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Bird Species Inventory in Tlogoguwo Village, Purworejo

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Abstract: Tlogoguwo village is located in the Menoreh karst mountains, which administratively belongs to Kaligesing Sub-district, Puworejo District. Tlogoguwo is located at an altitude of 700 meters above sea level, and has riverine, agroforestry, and secondary forest habitats. These habitats provide varied vegetation cover that supports bird survival such as foraging, nesting, sheltering, and resting.. Unfortunately, information on bird species data in Tlogoguwo Village is minimal, therefore this inventory activity is important to update bird species data in Tlogoguwo Village. This study aims to obtain data on bird species found in Tlogoguwo Village and determine their conservation status. This data can be used as a reference base for further bird research or as a basic foundation in developing biodiversity protection strategies. Bird species inventory research in Tlogoguwo Village was carried out on March 19-27, 2022 every Saturday and Sunday. Each day the data collection was divided into 2 sessions, namely, session 1 (07.00-10.00 WIB) and session 2 (14.30-17.30 WIB). The method used in this study is a combination of the Cruising method and the Encounter Rates method. The data obtained were analyzed using the relative abundance index and tabulated in tabular form. The results showed that there were 40 bird species from 23 families spread throughout the observation area. The abundance value of birds was categorized into 6 species "frequent" and 34 species "uncommon". Protected bird conservation status by P 106 2018, there were 3 bird species. The conservation status by IUCN in this study is classified into 3 categories, that endangered (EN), vulnerable (VU) and least concern (LC). The Status of international trade according to CITES indicates 3 species are included in Appendix II.

Keywords: Birds, Encounter Rates, Inventory, Species, Tlogoguwo Village.

Introduction

Birds are one of the wildlife species that are widely used by humans as food, pets, fulfillment of economic needs, and aesthetics (Adelina, 2016). Bird survey techniques are simpler and monitoring is relatively easier, making the distribution, ecology, biology, and life history of birds better known than other taxa (Widodo, 2013). Ecologically, birds have the potential to control plant pests, help pollinate plants, spread plant seeds and can be used as indicators of environmental quality (Ashari, 2019). Their diversity is strongly influenced by changes in biotic and abiotic factors, both in the short and long term, making birds an indicator of environmental quality.

In the food chain, birds occupy the top position, making them more sensitive to changes in environmental contamination (Widodo, 2013). The nature of birds that tend to be easy to detect, observe, easy to identify taxonomy, and widely distributed with varied ecological habitats, is the basis for birds to be used as environmental indicators. Aesthetically, the morphology of birds such as feather color, beak shape, habits and sound are attractive to enthusiasts. Meanwhile, economically, birds can also bring benefits to certain groups, such as birdwatching tours that are carried out by observing the lives of birds in nature as a means of recreation or learning.

According to Burung Indonesia (2023), by early 2023, Indonesia was home to 1826 species of birds with 172 species threatened with extinction. The main problems that threaten bird extinction are habitat loss or destruction and hunting for trade. Endangered species can be triggered by poaching, land use change, habitat fragmentation, or the

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innate nature of birds in reproducing (Prawiradilaga, 2019).

Birds are among the wildlife that have a consumer role in the food chain. The scarcity of one of the species in the chain will disrupt the sustainability of an ecosystem. Low public awareness about conservation and weak monitoring of legal sanctions are also factors in the decline of bird species. In addition, minor factors caused by predators, competitors with other animals, and disease due to pathogen infection can affect the decline of bird populations. The wildlife trade is also a serious threat to the existence of animals in nature. Some birds are traded for food (meat consumption), medicine and rituals. In order to fulfill market needs, traders will try to obtain bird supplies by various means. This will trigger threats to the sustainability and existence of birds in nature (Haryoko, 2010).

Tlogoguwo Village is an area with a menoreh karst landscape that is high in biodiversity value and both from the physical, chemical, and biological aspects of the karst ecosystem has its own characteristics. Administratively, Tlogoguwo Village is included in the Kaligesing District, Purworejo Regency with an altitude of 700 meters above sea level. Most of the area is dominated by agroforestry ecosystems that provide trees with dense cover, rivers, and sufficient food availability in nature making this location a strategic residence for birds.

