KANCILAN FLORES (*Pachycephala nudigula nudigula*): THE ICONIC BIRD OF KELIMUTU NATIONAL PARK, INDONESIA

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KANCILAN FLORES (*Pachycephala nudigula nudigula*): THE ICONIC BIRD OF KELIMUTU NATIONAL PARK, INDONESIA. Kancilan Flores (*Pachycephala nudigula nudigula*) is an iconic bird of Kelimutu National Park. The bird has a unique characteristic with the ability to make a wide variety of song. The local people call this bird '*Garugiwa*' and also '*burung arwah*' or 'spirit bird' because it is small and hard to spot but has a loud chirp. Some literature mentions this bird with different scientific names. This study aimed to identify this bird to rectify this misnaming scientifically and to observes Kancilan Flores behavior, habitat, and population. Kancilan Flores is an attractive fauna for tourists. Therefore, this study also recommended potential birdwatching locations for Kancilan Flores. This study used a transect line and direct observation methods. The results showed that the estimated population size of Kancilan Flores in the Kelimutu National Park was 1,667 individuals with a population size range of 1,245–2,089 individuals. The population density of Kancilan Flores was estimated at 0.53 individuals per hectare. The Kancilan Flores is most commonly found at an altitude of 1,500–1,600 m a.s.l. Recommended areas as bird watching locations for Kancilan Flores, namely the Edelweiss Garden, Perekonde, the lower Arboretum, and the Kancilan Flores middle Arboretum. Therefore, it is necessary to protect the population of Kancilan Flores by strictly prohibiting hunting and destruction of their habitat.

Keywords: Kancilan Flores, Flores, Garugiwa, habitat, Kelimutu, population

*PACHYCEPHALA NUDIGULA NUDIGULA: BURUNG IKON DARI TAMAN NASIONAL KELIMUTU. Kancilan Flores (*Pachycephala nudigula nudigula*) adalah salah satu jenis burung legendaris yang berada di Taman Nasional Kelimutu. Burung tersebut mempunyai ciri khas yang unik dengan kemampuan berkicau dengan ragam suara yang sangat bervariasi. Masyarakat sekitar menjuluki burung ini dengan nama burung arwah, karena ukurannya yang kecil dan sulit untuk dijumpai namun memiliki kicauan yang nyaring. Beberapa literatur menyebut nama burung ini dengan nama ilmiah yang masih berbeda-beda. Penelitian ini bertujuan untuk mengidentifikasi burung ini untuk memperbaiki kesalahan penamaan secara ilmiah dan untuk mengamati perilaku, habitat, dan populasiKancilan Flores. Selain itu, Kancilan Flores adalah fauna yang menarik untuk wisatawan. Oleh karena itu, penelitian ini juga akan memberikan rekomendasi potensi lokasi bird watching Kancilan Flores. Penelitian ini menggunakan metode survei berupa jalur transek dan pengamatan secara langsung di habitatKancilan Flores. Hasil penelitian menunjukkan dugaan ukuran populasi Kancilan Flores di Kawasan TN Kelimutu adalah sebanyak 1.667 individu dengan kisaran ukuran populasi antara 1.245–2.089 individu. Populasi burung Kancilan Flores hanya sekitar 0,53 individu per hektarnya. Kancilan Flores paling banyak dijumpai pada ketinggian 1.500–1.600 m a.s.l. Rekomendasi area sebagai lokasi bird watching Kancilan Flores, yaitu sekitaran Kebun Edelweiss, Perekonde, Arboretum bagian bawah, dan Arboretum bagian tengah. Karena itu perlu usaha perlindungan terhadap populasi Kancilan Flores dengan melarang keras perburuan dan pengrusakan habitatnya.*

