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REGULAR RESEARCH ARTICLE

# Between Hopes and Threats: New Migratory Birds Records on the Sawala Mandapa Education and Training Forest, Indonesia

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**ABSTRACT**

Java Island is one of the tropical areas for bird migration, especially the Asian-Australian flyway of migratory birds. The SMETF is one of the protected forest areas that migratory birds can visit in Java. This research aims to identify migratory birds in SMETF. Transect and point count methods are used to observe migratory bird movements and their activities. In the research area, four migratory birds were identified: *Ficedula zanthopygia*, *Agropsar sturninus*, *Pernis ptilorhynchus o.*, and *Accipiter soloensis*. The first and second species showed many activities for four months from October 2020 to January 2021, and this is an indication that both are using the research site as a wintering habitat. The activities of the *Pernis ptilorhynchus o.*, *Accipiter soloensis* were dominated by flying "flock" over the forest. Only the *Pernis ptilorhynchus* was observed carrying out hunting activities, indicating that this bird uses the area as a stopover area. This research also identified illegal hunting techniques, such as *ngaleugeut* and *mikat, as* severe threats to migratory birds in the SMETF.

**KEYWORDS**

Bird migration; Migratory birds, Education forest; Training forest; Wintering habitat; Stopover area

## 1. INTRODUCTION

Java Island is one of the world's most densely populated regions (Smiet, 1990) and the most densely populated in Indonesia (Imron & Djuwantoko, 2003). It constitutes about 6% of Indonesia's land, but it is inhabited by around 60% of its population (Soedomo, 2014; Nijman & Nekaris, 2017). The population increase will affect land-use change processes such as forest clearing for agriculture, settlement, and infrastructure expansion, causing deforestation (Prasetyo et al., 2011). A present forest remains in Java, covering around 7% of the land area (Husodo et al., 2019). With natural forest covering just under 10% of the total area (Imron & Djuwantoko, 2003) and less than 10% of Java's land remaining forest remainder is primarily a mosaic of rice fields, urban areas, and villages (Whitten et al., 1999). Pollution, climate change, deforestation, habitat loss, as well as exotic species invasion are all examples of negative environmental changes (Bierwagen, 2007; Mazumder, 2014; Scanes, 2018), which will directly affect bird migration.

Bird migration is a regular and seasonal movement of the bird population from one area to another due to a lack of available food or breeding (Purwanto et al., 2015). Another note states that Java is one of the islands in Indonesia which is vital for bird migration, especially the Asian Australian Flyway (Nijman, 2001). In Java, migratory birds, especially land-based migratory birds, have been widely recorded in scientific publications. Recorded that four species of raptors migrated autumn to Java and recorded six raptors crossing the mountains in Central Java (Nijman, 2005), including

the Oriental Honey-buzzard and the Chinese Sparrowhawk. The distribution of the Oriental Honey-buzzard wintering habitat covers an area of 3013.13 km$^2$, and 8.11% of it is in West Java (Syartinilia et al., 2021) and the Chinese Sparrowhawk is a common migratory raptor on the island of Java (Nijman et al., 2006). Other records for Purple-backed Starling have been found in Yogyakarta (Setiyono et al., 2013), and Yellow-rumped Flycatchers have been recorded in Yogyakarta (Yuda, 1994). As a protected forest, the Sawala Mandapa Education and Training Forest (SMETF) has no published scientific record of the existence of migratory birds. On the other hand, protected areas are significant for biodiversity conservation (Fetene et al., 2019; Nandy et al., 2015).

The SMETF is one of the protected areas on Java Island. In principle, it is designated for media and objects of education and training on forestry science and biodiversity conservation. The SMETF is an area with good forest cover so that it has the potential to become a stopover, roosting site, or wintering habitat for migratory birds. For migratory birds, choosing the best stopover location along the flight path is very limited, so the opportunity to rest to collect energy safely is also limited (Nijman, 2001). Many alternative sites make flyways for bird migration stable but will become more vulnerable once these sites are lost sequentially (Xu et al., 2020). Therefore, the existence of SMETF is fundamental to the sustainability of bird migration in Java, compared to active agricultural land, rural areas, cities, and industries around it. However, intensive anthropogenic activities around it can threaten biodiversity, one of which is the bird population causing limited access to a suitable area and promoting predation risk (Iswandaru et al., 2020b). One of the promotes affecting the decline of the bird population in nature is illegal bird hunting (Hakim et al., 2020). In Southeast Asia, wildlife, including birds, are hunted for three reasons such as culture, food, and money (Harrison et al., 2016). In Java, birds are intensively hunted not only for food and kept in cages but to be sold to bird shops or traded in markets (Iskandar et al., 2016), including migratory birds (Gunawan et al., 2017).

On the other hand, birds are critical components of the earth's biodiversity; they are well-known bio-indicator and play an essential role in the functioning and balancing of ecosystems (Kiros et al., 2018). The existence of bird species in the forest ecosystem is necessary (Ramachandran & Ganesh, 2012) for a sustainable forest ecosystem (Chan & Chan, 2019), such as seed dispersal (Ning et al., 2019), plant-pollinator (Lindell & Thurston, 2013), pets control (García et al., 2018). The change in a forest will disturb animal communities' distribution (Tesfahunegny et al., 2016), including the bird community (Iswandaru et al., 2020a).

Thus, maintaining a sense of security and forest cover in stopover sites, roosting sites, or wintering habitats for migratory birds is very important because environmental changes due to disturbances in these locations can significantly impact the whole population of the flyway. Therefore, the decisive reason behind why this research was conducted is to identify, save, and protect migratory bird species in SMETF so that their existence is sustainable. Therefore, this study aims to analyze the threats and hopes of migratory birds in SMETF to develop effective conservation action to save and protect the migratory birds.

