several other birds, including *Gerygone sulphurea*, *Acridotheres javanicus*, *Rhipidura javanica*, *Prinia familiaris*, *Chloropsis cyanopogon*, *Oriolus chinensis*, *Lalage nigra*, *Pycnonotus goiavier,* were recorded to come often to forage or just perch and sing in the trees around the yard.

Fig. 5. Left: a juvenile in the nest; Right: an adult eats an insect.

Nine birds were recorded as winter arrivals in Sumatra. *Lanius cristatus*, *Lanius tigrinus,* and *Ficedula zanthopygia* are migratory birds from the songbird (Eaton et al. 2021; MacKinnon et al. 2010). *Accipiter soloensis, Accipiter badius,* and *Pernis ptilorhyncus* are migratory birds from the raptor (Germi 2005; Germi et al. 2013; Iswandaru et al. 2022; Nijman 2001, 2005; Nijman et al. 2006). *Glareola maldivarum* is a migratory bird from the waterbird (Gönner et al. 2014; Susanto et al. 2015). *Hierococcyx vagans* and *Eudynamys scolopaceus* are migratory birds from the brood parasitism bird (Ali et al. 2007; Payne 1998; Praveen and Lowther 2020). The nine birds that migrated to the buffer village were recorded utilizing different habitat types for their daily activities. Migratory birds are noted to use different habitat types. Songbirds do more daily activities around the yard, such as eating, perching, and singing using trees or other plants. Waterbird utilizes the ecosystem of rice fields and surrounding swamps to eat, explore and rest. For raptors, it was recorded flock across the buffer village. The *Eudynamys scolopaceus* was found using the yard around the house for foraging, such as ripe fruits, one of which is papaya (**Fig. 6**). The presence of these migratory birds is a unique attraction because they can only be found in the buffer village between October–April when their breeding habitat experiences winter. They migrate to the tropics for a warm environment and abundant food sources because it is available all year round (Iswandaru et al. 2022; Sodhi et al. 2011). This result indicated that the buffer villages around WKNP have the potential as wintering habitats or stopover areas.

Eleven birds are listed as protected species based on the regulation of MoEF Number 106 of 2018 because their numbers are decreasing so fast that their populations are rare. Based on IUCN red list, one protected bird is *Chloropsis cyanopogon* because of its near-threatened status (NT). Usually, the leading cause is hunting for illegal trade due to market demand at high prices (Nijman et al. 2021; Nijman et al. 2022a; Nijman et al. 2022b). In the buffer village, this bird was observed eating ripe bananas around the backyard (**Fig. 6**). But on the other hand, the presence of birds with

protected status in the buffer village indirectly indicates that this area is capable of being a safe place for wild bird life. In addition, the presence of protected birds can increase visitor and public awareness regarding the conservation status of birds (Steven et al. 2015).

Fig. 6. Left: an adult male of *Eudynamys scolopaceus* eats papaya; Right: an adult female of *Chloropsis cyanopogon* eats banana.