Kata kunci: Kancilan Flores, Flores, Garugiwa, habitat, Kelimutu, population

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I. INTRODUCTION

Kelimutu National Park is located in Ende Regency, Flores Island, East Nusa Tenggara, Indonesia. The three-coloured crater lake in this national park is one of the major tourist destinations in East Nusa Tenggara. During the past five years (2015-2019), it attracted approximately 81.887 visitors per year. Conservation areas are rich in biodiversity but are often only a few of the species that have been studied. In Kelimutu National Park, there are 176 species of flora, 13 species of reptiles and amphibians, 13 species of mammals, and 93 species of birds (Balai Taman Nasional Kelimutu, 2019; Hidayat & Kuspriyangga, 2020). In this national park, there are also several endemic flora and fauna. There are four species of endemic and rare flora: *Begonia kelimutuensis*, *Rhododendron renschianum*, *Alstonia scholaris*, and *Timonius timon*. In addition, there are 16 rare and endemic species of Lesser Sunda Island, one of which is Bare-throated Whistler/Kancilan Flores (*Pachycephala nudigula*) (Balai Taman Nasional Kelimutu, 2019). In the local language (Lio tribe), people in Kelimutu called the bird 'Garugiwa or Gerugiwa'. People in Manggarai call it 'Kiong or Ngkiong' (Verheijen, 1963), while in West Nusa Tenggara this species is known as 'Samyong'. The local people believe that this bird is an ancestral spirit (*burung arwah*), and they shall not hunt it.

Kancilan Flores is an Australasian songbird from the Pachycephalidae family, originated in Australo-Papua with a beautiful and loud song (whistler) (Jønsson, Irestedt, Christidis, Clegg, Holt, & Fjeldså, 2014). Kancilan Flores consists of two subspecies, namely *Pachychepala nudigula nudigula* Hartert 1897 (spread on the island of Flores) and *P.n. ilsa* (spread on Sumbawa Island) (Bibby, Jones, & Marsden, 2000; BirdLife International, 2016; Bishop, 2017; Jønsson et al., 2014). Kancilan Flores is a species belonging to the genus Pachycephala with an old lineage (Jønsson et al., 2014), and its speciation occurs sympatric ally with the rusty-breasted whistler (*Pachycephala fulvotincta*) (Jønsson et al., 2014). *P. nudigula* was found throughout Papua Island to the Lesser Sunda Islands, especially Flores Island and Sumbawa Island 4-1.8 million years ago, during the Pliocene period (Jønsson et al., 2010).

Kancilan Flores is spread on Sumbawa Island and Flores Island in the montane forest with an altitude above 1.200 m a.s.l (Bishop, 2017). According to Jønsson et al. (2014), Kancilan Flores is spread in the undisturbed forest at an altitude of 1.000 m a.s.l. Kancilan Flores was first identified in the Kelimutu National Park Area as *Monarcha* sp. (Wawo et al., 2010). Several scientific publications also refer to the Kancilan Flores as *Monarcha* sp. (Karimah & Hastuti, 2018; Rodja, 2013; Winarto & Sitepu, 2019). Kancilan Flores can be recognized by its beautiful singing and can produce a variety of chirp. This bird lives in relatively high forest land areas, in mountainous areas within the Kelimutu National Park (Fauzi, 2013; Hermawan, Chandra, & Sitepu, 2019). Kancilan Flores is also found in mixed natural forests with an altitude above 1.000 m a.s.l in the Kelimutu National Park (Bishop, 2017). Until 2008, the scientific identification of the Kancilan Flores bird has not been carried out. Special observations of this bird in Kelimutu National Park only started in 2009. In 2009 identification was carried out, and based on its morphology, this bird was identified as *Pachycephala nudigula*. Kancilan Flores is in the IUCN Least Concern category with decreasing population status (BirdLife International, 2016; Langkamau, Purnama, & Kaho, 2020; Nyanasengeran, Yong, & Chiok, 2020).

This study aims to scientifically identify the Kancilan Flores bird and observe its activities habitat, and population in Kelimutu National Park. Data obtained from this study will be used as a baseline for continuous monitoring of the Kancilan Flores population. Moreover, Kancilan Flores is an attractive fauna for tourists. Therefore, this study also provides recommendations for potential birdwatching locations for Kancilan Flores.

II. MATERIAL AND METHOD

A. Study Area

Kelimutu National Park is located in S 8°43' 21" - 8°48' 24" and E 121°44' 24" - 121°50' 15" and covers an area of 5.356,5 ha (Figure 1). In 2009 a survey of the Kancilan Flores population was carried out in the utilization zone of 96.50 hectares of Kelimutu National Park. Meanwhile, in 2014 a population survey was conducted in all areas of Kelimutu National Park (core zone, wilderness zone, utilization zone, and rehabilitation zone).