## 2. MATERIALS AND METHODS

### 2.1 Study area

The SMETF is located in Majalengka Regency, West Java Province, and a protected forest area with an area of 146.58 Ha. The area consists of two Management Blocks,

namely the Sawala Block and the Mandapa Block. Geographically, the Sawala Block is located at the coordinates 108.10.45 – 108.12.15 East Longitude and 6.45.15 – 6.45.06 South Latitude, with an area of 128.63 Ha, while the Mandapa Block is at the coordinates 108.13.15 – 108.13.30 East Longitude and 6.45. 43 – 6.45.46 South Latitude with an area of 17.95 ha. However, this study focused on Sawala Block with considerations such as ecosystem variations, observation spot access, and community mobility.

The SMETF vegetation cover of 79,83% is plantations dominated by *Tectona grandis, Swietenia mahagony, Cassia siamea, Enterolobium cyclocarpum, Dalbergia latifolia, Schleichera oleosa, Lagerstroemia speciosa*. Others are reservoirs/ponds, office areas, and soccer fields, covering 20,17% (Dimyati, 2018). The SMETF is dominated by non-evergreen trees and will shed their leaves during the dry season as a form of environmental adaptation. In conditions, forest cover is more open, and other vegetation such as shrubs and undergrowth species dries up and dies. The dry season is characterized by low or no precipitation and consequently low humidity. The SMETF is located among seven villages with a population of 38,164 people. Land use around SMETF is dominated by agricultural land, paddy fields, settlements, industrial areas, and urban areas, so it has the potential to cause disturbances from anthropogenic activities.

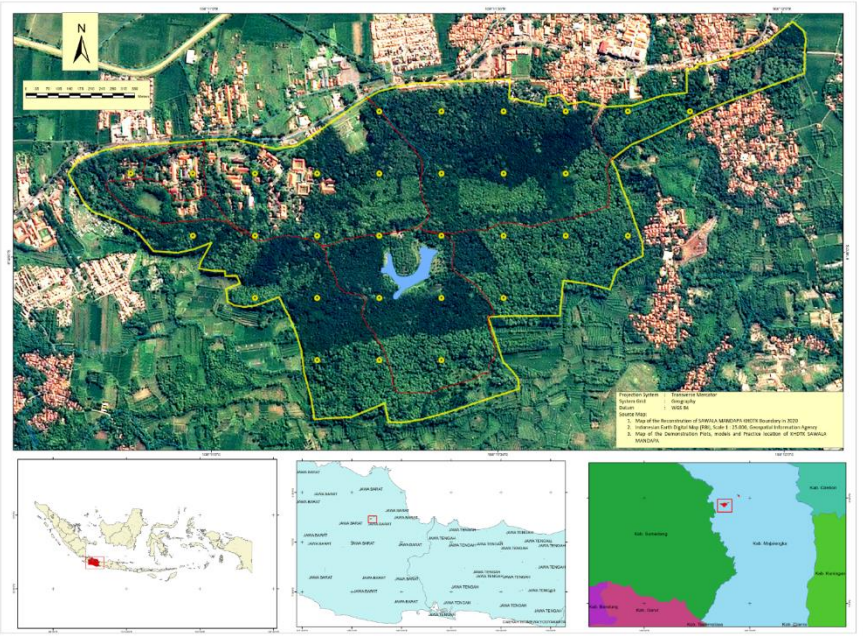

Figure 1. Maps of study site in the SMETF.

### 2.2 Data collection

The survey was conducted with the transect method in December 2019. The transect method was carried out by walking for 5 km following an existing pathway to observe the presence of birds in the forest and their activities. The 5 km transect is determined based on the access that connects the habitat types to allow observing bird activities in utilizing the forest.

The transect method was used in the initial survey to select and determine point counts based on the following:

- Open tree canopy to observe species of raptors that may pass by high-flying habits in groups when migrating.
- Location and activity, to observe birds that may use certain habitat types, such as waterbirds using wetlands (the research location has water ponds/dams) and other migratory birds that use forests while migrating.

Migratory bird data were collected twice in January - April 2020 and October - January 2021, using the point count method (Bibby et al., 2000). Data were collected at 31 observation points in 4 habitat types (Figure 1). The habitat types in SMETF are forest, agroforestry, reservoirs (water reservoirs), and built-up areas. Observation uses a radius of 50 m, and the distance between observation points is 200 m (Figure 2). Observers recorded and counted the types of migratory birds detected within a 30-minute observation radius. Observations were made when the weather was not raining.

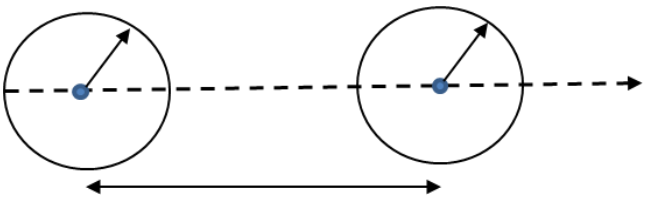

Figure 2. Illustration of the observation plot using the point count method

Data were conducted at 06.00 – 09.00 am and 09.01 – 12.00 am and at 12.01 – 03.00 pm and 03.01 – 06.00 pm (Nijman, 2001). In general, birds are most active in the morning and evening (Iswandaru et al., 2020a; MacKinnon et al., 2010). Nikon Monarch 10x42 DCF binoculars are used for observation and a compass to detect flight direction. The Nikon D5600 DSLR Camera and Nikon 70-300 mm Telephoto Zoom Lens were used to document birds that may be perching or flying and aid identification. Voice Recorder is used to record the sound of birds that are heard, then adjusted to the birds' sounds from the bird sound recording database of Xeno-canto (www.xeno-canto.org) to aid identification. All bird species are recorded and identified at each direct encounter, either with the naked eye or using binoculars (Kiros et al., 2018). Identification of bird species based on (MacKinnon et al., 2010). This scientific name is written based on (del Hoyo & Collart, 2019).