The abundance of birds in Tlogoguwo Village is a potential that must be maintained and preserved. This abundance can be used as an indicator of environmental change which is then related to the management of conservation areas. However, the presence of bird species in Tlogoguwo Village is still very minimal information, so inventory research needs to be carried out as data that forms the basis for consideration of the management of the Tlogoguwo karst area. Through the inventory, birds in the Tlogoguwo Village area can be recorded and their conservation status known, so that local people can be educated and participate in preserving the birds in the area.

Materials and Methods

The tools and materials used were binoculars, cameras, stationery, tally sheets, and John Mackinnon's 2010 Field Guide to Birds of Sumatra, Java, Bali and Kalimantan and Birds of Indonesian Archipelago.

This research was conducted on March 19-27, 2022 every Saturday and Sunday with 2 sessions, session 1 (07.00-10.00 WIB) and session 2 (14.30-17.30 WIB). The research location is located in Somoroto and Munggangsari Hamlets, Tlogoguwo Village, Kaligesing District, Purworejo Regency, Central Java. The method used in this research is a combination of the roaming method and the encounter rate method. The roaming method used refers to the trails or hiking trails available at the research location. The roaming method is carried out by determining the starting point of the path, then the researcher walks along the path and records all types of birds seen either perching, flying, or other activities (Sundra, 2016). The encounter rate method was used to record every bird encounter during the observation. Encounter rate is a direct observation by exploring and counting each bird species encountered in the field (Alamsyah & Marhento, 2016). This allows the calculation of encounter rate for each species to be done by dividing the number of birds recorded by the number of hours of observation, which gives the number of birds per hour for each species. Data recording included, bird species, number of birds, and activity.

Identification activities were carried out in the field by paying attention to morphological characteristics such as size, body shape, plumage color, voice, and habitat type. In addition, identification was also carried out with photo documentation, field guide books of birds in Sumatra, Java, Bali and Kalimantan John Mackinnon, 2010 and Birds of Indonesian Archipelago. Furthermore, the identified birds were entered into the observation tally sheet according to the time the bird species was found.

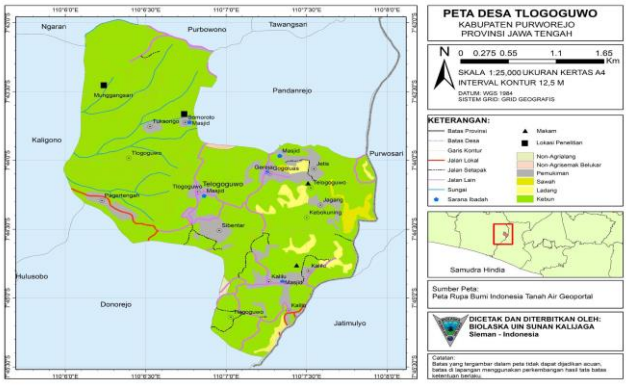


Figure 1. Map of the study location.

Encounter-level data can be separated into simple order-of-abundance categories, making it useful to provide a species list.

$$\text{Relative abundance} = \frac{\text{Number of individuals for each bird species}}{\text{Number of hours observed}}$$

The data obtained were then tabulated using the simple abundance order scale of Lowen at al. (Colin Bibby 2002).

Table 1. Simple Abundance Order Scale from Lowen at al. (Colin Bibby 2002).

Abundance category	Abundance value	Order scale
<0,1	1	Rarely
0,1-2.0	2	Uncommon
2,1-10,0	3	Frequent
10,1- 40,0	4	Common
40,0 +	5	Abundant