The Kelimutu National Park area has two types of forest ecosystems: the sub-montane forest and the montane forest. The sub-montane forest has an altitude between 1,000-1,500 m a.s.l with temperatures ranging from 27°C to 30°C. While montane forest in Kelimutu is at an altitude of 1,500–1,700 m a.s.l with a temperature of 25°C–27°C (Zona Pengelolaan Taman Nasional Kelimutu Provinsi Nusa Tenggara Timur, 2016). The dominant vegetation is *Casuarina junghuhniana*. At altitudes above 1,200 m a.s.l, many typical mountain flora species are found, namely Vaccinium varingiaefolium and *Rhododendron renschianum*. Based on forest type, it can be divided into 2, namely Primary Forest (2,630.49 ha) and Secondary Forest (515.89 ha).

B. Population

The survey was conducted in August 2009 and September 2014 in Kelimutu National Park. In 2009 the survey was only conducted in the utilization zone. Meanwhile, the survey in 2014 was conducted in a wider area. The survey conducted in 2009 aims to identify, obtain population data and explore the potential of birdwatching as an alternative tourist attraction for visitors to Lake Kelimutu. Surveys were conducted to invent possible sites occupied by Kancilan Flores. To identify Kancilan Flores, the observers follow, take photos, and record videos of the birds. The survey line is a tracking route from the area entrance (Post Moni) to the top of Mount Kelimutu.

The survey in 2014 was only to obtain population data in existing routes (trekking routes, inventory routes, and patrols routes) that already existed in the Kelimutu National Park area. The method used for estimating the Kancilan Flores population in this study was the strip transect method. Observations were made on a transect line with a length of 1 km and a width of 40 m to the left or right of the line (Bibby, Jones, & Marsden, 1998) (Figure 2). The Kancilan Flores population survey was conducted on 21 transect lines in the Kelimutu National Park or 21 Km in total. Observers

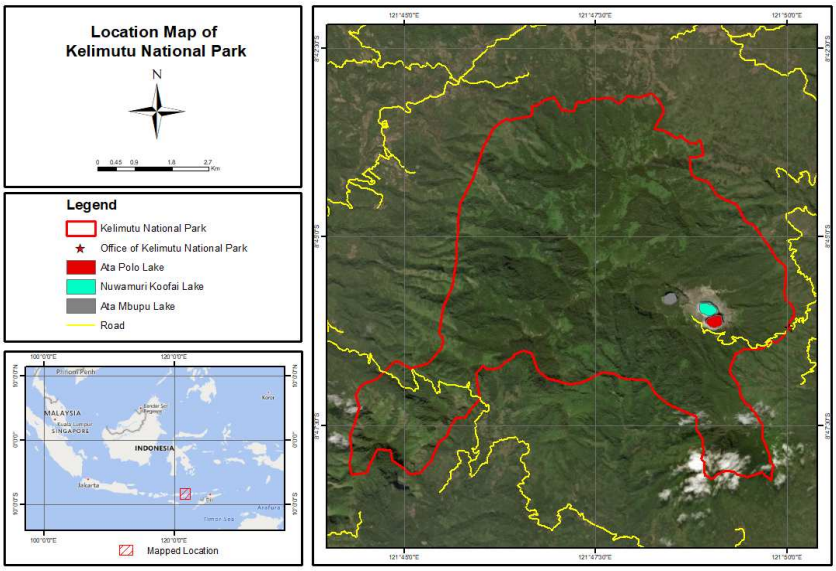

Figure 1. Location map of Kelimutu National Park

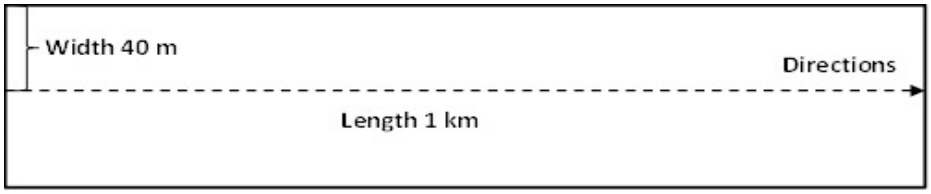

Figure 2. Transect method

walked at a constant speed while noting any Kancilan Flores found on the route and making sure not to record birds outside the transect to avoid double counting. The data taken during the observation were the number of individuals, location coordinates, sighting angle, altitude, habitat type, and time of observation.