Threats and hopes data were conducted using a mixed-method between qualitative and quantitative methods with observation and in-depth interviews with an informant (Iskandar et al., 2019). The snowball technique purposively selected informants (Albuquerque et al., 2017). Qualitative methods are used to explain the phenomenon of bird threats in-depth at SMETF. The quantitative method was used to quantify the result of depth interview on a percentage scale. The snowball technique is applied through chain referrals where the informant will provide recommendations to recruit the next informant needed. In-depth interviews were conducted with competent informants, including rangers, forestry extension workers, SMETF managers, and bird and *Kroto* hunters (if they happen to be found in the forest). Several aspects discussed with informants included the history of SMETF, past and present bird population dynamics, threats to birds, and hopes for preserving birds at SMETF, especially migratory birds, in the future. The in-depth interviews used several critical questions, including the types of birds that have been seen or recorded in SMETF, experiences of

finding hunters or hunting tools, motives for hunting, and the flow of bird trade. The number of informants is not limited. If the answers from the informants are saturated (stagnant or no progress), then the in-depth interview will be stopped.

### 2.3 Data analysis

Qualitative data were analyzed descriptively by cross-checking, summarizing, and synthesizing. Quantitative data were analyzed by simple static computing that is calculated by the formula following (Newing et al., 2010):

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

Remarks:
P = percentage of the total answer of respondents
f = number of respondent answers
N = total respondent

## 3. RESULTS

### 3.1 Birds in Sawala Mandapa Education Training Forest (SMETF)

During the study in 31 observation points for four habitat types, the total number of birds in SMETF was recorded at 65 species of 33 families (Tabel 1).

**Table 1.** List of Birds in the SMETF

| No. | Family | Species | Common Name | Status of Indonesian Regulation | Status of IUCN |
|---|---|---|---|---|---|
| 1 | Acanthizidae | *Gerygone sulphurea* | Golden-bellied Gerygone | - | LC |
| 2 | Accipitridae | *Elanus caeruleus* | Black-winged Kite | D | LC |
| 3 | Accipitridae | *Spilornis cheela* | Crested Serpent-eagle | D | LC |
| 4 | Accipitridae | *Pernis ptilorhynchus** | Oriental Honey-buzzard | D | LC |
| 5 | Accipitridae | *Accipiter soloensis** | Chinese Sparrowhawk | D | LC |
| 6 | Aegithinidae | *Aegithina tiphia* | Common Iora | - | LC |
| 7 | Alcedinidae | *Alcedo coerulescens* | Blue-eared Kingfisher | - | LC |
| 8 | Alcedinidae | *Alcedo meninting* | Cerulean Kingfisher | - | LC |
| 9 | Alcedinidae | *Ceyx erithaca* | Oriental Dwarf-kingfisher | - | LC |
| 10 | Alcedinidae | *Halcyon cyanoventris* | Javan Kingfisher | - | LC |
| 11 | Alcedinidae | *Halcyon chloris* | Collared Kingfisher | - | LC |
| 12 | Apodidae | *Collocalia linchi* | Cave-Swifleft | - | LC |
| 13 | Artamidae | *Artamus leucorhynchus* | White-breasted Woodswallow | - | LC |
| 14 | Campephagidae | *Hemipus hirundinaceus* | Black-winged Flycatcher-shrike | - | LC |
| 15 | Campephagidae | *Pericrocotus cinnamomeus* | Small Minivet | - | LC |
| 16 | Campephagidae | *Lalage nigra* | Pied Triller | - | LC |
| 17 | Caprimulgidae | *Caprimulgus affinis* | Savanna Nightjar | - | LC |
| 18 | Caprimulgidae | *Caprimulgus macrurus* | Large-tailed Nightjar | - | LC |
| 19 | Cisticolidae | *Cisticola juncidis* | Zitting Cisticola | - | LC |
| 20 | Cisticolidae | *Orthotomus ruficeps* | Ashy Tailorbird | - | LC |
| 21 | Cisticolidae | *Orthotomus sepium* | Olive-beaked Tailorbird | - | LC |
| 22 | Cisticolidae | *Prinia polychroa* | Brown Prinia | - | LC |
| 23 | Cisticolidae | *Prinia flaviventris* | Yellow-bellied Prinia | - | LC |
| 24 | Columbidae | *Geopelia striata* | Zebra Dove | - | LC |