Birds with beautiful colors are in great demand by visitors who like photography (Green and Jones 2010; Zhu et al. 2021) because of bright and contrasting colors, color patterns, uniqueness, and charisma (Lišková et al. 2015; Lišková and Frynta 2013; Senior et al. 2022; Stoudt et al. 2022). Colorful birds found in the buffer villages around WKNP, namely *Dicaeum trigonostigma*, *Dicaeum trochileum*, *Dicaeum chrysorrheum, Chalcophaps indica*, *Merops viridis*, *Merops philippinus*, *Psittinus cyanurus*, *Loriculus galgulus*, *Chrysophlegma miniaceum*, *Treron vernans*, *Alcedo meninting*, *Psilopogon rafflesia*. Male individuals dominate birds with attractive colors. *Dicaeum trigonostigma* has two dominant colors, namely orange and blue. The color is orange on the back to the stomach, while the head, wings, and tail are slate-blue. *Dicaeum trochileum,* the body is dominated by red, grayish white, and black. Red on the head, back, and chest, while the underside of the body is grayish-white with black wings and tail. *Dicaeum chrysorrheum,* consists of olive green color on the part of the head, back, wings to tail, while the lower body starting from the throat, chest, and belly, is white with slightly thick vertical black stripes. *Chalcophaps indica,* metallic green on the top, especially the wings. The head (crown) is white or gray, while the lower body and neck are pink. *Merops viridis,* birds are predominantly green except for the head (crown) and brown coat. Blue-green wings with a bright blue rump and throat with a long tail with bands. *Merops philippinus,* greenish bird with a yellow or orange throat. The head to the wings and lower body are green, and the rump and long tail are blue and have bands. *Psittinus cyanurus,* the bird is blue on the head and has a red beak and black coat. The wings and upper body are greenish, while the underparts are grayish with blue stripes. *Loriculus galgulus*, the dominant color of the bird, is green, with a bit of red on the throat and tail, and the beak is black. *Chrysophlegma miniaceum* is a bird with a dominant red color to brownish red with a yellow crest. The coat is olive green with a striped pattern with red wings. Lower body to buttocks, horizontal brown stripes with a black tail. *Treron vernans,* a colorful bird with a gray head, pink neck, and orange chest. Greenish wings with yellow and black fringe feathers. Lower body yellowish green with a gray tail. *Alcedo meninting* birds with dominant colors blue and orange. The upper body is metallic blue, and the lower body is light orange. The bill is blackish red. Easy to find around wetlands such as swamp areas. *Psilopogon rafflesia,* greenish almost all over the body. The head is blue, red, black, and yellow, with a blue throat.

Parrots are very interesting for visitors because they have a distinctive morphology that makes them look unique and not too sensitive to human movement. In addition, it has beautiful colorful feathers, thus providing a visually entertaining spectacle (Lee et al. 2017). *Psittinus cyanurus*, this bird eats star fruit (Yeo 2016) and other fruits. The site recorded eating fruit of *petai* or *Parkia speciosa* (**Fig. 7**). *Loriculus galgulus,* these birds feed on fruits, buds, and sometimes small insects (Arndt 2006; Kasper 2002) and prefer to perch on the branches of fruit trees (Zhen 2020). In recorded locations, it perches on banana trunks to collect nesting material (**Fig. 7**) other than leaves, bark, and wood chips (Andrysek et al. 2014; Zhen 2020). Both birds often perform daily activities in the yard in the morning, such as foraging, perching, and singing. They are sometimes seen flying with noise from the WKNP area to settlements or their surroundings (Hoogerwaard 2000).

Fig. 7. Left: an adult male of *Psittinus cyanurus* eats *Parkia speciosa* fruit; Right: an adult male of *Loriculus galgulus* cuts nesting materials.

Raptors are birds of great interest in avitourism (Green and Jones 2010). Raptor is also charismatic bird when viewed from their morphology (Mcclure et al. 2018; Natsukawa et al. 2021). Seven species of raptors can be found in the villages around WKNP, three of which are migratory birds (**Table 4**). Four species are resident birds whose daily activity can be seen throughout the year. *Microhierax fringillarius*, a small type of raptor (14–17 cm), lives solitary or in pairs. They were often seen perching on dry, dead trees while eating prey in the form of dragonflies caught near the plantations on the outskirts of the village. *Elanus caeruleus*, a medium-sized (30 cm) raptor, is white with red eyes. Likes open and dry places to hunt prey in the form of snakes, lizards, and mice. They are often seen perched on treetops and electricity poles or seen flying around while hunting for prey. *Nisaetus cirrhatus*, is a large type of raptor (51–82 cm). More often seen flying while making noise when hunting for prey above plantations or fields. It is easy to spot in flight because the underbody is white with thick brown stripes. *Accipiter trivirgatus*, a medium-sized raptor (30–46 cm). They are often seen flying near forests and plantations when hunting for prey, rarely seen perching in buffer village areas. The attraction of the raptor is when it flies in circles (soaring) and swoops sharply to pounce on prey.