Result and Discussion

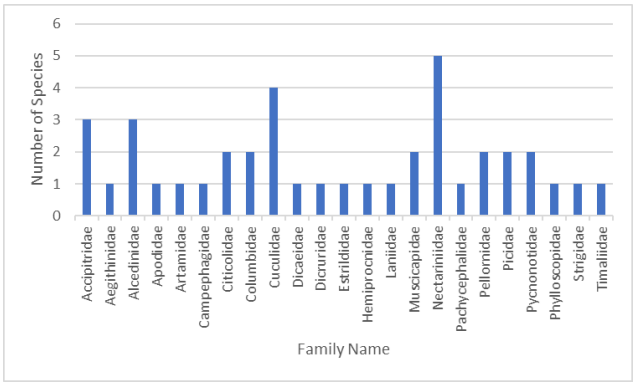
The research in Somoroto and Munggangsari hamlets resulted in 40 bird species from 23 families with a total distance traveled during the observation of 7.7 km. The most common families found in both locations were Nectariniidae, Cuculidae, Accipitridae, and Alcedinidae. Families that were rarely found were Aegithinidae, Apodidae, Artamidae, Campephagidae, Dicaeidae, Dicruridae, Estrildidae, Hemiprocnidae, Laniidae, Pachycephalidae, Phylloscopidae, Strigidae and Timaliidae. Other families only found one species (Figure 2).

Table 2. Bird Species Found in Somoroto and Munggangsari Hamlets.

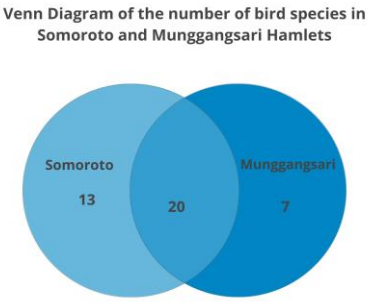
Scientific name	Encounter location		Endemicity	Seationality	Class/relative abundance	IUCN Status
	Somoroto	Munggangsari				
Accipiter trivirgatus	-	✓	-	-	Uncommon	LC
Pernis ptilorhynchus	-	✓	-	-	Uncommon	LC
Spilornis cheela	✓	✓	-	-	Frequent	LC
Aegithina tiphia	✓	✓	-	-	Frequent	LC
Alcedo meninting	✓	✓	-	-	Uncommon	LC
Halcyon cyanoventris	✓	-	✓	-	Uncommon	LC
Todiramphus chloris	✓	✓	-	-	Uncommon	LC
Collocalia linchi	✓	✓	-	-	Frequent	LC
Artamus leucoryn	✓	-	-	-	Uncommon	LC
Pericrocotus cinnamomeus	✓	-	-	-	Uncommon	LC
Orthotomus sepium	-	✓	✓	-	Uncommon	LC
Orthotomus sutorius	✓	✓	-	-	Frequent	LC
Chalcophaps indica	-	✓	-	-	Uncommon	LC
Ptilinopus melanospilus	✓	-	-	-	Uncommon	LC
Cacomantis merulinus	✓	✓	-	-	Uncommon	LC
Cacomantis sonneratii	✓	-	-	-	Uncommon	LC
Phaenicophaeus curvirostris	✓	✓	-	-	Frequent	LC
Surniculus lugubris	✓	-	-	-	Uncommon	LC
Dicaeum trigonostigma	✓	✓	-	-	Frequent	LC

Dicrurus leucophaeus	✓	-	-	-	Uncommon	LC
Lonchura leucogastroides	✓	✓	✓	-	Frequent	LC
Hemiprocne longipennis	-	✓	-	-	Uncommon	LC
Lanius schach	-	✓	-	-	Uncommon	LC
Enicurus leschenaulti	✓	✓	-	-	Uncommon	LC
Muscicapa sibirica	✓	-	-	✓	Uncommon	LC
Aethopyga mystacalis	✓	✓	✓	-	Uncommon	LC
Anthreptes malacensis	✓	✓	-	-	Frequent	LC
Arachnothera affinis	✓	✓	-	-	Frequent	LC
Arachnothera longirostra	✓	✓	-	-	Uncommon	LC
Cinnyris jugularis	✓	-	-	-	Uncommon	LC
Pachycephala cinerea	✓	✓	-	-	Uncommon	LC
Malacocincla sepiaria	✓	✓	-	-	Frequent	LC
Pellorneum capistratum	✓	✓	✓	-	Uncommon	LC
Picoides moluccensis	✓	-	-	-	Uncommon	LC
Sasia abnormis	-	✓	-	-	Uncommon	LC
Alophoixus bres	✓	-	✓	-	Uncommon	EN
Rubigula dispar	✓	✓	✓	-	Frequent	VU
Phylloscopus borealis	✓	-	-	✓	Uncommon	LC
Otus lempiji	✓	-	-	-	Uncommon	LC
Mixornis flavicollis	✓	✓	✓	-	Uncommon	LC

Note: LC: Least Concern, EN: endangered, dan VU: vulnerable based on International Union for the Conservation of Nature and Natural (IUCN)



(a)



(b)

Figure 2. a) Number of species in each family found in Somoroto and Munggangsari Hamlets, b) Number of species in Somoroto and Munggangsari Hamlets and Number of transitional species in these hamlets.