| No. | Family | Species | Common Name | Status of Indonesian Regulation | Status of IUCN |
|---|---|---|---|---|---|
| 25 | Columbidae | *Streptopelia bitorquata* | Island Collared Dove | - | LC |
| 26 | Columbidae | *Spilopelia chinensis* | Eastern Spotted Dove | - | LC |
| 27 | Cuculidae | *Phaenicophaeus curvirostris* | Chestnut-breasted Malkoha | - | LC |
| 28 | Cuculidae | *Cacomantis merulinus* | Paintive Cuckoo | - | LC |
| 29 | Cuculidae | *Cacomantis sonneratii* | Banded Bay Cuckoo | - | LC |
| 30 | Cuculidae | *Cacomanthis sepulcralis* | Rusty-breasted Cuckoo | - | LC |
| 31 | Cuculidae | *Surniculus lugubris* | Square-tailed Drongo-Cuckoo | - | LC |
| 32 | Cuculidae | *Centropus bengalensis* | Lesser Coucal | - | LC |
| 33 | Dicaeidae | *Dicaeum trochileum* | Scarlet-headed Flowerpecker | - | LC |
| 34 | Dicaeidae | *Dicaeum trigonostigma* | Orange-bellied Flowerpecker | - | LC |
| 35 | Estrildidae | *Lonchura leucogastroides* | Java Sparrow | - | LC |
| 36 | Estrildidae | *Lonchura maja* | White-headed Munia | - | LC |
| 37 | Estrildidae | *Lonchura punctulata* | Scaly-breasted Munia | - | LC |
| 38 | Hirundinidae | *Hirundo tahitica* | Pacific Swallow | - | LC |
| 39 | Laniidae | *Lanius schach* | Long-tailed Shrike | - | LC |
| 40 | Meropidae | *Merops leschenaulti* | Blue-tailed Bee-eater | - | LC |
| 41 | Muscicapidae | *Ficedula zanthopygia** | Yellow-rumped Flycatcher | - | LC |
| 42 | Muscicapidae | *Hypothymis azurea* | Black-naped Monarch | - | LC |
| 43 | Nectariidae | *Anthreptes malacensis* | Plain-throated Sunbird | - | LC |
| 44 | Nectariidae | *Nectarinia jugularis* | Olive-backed Sunbird | - | LC |
| 45 | Oriolidae | *Oriolus chinensis* | Black-naped Oriole | - | LC |
| 46 | Pachycephalidae | *Pachycephala grisola* | Mangrove Whistler | - | LC |
| 47 | Phasianidae | *Gallus varius* | Green Junglefowl | - | LC |
| 48 | Phylloscopidae | *Phylloscopus trivirgatus* | Mountain Warbler | - | LC |
| 49 | Picidae | *Dendrocopos moluccensis* | Sunda Pygmy Woodpecker | - | LC |
| 50 | Picidae | *Dendrocopos macei* | Fulvous-breasted Woodpecker | - | LC |
| 51 | Picidae | *Sasia abnormis* | Rufous piculet | - | LC |
| 52 | Pittidae | *Hydronis guajanus* | Javan Banded Pitta | D | LC |
| 53 | Ploceidae | *Passer montanus* | Eurasian Tree Sparrow | - | LC |
| 54 | Pycnonotidae | *Pycnonotus aurigaster* | Sooty-headed bulbul | - | LC |
| 55 | Pycnonotidae | *Pycnonotus goiavier* | Yellow-vented bulbul | - | LC |
| 56 | Pycnonotidae | *Pycnonotus atriceps* | Black-headed Bulbul | - | LC |
| 57 | Rallidae | *Amaurornis phoenicurus* | White-breasted Waterhen | - | LC |
| 58 | Sittidae | *Sitta frontalis* | Velvet-fronted Nuthatch | - | LC |
| 59 | Strigidae | *Otus lempiji* | Sunda Scops-owl | - | LC |
| 60 | Sturnidae | *Agropsar sturninus** | Purple-backed Starling | - | LC |
| 61 | Timaliidae | *Malacocincla sepiarium* | Horsfield's Babbler | - | LC |
| 62 | Timaliidae | *Pellorneum capistratum* | Black-capped Babbler | - | LC |
| 63 | Timaliidae | *Mixornis flavicollis* | Grey-cheeked Tit- | - | LC |

| No. | Family | Species | Common Name | Status of Indonesian Regulation | Status of IUCN |
|---|---|---|---|---|---|
| | | | Babbler | | |
| 64 | Turnicidae | *Turnix suscitator* | Barred Buttonquail | - | LC |
| 65 | Tytonidae | *Tyto alba* | Common Barn-owl | - | LC |

Note: *) Migrant Birds; D) Protected; LC) Least Concern

### 3.2 Migratory birds

The composition of migratory birds recorded in the Sawala Mandapa Education Training Forest consists of 4 species, namely Yellow-rumped Flycatcher (Ficedula zanthopygia), Purple-backed Starling (Agropsar sturninus), Oriental Honey-buzzard (Pernis ptilorhynchus orientalis) and Chinese Sparrowhawk (Accipiter soloensis). Yellow-rumped Flycatcher (Ficedula zanthopygia) and Purple-backed Starling (Agropsar sturninus) are migratory birds of the passerine group. The Oriental Honey-buzzard (Pernis ptilorhynchus o.) and the Chinese Sparrowhawk (Accipiter soloensis) are migratory birds of the raptor group.

At least 23 records of encounters at six observation points from January 2020 to January 2021 at the SMETF showed several migratory birds (Table 2). Based on the migration period, migratory birds were recorded from November to January (Winter), March to April (Northward migration), and October (Southward migration).

Table 2. Numbers of migratory birds in SMETF during January 2020 to January 2021

| Month (2020-2021) | Species | Records in PC | Number |
|---|---|---|---|
| January | - | - | - |
| February | - | - | - |
| March | YRF; OHB; CS | (27)*; (19)***; (19)**** | 1; 19; 36 |
| April | YRF | (27)* | 1 |
| October | YRF; DS; OHB; CS | (20)*; (8, 9)**; (19)***; (19)**** | 1; 12; 29; 61 |
| November | YRF; DS | (8, 20, 27)*; (8, 9)** | 3; 12 |
| December | YRF; DS; OHB | (8, 27); (8, 9)**; (8)*** | 3; 8; 1 |
| January | YRF; DS | (8, 20, 27); (8)** | 4; 4 |

Note:
YRF (*Ficedula zanthopygia*)*
DS (*Agropsar sturninus*)**
OHB (*Pernis ptilorhynchus orientalis*)***
CS (*Accipiter soloensis*)****
PC (Point Count)

October is the complete encounter record for the four migratory bird species at four observation points for eight months. This month also recorded data on the highest total number from the four migratory bird species, 103 individuals. The lowest record in April was one individual (Figure 3).