Because of their limited distribution, endemic birds are in great demand to be seen by visitors. The higher the number of endemic birds, the more attractiveness in avitourism (Puhakka et al. 2011). Three endemic bird species were recorded in the WKNP buffer village (**Table 4**). *Lonchura leucogastroides* is an endemic bird distributed in Sumatra, Java, and Bali. *Lonchura ferruginous* is an endemic bird with natural distribution only on the islands of Java and Bali (BirdLife International 2018) and the first recorded in Sumatra in 2007 (Iqbal 2011). Both are easy to find around the yard and rice fields, especially when the rice starts to bear fruit. *Dicaeum*

trochileum is an endemic bird distributed in Sumatra, Kalimantan, Java, and Bali (Cheke and Mann 2008). This bird is very fond of the seeds and fruit of parasites and small insects (Cheke and Mann 2008; Taufiqurrahman 2010), so to find them, only look for plants overgrown with parasites around the yard.

Nocturnal birds are in great demand in avitourism, especially night birding tourism (Olah and Simay 2007). Night birding tourism is preferred because it provides experiences and challenges to train alert instincts so that it is different from ordinary birding. Nocturnal birds found in the buffer villages around WKNP were *Caprimulgus macrurus*, *Otus lempiji*, *Tyto alba*, *Batrachotomus auritus*, and *Batrachotomus cornutus*. To find these two birds is not difficult, except for the genus *Batrachotomus* and *Tyto alba*. *Caprimulgus macrurus* can be found most of the night. Usually, the beginning of its existence can be signaled by sound in the bushes or gardens around the settlement at night. *Otus lempiji*, including owls, are common and often found around settlements (Lok et al. 2009). At the research site, it was easier to find bamboo clumps or trees with slightly open canopy in the yard some distance from the settlement. Based on observations, the best times to observe these two species are dusk and dawn. *Tyto alba*, a large owl, is often found nesting in buildings, cliffs, and caves (Olsen et al. 2020; Saufi et al. 2020). At the study site, these birds often approach settlements or perch on trees near rice fields when hunting for rats. *Batrachotomus auritus* and *Batrachotomus cornutus* are night birds of the frogmouth. Both prefer trees with dense crowns and horizontal branches for perching, resting, and nesting (Cheong and Li 2010; Syahputra and Iqbal 2016). At the research site, *Batrachostomus auritus* was only observed once perched on a *Schima wallichii* tree, then flew. *Batrachotomus cornutus* observed an individual male keep of the nest on a branch of the tree *Syszygium aqueum* (**Fig. 8**). Based on observations, the best time to watch frogmouth and owls is from 10 pm to 04.30 am.

Fig. 8. A male of *Batrachotomus cornutus* keeps the nest on the day.

During the observation, the birds occupied several different habitat types, such as backyards, rice fields, fields, and plantations. This result indicates that each species has a different habitat preference from other species. In addition, it is also an indicator that the buffer village can provide the resources needed for birds to live and breed. In addition, another indication is that the condition of the buffer village can provide a safe place for birds from predators and bad weather.

It is an excellent opportunity for a bird conservation program in rural areas around the conservation area, where the balance of positive and negative impacts of avitourism activities is a top priority in its management for the communities involved. In addition, through the development

of avitourism, it is hoped that at least reduce or prevent illegal practices in utilizing forest resources from within the WKNP area due to switching to avitourism activities. There is also potential to raise awareness about the conservation status of birds among the parties involved, including visitors. However, the biggest challenge is the impact of avitourism management on birds and their habitats. Of course, this requires the commitment of all parties to take care of each other that avitourism is ecologically, economically, and socially sustainable tourism.

4. Conclusions

Birds that have the potential as objects and attractions of avitourism in the buffer villages around WKNP consist of 55 species (67.07%) of the total number of species recorded (82 species). There were nine criteria for the 55 preferred birds in the buffer village, and several species had more than one criterion with four classification types. The criteria are nocturnal (4 species), top 50 WKNP (10 species), parrot (2 species), colorful (12 species), raptor (7 species), protected (11 species), migrant (9 species), endemic (3 species), and songbird (8 species). The top classification consists of 3 criteria (nocturnal, top 50 WKNP, parrot). The favorite classification consists of 3 criteria (colorful, raptor, and protected). The impressive classification consists of 2 criteria (migrants and endemic), and the interesting classification consists of 1 criteria (songbird). The existence of 55 species of birds that have the potential to act as avitourism objects and attractions is an opportunity to make a buffer village an alternative location for avitourism to increase income to support community welfare.

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