Based on Figure 2, 33 species from 21 families were found in Somoroto Hamlet, while 27 species from 18 families were found in Munggangsari Hamlet. Bird species found in both hamlets totaled 20 species. Somoroto Hamlet has more bird species influenced by the environmental conditions of the observation location and vegetation cover. When compared to the condition of vegetation cover between Somoroto and Munggangsari Hamlets, the vegetation cover in Somoroto Hamlet tends to be more open.

Based on Table 2, 8 species of Javanese endemic birds were found in this study site, including *Halcyon cyanoventris, Orthotomus sepium, Lonchura leucogastroides, Aethopyga mystacalis, Pellorneum capistratum, Alophoixus bres, Rubigula dispar* and *Mixornis flavicollis*. Besides endemic birds, migratory birds were also found, including *Muscicapa sibirica* and *Phylloscopus borealis*. *Muscicapa sibirica* and *Phylloscopus borealis* were found in Somoroto Hamlet perched on branches. These birds like open areas, plantations, shrubs, and secondary forests that match the habitat

conditions in Somoroto Hamlet. This bird is a regular visitor from early September to May, originating from the Palaeartic region (Hidayat, 2013; Taufiqurrahman et al. 2022).

The results of data analysis show that the relative abundance of each bird species in Somoroto and Munggangsari Hamlets is different. Based on the simple order scale of Lowen at al. (Colin Bibby, 2002), the bird species found in this study are classified into two abundance categories, namely uncommon and frequent. Bird species that were frequently found in both observation sites were *Spilornis cheela, Aegithina tiphia, Collocalia linchi, Pericrocotus cinnamomeus, Dicaeum trigonostigma, Lonchura leucogastroides, Anthreptes malacensis, Arachnothera affinis, Malacocincla sepiaria,* and *Rubigula dispar* (table 2). These bird species are frequent found in Tlogoguwo Village, especially in Somoroto and Munggangsari Hamlets because of the availability of sufficient food and most of these bird species are always in groups or pairs in carrying out their daily activities, so this also provides ample opportunities for breeding (Hadinoto et al. 2012).

(a) (b)

Figure 3. Vulnerable and threatened birds. a) *Rubigula dispar* (VU) perching and b) *Alophoixus bres* (EN) perching (Source: Huda 2022, unpublished data).

Based on the research conducted, bird species with vulnerable and endangered status according to IUCN were found. The birds are *Rubigula dispar* (VU) and *Alophoixus bres* (EN), which belong to the Pycnonotidae family. The conservation status was set due to a drastic decline in the last 10 years (BirdLife International, 2023) which was entirely caused by traps for the bird trade (Symes et.al, 2018). Nonetheless, *Rubigula dispar* was one of the most frequently found birds at this observation site. This is because *Rubigula dispar* and *Alophoixus bres* are quite tolerant of degraded habitats and tend to prefer living in open habitats such as open forests, shrubs, urban edges, and drier semi-deciduous forests (Fishpool and Tobias, 2020) in accordance with the habitat in Tlogoguwo Village.

Habitats in the Tlogoguwo Village area have heterogeneous vegetation levels so that food sources are more available. These habitats tend to be chosen by animals because they have an abundance of resources for their survival (Rohiyan at al. 2014 in Surur at al. 2020). According to Djuwantoko (2003), bird communities prefer complex habitats compared to monoculture forests such as teak and pine forests. This is because the diversity of plant species triggers abundant food availability, such as fruits, seeds, nectar and small insects. Tree vegetation in a habitat has an important role as a shelter, nesting, playground and food source for birds. Likewise with Maulidya et al. (2021), plants are one of the supporters of bird presence in a habitat that affects the diversity of certain bird species that utilize these plants.