### 3.3 Yellow-rumped Flycatcher (*Ficedula zanthopygia*)

At SMETF, it was recorded for the first time on March 29, 2020, at 09.04 am, an adult male with black and yellow and white characteristics (MacKinnon et al., 2010) was staying and perched on the branch of *Cassia siamea* in the edge of DTM, then the sound is more frequent on April. On the next record, on October 17, 2020, at 6.26 am, an adult male was seen perched in the middle canopy of the *Tectona grandis* while chirping "song" at the forest. In November 2020, voices were heard more often, especially at 06.30 – 09.30 am in the shrubs around the forest and built-up area. In December 2020, two individuals, male and female, were seen flying from the thicket and perching in the middle canopy of *Schleichera oleosa* in the forest. Figure 4 shows that on December 28,

2020, the female individual has brown, yellow, and white characteristics (MacKinnon et al., 2010) perching on a branch of *Melia azedarach* in the forest.

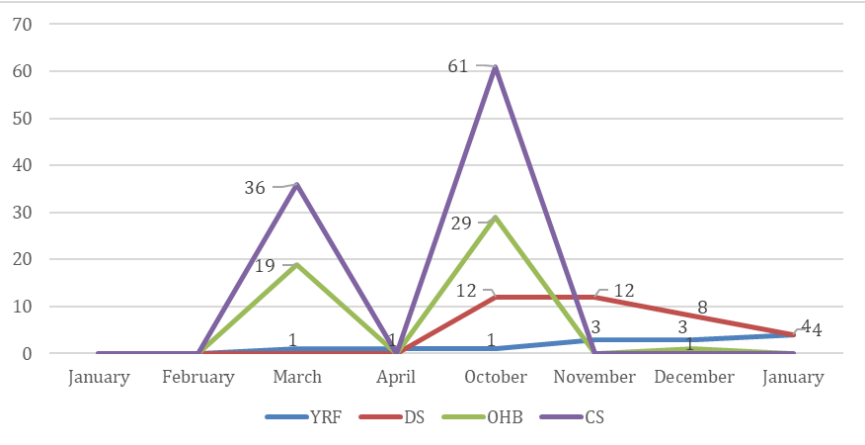


**Figure 3.** Monthly trends in the number of migratory birds (in individuals) in the SMETF from January 2020 to January 2021 (May to September are not counted).

**Figure 4.** Female (adult) of Yellow-rumped Flycatcher (*Ficedula zanthopygia*)

### 3.4 Purple-backed starling (*Agropsar sturninus*)

At SMETF-BS, it was recorded for the first time on October 13, 2020, at 03.40 pm, with flocks (12 individuals) and perching on a branch of the *Enterolobium cyclocarpum*, then flying again until perched on a *Gmelina arborea* around the built-up area. On the following note, on October 28, 2020, at 06.29 am, 12 individuals were seen flying and perching on the canopy of *Pterospermum javanicum*. On November 24, 2020, at 10:15 am, 12 individuals were seen perching on the branch of *Vitex cofassus*. On December 27, 2020, at 10:46 am, a male individual was seen feeding in the canopy of *Gluta*

*renghas*. Figure 3 shows four individuals that were seen sitting between the canopy of the *Santalum album* on January 26, 2021, at 08.45 am.

Figure 5. Four individuals were sitting for a rest

### 3.5 Oriental Honey-buzzard (*Pernis ptilorhynchus orientalis*)

At SMETF, it was first recorded on March 19, 2020, at 10.06 am. Two groups flew over the forest from East to West. The first group flock of about eight individuals, and the second group of about 11 individuals, joined with other types of raptors. On October 15, 2020, at 03.13 – 03.35 pm, three groups flew from West to East. The first group recorded seven individuals, the second group had nine individuals, and the third group recorded 13 individuals. Then, on December 22, 2020, at 02.58 pm, it was recorded that one individual was hunting in the forest. Three days later, on December 25, 2020, at 07.35 am, an individual has recorded perching on a dry stem approaching the apiary to hunt in the built-up area, then flying low and perching on the branch of *Tectona grandis* for one to two minutes, then flying again to the *Delonix regia* and perched for five minutes, then flew and perched on a branch of *Ficus benjamina* for 45 minutes after foraging (Figure 6).

### 3.6 Chinese Sparrowhawk (*Accipiter soloensis*)

At SMETF, it was recorded for the first time on March 19, 2020, at 08.45 – 09.57 am, with two flock groups from East to West. The first group flew 17 individuals and the second group 19 individuals. The following note is that there were two groups of flocks on October 15, 2020, from 03.10 – 03.25 pm. The first group recorded about 56 individuals, and the second group recorded five individuals joined together with the Oriental Honey-buzzard flying from West to East. Figure 7 shows the Chinese Sparrowhawk flying over the forest. Estimates of the number in the hundreds form a large group with other types of raptors, but they fly at a high altitude that it is difficult to count to get an exact number.

**Figure 6.** An immature perched to rest in the branch of Ficus benjamina after foraging

**Figure 7.** One of the Chinese Sparrowhawk flying over the SMTEF-BS

### 3.7 Threat and Hope

There are three threats to migratory birds in SMETF based on in-depth interviews with informants. The hunters used three different traditional techniques (Table 3). Two of the three recorded threats (66,67%) can be carried out outside the area with the target of wild birds from within the area SMETF. However, if possible, all threats (100%) can be made inside the SMETF.

**Table 3.** Threats of Wild Bird in SMETF

| No. | Threats | Traditional Technique | Target | Location | |
|---|---|---|---|---|---|
| | | | | In the area | Outside the area |
| 1 | Illegal hunting | *Ngaleugeut* | Wild bird | √ | √ |
| 2 | Illegal hunting | *Mikat* | Wild bird | √ | √ |
| 3 | Illegal hunting | *Ngala kroto* | Egg of Weaver Ant (*kroto*) | √ | - |

Thus far, there are three traditional techniques commonly used by hunters in SMETF and its surroundings. This traditional technique is carried out using simple tools readily available from around the house (Table 4).

**Table 4.** Traditional Technique for Hunting of Wild Bird in SMETF

| No. | Traditional Technique | Explanation |
|---|---|---|
| 1. | *Ngaleugeut* | Hunting technique using glue made from jackfruit sap to trap birds. The technique is that bamboo or twigs are smeared with sap and then placed between the shrubs or tree branches, then the electronic bird sound recording (*mp3*) on the cellphone/handphone is used to attract the attention of wild birds approaching and perching on bamboo or twigs that have been smeared with sap. The traps will be monitored by hunters hiding relatively close. Trapped wild birds cannot fly because their legs or wings stick to the bamboo or twig. The birds are immediately taken by hunters and cleaned on the affected area using water so as not to damage feathers or legs. Then the bird is stored in a cage. The wild birds targeted by this technique are usually common chirping birds, depending on the type of *mp3* bird sound recording used. |
| 2. | *Mikat* | Hunting technique using a trained, tame bird, placed in a cage with two parts, each partition has one door. The technique is that a tame bird is placed in one partition with the door closed. Then the door to another partition opened. The cage is hung from a tree branch and will be watched by hunters hiding five to seven meters away. The tame bird will make a sound because it hears the voices of other birds around it. Wild birds that are targeted are usually attracted and approached because their territory is disturbed by the other bird, which is none other than the sound of the tame bird in the partition in the cage. The wild bird will look for the closest position to dispel with full aggressiveness and is ready to attack the tame bird. In this condition, wild birds are usually trapped in a cage because the door that was opened initially will be closed due to being triggered by the wild bird's aggressive movement and focus on attacking. Wild birds that are the target of hunting with captivating techniques are usually unique chirping birds. This technique depends on the type of tame bird used as an attention grabber. |
| 3. | *Ngala kroto* | The hunting technique is using a long stalk made of bamboo. At the end of the stalk, a basket is tied to hanging. When the hunters find a productive ant nest, the hunter will puncture the nest using the stalk's tip and then be beaten by hand to produce a shock. Because of the shock, the ants' eggs "*Kroto*" (including the queen and the worker brood) will fall into the basket or plastic bag. |

Informants' confessions stated that illegal practices (illegal hunting and illegal logging) were still carried out at SMETF for two reasons: (1) economic pressure; (2) hobbies. So far, economic pressure has been the main reason for illegal practices, while hobbies are the following reason. There are at least four motives for carrying out illegal practices (Table 5).

**Table 5.** The motive of Illegal Hunting in SMETF

| No. | Result of Illegal Hunting | Purpose | Motive | |
|---|---|---|---|---|
| | | | Economic Pressure | Hobbies |
| 1. | Wildbird (Songbird or other bird) | Sold to bird traders | √ | |
| 2. | Wildbird (Songbird) | Raised by hunters themselves | | √ |
| 3. | *Kroto* | Sold to bird traders as bird feed or fishing tackle traders as fish bait | √ | |

| No. | Result of Illegal Hunting | Purpose | Motive | |
|---|---|---|---|---|
| | | | Economic Pressure | Hobbies |
| 4. | *Kroto* | Used by hunters themselves as fish bait for fishing | | √ |

Additionally, to threats, records on expectations of migratory birds in SMETF were collected based on the results of in-depth interviews with all informants (Figure 8).

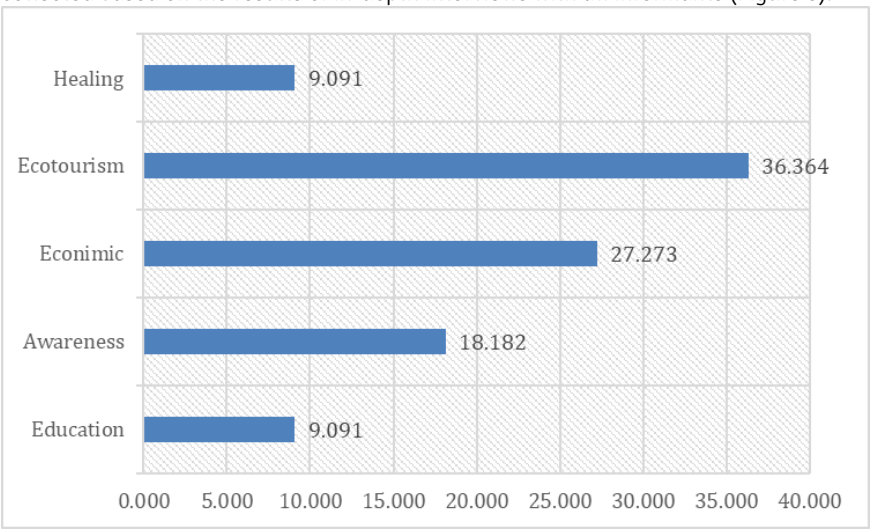


**Figure 8.** Percentage of hopes for the existence of the migratory birds in the SMETF

The biggest hope for the existence of migratory birds in the SMETF 36.364% is as a tourist attraction (*ecotourism*), then 27.273% to increase income (*economic*) by removing the prohibition on catching birds and taking *Kroto* in the forest. Furthermore, increase interest and participation (*awareness*) in protecting the forest collaboratively. Finally, the slightest hope is as a media of *education* and *healing*, each of which is 9.091%.