Habitats that dominate in the Tlogoguwo Village area are rivers, ponds, agroforestry, and secondary forests. The existence of aquatic habitats such as rivers and ponds can provide food in the form of small aquatic animals such as fish that are favored by several birds such as *Halcyon cyanoventris*. *Halcyon cyanoventris* is one example of a bird species that can be used as an indicator of the success of an ecosystem because of its role as a predator of insects, amphibians, and pisces (Aliyani et al. 2018). As an insect predator, *Halcyon cyanoventris* has a role in maintaining the stability of insect populations. If there are no birds in the food chain, the insect population can grow uncontrollably and eventually damage the environment. Sari (2022), stated that birds have an important role in the food chain as natural predators of insects to control insect populations.

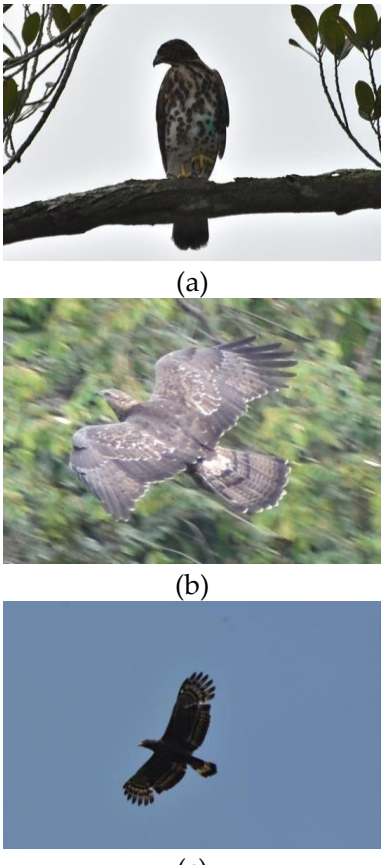
Agroforestry habitats in the Tlogoguwo Village area consist of *Coffea sp.*, *Cocos nucifera*, *Falcataria moluccana*, *Leucaena leucocephala*, and flowering plants such as *Calliandra calothyrsus*. This habitat provides several plants that produce nectar, so in this study found birds from the Nectariniidae family such as *Anthreptes malacensis* and *Arachnothera affinis*. Habitats consisting of a mixture of large trees, shrubs, and seasonal plants

are able to provide shelter and food sources for birds. In agreement with Senoaji (2012), agroforestry habitats consist of shrubs, seasonal plants and or grasses. The availability of food sources such as flowering plants allows the discovery of bird groups from the Nectariniidae family in this habitat. Agroforestry habitats allow birds to find food sources from flowers, fruits, and available insectivores (Whelan et al. 2015).

(a) (b) (c)

Figure 4. Habitats at the observation site. a) River, b) Agroforestry, and c) Secondary forest (Source: Personal documentation).

Secondary forest is one of the habitats in Tlogoguwo Village (Figure 4). Naturally, secondary forests are formed from the destruction of primary forests caused by natural disasters such as floods, landslides, volcanic eruptions, and deliberate human actions (anthropogenic) such as land clearing for plantations. The secondary forest in Tlogoguwo Village is dominated by bush vegetation and agricultural land which is then used as a habitat by several bird species that need more open areas as a place to play and find food. Members of the Accipitridae family are species that depend on the existence of primary forests as places to live and places to make nests, but members of the Accipitridae family also use secondary forests as places to find food and play (Putri, 2016). In line with this, Djuwantoko (2003) states that the combination of various plant species can also produce good habitat for raptors. At least, in this study we found three raptor species including *Accipiter trivirgatus*, *Pernis ptilorhynchus*, and *Spilornis cheela* which belong to the Accipitridae family. This can be used to predict that the ecosystem in Tlogoguwo Village can provide suitable habitat for top predators.



(a)

(b)

(c)

Figure 5. Protected birds. a) *Accipiter trivirgatus* perching, b) *Pernis ptilorhynchus* in flight, c) *Spilornis cheela* in flight (Source: Huda, 2022, unpublished data).