## 4. DISCUSSION

Yellow-rumped Flycatcher, Purple-backed Starling, Oriental Honey-buzzard, and Chinese Sparrowhawk are winter visitors in Java (MacKinnon et al., 2010; Nijman, 2001; Yuda, 1994). They migrate to the tropics to get a warm environment and an abundant food source because it is available all year round (Sodhi et al., 2011). These four species are new records for SMETF after 15 years of being designated as protected forest areas.

For the Yellow-rumped Flycatcher and Purple-backed Starling, they were recorded doing activities at SMETF-BS. Yellow-rumped Flycatchers are found more active in the forest, while Purple-backed Starling prefers the built-up area for activities. In addition, these two types of birds have different habitat preferences. In wintering habitats, many studies have noted that the Purple-backed Starling is found in open habitats because it has foraging behavior on the ground (MacKinnon et al., 2010), and Yellow-rumped Flycatcher likes to do activities in the middle canopy (Yuda, 1994), and the shrubs (MacKinnon et al., 2010).

The first record for the Yellow-rumped Flycatcher in March – April 2020 is that it has been seen doing more perching and foraging activities. March – April is a period of return migration to habitat breeding, so naturally, Yellow-rumped Flycatchers do many feeding activities, possibly to supply energy before migrating to the breeding habitat. In contrast to the presence of the Yellow-rumped Flycatcher in October – January 2021, which was noted to carry out more varied activities such as perching, singing with several variations, playing, and foraging in 3 observation plots (8, 20, 27), with small amounts one to four individual. During the observation, the number recorded was around 5-6 individuals. However, more often heard chirping (song, sub-song, call, alarm call) than seen because, in addition to its relatively small size ∓ of 13 cm (MacKinnon et al., 2010), this bird likes to move in the tree canopy to find food.

The record for Purple-backed Starling is that each observation finds a varied number of individuals; namely, in October – November 2020, there were 12 individuals recorded, while in December, it was recorded as eight individuals than in January 2021, it was recorded as four individuals. It is not yet known exactly why the numbers have decreased in the short period. However, we suspect that some individuals search for other wintering habitats. Other allegations, some individuals were caught by hunters elsewhere. The Purple-backed Starling behaves in groups or around cities, and settlements will be easily trapped and trafficked (Chng et al., 2018). During the October 2020 – January 2021 observations, the mornings were more often doing foraging activities. During the day prefers perched in a tree with a tight canopy. In the afternoon, several times were seen flying in groups in circles, occasionally perching on the canopy of *Ficus benjamina*, then flying again and perching again in another tree. Apart from that kind of behavior, we did not find this bird doing any activity in the forest. With records from all observations, it indicates that the SMETF is one of the vital wintering habitats for Yellow-rumped Flycatcher and Purple-backed Starling in Java.

For the Raptors, most of them were recorded as flying in passing groups over the SMETF. Note that in March 2020, the flock's direction is flying from East to West (Northward migration), while in October 2020 is from West to East (Southward migration). The raptors recorded in March may be migrating back to their breeding habitats in East Asia: Japan, North Korea, Northeast China, Northern Mongolia, and Southern Siberia (Decandido et al., 2015; Wells, 1999). Note that in October 2020, there is a migration to the wintering habitat, one of which is the island of Java (Nijman, 2001; Nijman, 2005). On average, the raptors that were recorded crossing the SMETF on migration to habitat breeding or wintering habitat consisted of two to three groups from moderate to a large number of individuals. The smallest Oriental Honey-buzzard group contains seven individuals, and the most prominent group contains 13 individuals. Chinese Sparrowhawk, recorded that the smallest group contains five individuals, and the most prominent group contains 56 individuals. In addition, the estimated time passes are only recorded from 08.00 – 10.30 am and evening from 03.00 – 05.00 pm. The record in December 2020 is vital because we found the Oriental Honey-buzzard perched around the honeybee demonstration plot to hunt for prey. The Oriental Honey-buzzard has a habit of perching near the apiary before deciding to go down to eat (Yang et al., 2015). Many studies have stated that the Oriental Honey-buzzard has feed preferences such as bees, wasps, larvae, honeycomb wax, honey, including pollen (MacKinnon et al., 2010; McInerny & Shaw, 2019; Mori, 2019; Pramono et al., 2015; Yang et al., 2015). This phenomenon indicates that SMETF is a vital stopover area for the Oriental Honey-buzzard. For the Chinese Sparrowhawk, no other activities were recorded during the observation period except for flying over the SMETF.

Threats are also significant following migratory birds. Several traditional techniques for hunting wild birds have been known for a long time in rural areas, including the villages around SMETF. Bird hunting was common among villagers, but now hunting activities have trended to decline because the bird population in SMETF is no longer abundant. However, we still find bird hunting activities using traditional techniques (Table 4). Currently, most of the practice of hunting birds is carried out from outside the SMETF in the vicinity of agricultural land or house yards. The reason is that they are afraid of being caught by forest patrol officers. With *Ngaleugeut* and *Mikat* techniques, hunters can trap any bird they find, including migratory birds. Their targets are birds from deep in the forest provoked by fake bird sounds as bait, so they come out to find the sound. The study suggests that hunting for birds from outside the SMETF is very difficult to control because it is outside the jurisdiction of forest patrol officers, and this activity is alarming. In addition, unregulated bird hunting is also one of the causes of the decline in bird populations, specifical birds with market value (Hakim et al., 2020).

*Ngala Kroto* technique (Figure 9) is part of the local knowledge of the village community for itself. However, because there are socio-economic and cultural changes, hunting for *Kroto* (*Ngala Kroto*) becomes a source of livelihood, increasing the intensity. *Ngala Kroto* in SMETF often occurs because it is highly valued by buyers and has high demand in the market. In addition, *Kroto* is a well-known bird feed for various songbirds because it is thought to increase the aggressiveness and power of the bird's sound. Another finding is that *Kroto* is sold to fishing shops usually used by fish anglers as the main ingredient in making fish bait.

**Figure 9.** Kroto hunting in the SMETF

In one hunt, hunters can destroy 8-10 nests. These phenomena will affect the SMETF's carrying capacity in providing a source of food for wild birds so that it can disrupt the balance of the ecosystem. Ecologically, the presence of weaver ants in SMETF is significant because it provides a natural food source for insectivore birds,

including songbirds, and pest control (Césard, 2004; Van Itterbeeck et al., 2015; Van Mele, 2008).

However, only illegal logging has never existed again, while other threats still exist even though the intensity has decreased. This fact implies the existence of prevention efforts such as patrols and community empowerment programs. They hope that the foundation of species of migratory birds in SMETF will increase the richness and diversity of birds, and one day they will be an educational tourism attraction so that the existence of migratory birds is sustainable and beneficial.

### 4.1 Conservation

Yellow-rumped Flycatcher, Purple-backed Starling, Oriental Honey-buzzard, and Chinese Sparrowhawk is species of migratory bird for Indonesia (Atlas Burung Indonesia, 2020; Germi et al., 2009, 2013; Germi & Waluyo, 2006; MacKinnon et al., 2010; Mingju et al., 2017; Mittermeier et al., 2015; Nijman et al., 2006; Nijman, 2005; Setiyono et al., 2013; Sharma & Sangha, 2012; Sun et al., 2010). The four migratory birds are breeding in East Asia (Das & Debata, 2018; Germi et al., 2009; MacKinnon et al., 2010; Setiyono et al., 2013; Choi et al., 2015). The four migratory birds are classified as Least Concern by IUCN because the global population trend is stable for the Yellow-rumped Flycatcher and Purple-backed Starling (BirdLife International, 2016b, 2016a). However, the global population of Oriental Honey-buzzard and Chinese Sparrowhawk is declining (BirdLife International, 2021a, 2021b). In Indonesia, the two species have become protected by the Government of Indonesia (PERMEN LHK No. P.106/MENLHK/SETJEN/KUM.1/12/2018, 2018). As one globally critical habitat of migrant birds, SMETF has the advantage of its conservation status as forest protected. In addition, the site has been declared a field laboratory with great significant ecologically resource as education and learning objects for human resource of the Ministry of Environment and Forestry of Indonesia and other communities.

Generally, the threats of migrant birds in java may also be hunting, habitat loss, and degradation along its migration route. Hunting of migrant birds is one potential to be a significant threat to the migrant bird population in the East and Southeast (Yong et al., 2021). Hunting to supply the pet trade is undoubtedly the leading driver of taking in Southeast Asia (Harris et al., 2017). Based informant's story: "in SMETF, in the past hunting, using traditional technique (*Ngaleugeut* and *Mikat*) was so massive that it became the major cause of decline bird population." However, as a protected area, the hunting of birds in SMETF no longer exists. However, hunting birds in villages around protected areas is still going on by rural people (Iskandar et al., 2016) and around SMETF. Based on an in-depth interview with the informant, hunting of *Kroto* is still going on by some rural people in SMETF, but very rarely.

Although global data reports the status of all four migratory birds is LC. However, the small population of SMETF must be saved from various threats through conservation actions to avoid local extinction. On a local scale, continuous monitoring of numbers is essential to look at the population trend, notably to support the local authority in making policies and decisions. Furthermore, improving habitat through replanting native trees, forest protection through joint patrols, and improving the welfare of the community around SMETF through community empowerment programs such as training and mentoring in bird breeding, *Kroto* cultivation, and bird tour guides may have to be implemented to improve better habitat for Yellow-rumped Flycatcher, Purple-backed Starling, Oriental Honey-buzzard, Chinese Sparrowhawk in the future as well as to answer their expectations.

## 5. CONCLUSION

The composition of migratory birds recorded in the Sawala Mandapa Education and Training Forest consists of four species: Yellow-rumped Flycatcher, Purple-backed Starling, Oriental Honey-buzzard, and Chinese Sparrowhawk. The discovery of the four migratory bird species indicates that SMETF is an actual location as a stopover area for raptors and acts as a wintering habitat for passerines. This result means that this area is one of the forest areas in Java that plays a vital role in bird migration because it can be an alternative site in the Asian Australian Flyway. However, wild bird hunting, such as *Ngaleugeut* and *Mikat*, remains a threat to migrant birds. Thus, protecting and maintaining the SMETF and its resources significantly impact the conservation of migrant birds.

**Author Contributions:** Designing the study, coordinating the course of study, responsible for study concepts and topics, data collection center, corrections of data analysis: Author 1; Responsible for collecting data on the biophysical condition of the research location, including in making a map of the research location: Author 3; Implement and be responsible for collecting data on migratory birds from raptor and passerine groups such as the identification process, counting the number of species and individuals of each species: Author 1 and 2; Implement and be responsible for collecting and analyzing community social data, correction of language writing: Author 4 and 5.

**Competing Interest:** The authors declare no conflict of interest.

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