The high demand for birds in the market encourages traders and bird catchers to poach many bird species, which is still an illegal and unsustainable activity. According to a survey conducted by Burung Indonesia (2007), birds are the most popular pets (35% of the total sample of 1,781 families) compared to other animals such as fish, dogs, cats, rodents, reptiles, monkeys, and others in six major cities namely Jakarta, Bandung, Yogyakarta, Semarang, Surabaya, and Denpasar. In addition, bird keeping especially in Indonesia has become a very embedded culture and is difficult to eliminate (Mutiara et al. 2020).

One of the conservation efforts to protect and utilize the diversity of plant and animal species is also carried out with the CITES Appendix mechanism. CITES is an agreement between countries in regulating international trade in flora and fauna (in this case birds) and their parts (Nainggolan et al. 2019). The three bird species found in Tlogoguwo Village and included in the CITES Appendix II list are *Accipiter trivirgatus*, *Pernis ptilorhynchus*, and *Spilornis cheela*. The protection of plant and animal species (in this case the Accipitridae family) in Indonesia has been written in P.106/MENLHK/SETJEN/KUM.1/12/2018. However, other bird species encountered also need protection measures in order to prevent their decline.

Conclusion

The results of bird species inventory research in Tlogoguwo Village found 40 species from 23 families. The number of birds found in Somoroto Hamlet was 33 species from 21 families while the number of birds found in Munggangsari Hamlet was 27 species from 18 families. The total number of bird species found in the two hamlets is 20 species. Based on Lowen's order scale, birds that are frequent found are *Spilornis cheela, Aegithina tiphia, Collocalia linchi, Pericrocotus cinnamomeus, Dicaeum trigonostigma, Lonchura leucogastroides, Anthreptes malacensis, Arachnothera affinis, Malacocincla sepiaria*, and *Rubigula dispar*. One species is vulnerable, one species is endangered and three species from the Accipitridae family are included in Appendix II of CITES.

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References

Adelina, M. 2016. Bird species diversity in Pekon Kelungu Community Forest, Kotaagung District, Tanggamu Regency. *Sylva Lestari' Journal* 104: 51-60.

Ashari, H. D. 2019. Potential of birds as a birdwatching tourism attraction in the Forest of Mount Merapi National Park, Sermo Wildlife Sanctuary and its Surroundings (Yogyakarta). *Zoo Indonesia* 28: 8-20.

Alamsyah, M. & Marhento, G. 2016. Identification of bird species diversity in the traditional wisdom of the community in conservation efforts on Rambut Island, Thousand Islands. *Jurnal Formatif* 6: 119-124.

Aliyani, Y. P., et al. 2018. Bird community in Sermo Reservoir watershed Kulon Progo and its conservation status. *Jurnal Biologi Makassar* 3: 18-24.

BirdLife International 2023 Species factsheet: *Alophoixus bres*. Downloaded from http://datazone.birdlife.org/species/factsheet/brown-cheeked-bulbul-alophoixus-bres on 23/10/2023.

Burung Indonesia. 2007. Summary of survey data on bird keeping. Birdlife Indonesia-Department of Forestry Coordination Meeting. https://www.burung.org/.

Burung Indonesia. 2023. Retrieved from Status burung in Indonesia. https://www.burung.org/.

Collin Bibby. 2002. Bird Survey Techniques. Birdlife International Indonesia.

Dewi, N. & Kurnianto, A. S. 2021. Buffer zone management impact on birds assemblage in the High Nature Value Farmland (HNVF): Study case on Menu Betiri National Park. *Journal of Tropical Biology* 9: 27-37.

Djuwantoko, M. A. I. 2003. A new possibility for biodiversity conservation on totally fragmented forest: A case study in the Menoreh Hills Community Forest, Central Java, Indonesia. Congress Proceeding 1–9. http://www.fao.org/docrep/ARTICLE/WFC/XII/0694-B1.HTM

Fishpool, L., et al. 2020. Ruby-throated Bulbul (*Rubigula dispar*), version 1.0. In : J. del Hoyo, A. Elliott, J. Sargatal, D. A. Christie, and E. de Juana (eds), Birds of The World, Cornell Lab of Ornithology, Ithaca, NY, USA.

Hadinoto, et al. 2012. Bird species diversity in Pekanbaru City Forest. *Jurnal Ilmu Lingkungan 6* : 25–42.

Haryoko, T. 2010. Species composition and number of wild birds traded in West Java. *Biology News* 10: 385-391.

Hidayat, O. 2013. Avifauna species diversity in KHDTK Hambala, East Nusa Tenggara. *Jurnal Penelitian Kehutanan Wallacea 2*: 12–25.

Issa, M. A. A. 2019. Diversity and abundance of wild birds species in two different habitats at Sharkia Governorate, Egypt. *Basic Appl Zool 80* 1: 1-7.

Iwanda, R., et al. 2019. Distribution and daily activity of *Cinnyris jugularis* and *Anthreptes malacensis* at Dramaga Campus, Bogor.

Maulidya, A. L., et al. 2021. Bird population diversity and density in the green area of Cibinong Science Center (CSC) LIPI, West Java. *Jurnal Biologi* 14: 325-334.

Mutiara, D., et. al. 2020. Types of birds traded at the Palembang Bird Market, South Sumatra. *Jurnal Ilmiah Matematika dan Ilmu Pengetahuan Alam* 17: 23-30.

Nainggolan, F. H., Dewi, B. S., & Darmawan, A. 2019. Bird conservation status: case study in Cugung Village Forest Kesatuan Pengelolaan Hutan Lindung Model Rajabasa Rajabasa Regency District South Lampung. *Jurnal Sylva Lestari*, *7*: 52–61. https://doi.org/10.23960/jsl1752-61

Nurrofik, A., Arifianto, A., Aninnas, A., Suparno, K., Kurnianto, A. S., Septiadi, L., & Kurniawan, N. (2023). Preliminary observation on nesting ecology of endangered Brown-Cheeked Bulbul (*Alophoixus bres*) in Jatimulyo agroforestry. *Treubia* 50: 39–44.

Prawiradilaga, D. M. 2019. Diversity and Conservation Strategies for Indonesia's Endemic Birds. LIPI Press, Jakarta.

Putra Aliyani, Y., et al. 2018. Bird community in Sermo Reservoir watershed Kulon Progo and its conservation status. *Bioma : Jurnal Biologi Makassar 3*: 18–24.

Putri, I. A. S. L. P. P. 2016. Bird communities in artificial succession habitats in Bantimurung Bulusaraung National Park. Prosiding Seminar Nasional from Basic Science to Comprehensive Education: 109-120.

Sari, I. F. 2022. The Role of Bird Communities as Bioindicators of Environmental Quality and Potential for Birdwatching Tourism in Liwa Botanical Garden, West Lampung. *Thesis*

Savitri, N., et al. 2009. Morphological study of the oesophagus and stomach of the Cave Swiftlets (*Collocalia linchi*). *Veterinary Journal* 3.

Senoaji, G. 2012. Land management with agroforestry system by Baduy community in South Banten. *Jurnal Bumi Lestari* 12: 283–293.

Sundra, I. K. 2016. Methods and techniques for analyzing land flora and fauna. Universitas Udayana Denpasar, 1–24.

Surur, A. M., et al. 2020. Relationship between bird species diversity and tree composition at Campus 2 UIN Walisongo Semarang. *Jurnal Edu Biosfer* 2: 57-64.

Symes, W. S., et al. 2018. Combined impacts of deforestation and wildlife trade on tropical biodiversity are severely underestimated. *Nature Communications* 9: 1-9.

Taufiqurrahman, I., P.G., et al. 2022. Field Guide to the Birds of Indonesia Series I: Greater Sunda. Birdpacker Indonesia-Interlude, Batu.

Wahyuni, A. I. 2021. Identification of bird species and ecological roles around Turi Hamlet, Kembangan Village, Pule Subdistrict, Trenggalek Regency. *National Seminar: Conservation for Community Welfare II* 2: 1–10.

Whelan, C. J., et al. 2015. Why birds matter: From Economic Ornithology to Ecosystem Service. *J. Ornithol* 156: 227-238.

Widodo, W. 2013. Assessment of bird fauna as an environmental indicator in Mount Sawal Forest, Ciamis Regency, West Java. National Seminar X Biology Education: 1-12.

Yashmita-Ulman., et al. 2018. Agroforestry systems as habitat for avian species: Assessing its role in conservation. *Proceedings of the Zoological Society* 71: 127–145.