Population size estimation is done by counting the number of Kancilan Flores found in each observation line and then calculating the density using the King equation as follows (Bibby et al., 1998):

$$D = \frac{\sum x_i}{2.L.w} \text{ or } D = \frac{\sum x_i}{a} \quad \text{.....(1)}$$

Where:
D = Estimated population density according to King (individuals/km^2) or (individuals/ha)
xi = the number of individuals found at contact-i
L = observation track length (m)
a = extent of observation area (km^2 or ha)
w = left or right width of the observation track(m)

The population size for the entire observation area can be determined using the following equation (Bibby et al., 1998):

$$\bar{P} = \frac{\sum x_i}{2 \sum L_j w_j} \text{ or } \bar{P} = \frac{\sum D_j}{k} \times A \quad \text{.....(2)}$$

Where:
$\bar{P}$ = Estimated population density (individual)
k = number of observation track
A = the total extent of the observation area
D_j = population density at contact-j (individual/ km^2 or individual/ ha).

The range of population size estimation results can be determined using the following equation (Bibby et al., 1998):

$$\bar{D}_j = \frac{\sum D_j}{k} S^2 = \frac{\sum D_j{}^2 - (\sum D_j)^2/k}{k-1} \quad \text{.....(3)}$$

$$S_{\bar{D}} = \sqrt{\frac{S^2}{k}} \quad \text{.....(4)}$$

Where:
$\bar{D}_j$ = average of population density of all observation tracks (individual/ km^2 or individual/ ha)
S^2 = sample variance
$S_{\bar{D}}$ = standard deviation of the observation

Based on the calculation above, the range of population sizes in all areas studied is (Bibby et al., 1998):

$$P = \left[\bar{D} \pm \left(t_{a/2;\,db} . S_{\bar{D}}\right)\right] \times A \quad \text{.....(5)}$$

The locations where Kancilan Flores were found were selected to be recommended as potential locations for Kancilan Flores birdwatching. Behavioural observations were carried out in the morning (06.00-10.00) and afternoon (16.00-17.30) using the focal animal sampling method. Observations were conducted for six days at different locations. There were 21 birds observed. The data recorded are the time of encounter, the number of individuals, altitude, and the location's coordinates. Activities observations were made by documenting all Kancilan Flores activities with a camera.

In observing the Kancilan Flores habitat, the data collected included the location, species of observed trees, and the part of the canopy used. For the observation of canopy occupied by Kancilan Flores, the canopy area of each tree was divided vertically into the upper, middle, and lower crown (Makarova & Sharikov, 2015).

III.RESULT AND DISCUSSION

A. Identifications

Based on the photos obtained, relatively clear photos of the shape and colour of Kancilan Flores can be seen. When compared with the pictures of Flores Monarch *Symposiachrus sacerdotum*, the difference with Kancilan Flores is noticeable. *S. sacerdotum* has black and white colour, while Kancilan Flores is green with some yellowish-green.

B. Morphology

The distinguishing morphological feature of males and females is the colour of the head and wattles on the neck. The female individual has a grey head and does not have a red wattle on the neck (Figure 3). Male individuals have black head-to-neck hair (Figure 4). On the front, under the neck, there is a red wattle that bulges when singing. There is black fur under the neck. The top feathers of the crown sometimes form a crest when chirping loudly. Individual females do not sing like individual males.

The colour of the male and female body parts is the same. The breast and belly of the body is yellow-brown. In comparison, the back and wings are olive green or brownish yellow, darker than the bottom. The undertail of the tail is black but not as dark as the feather on its crown. The beak is black, with a white stripe on the mandible of the beak. Tail length is about ± 1/3 of body length. In general, when compared to the subspecies *P.n. ilsa*, the color of *P. n. nudigula* is darker (Bishop, 2017; Van Beirs, 2017). Kancilan Flores is a perching bird. Its feet are anisodactyl type (3 front toes and 1 hind toe) typical of songbirds. The middle toe is longer than the inner and outer toe.

C. Activities

Kancilan Flores is a solitaire bird and territorial. Kancilan Flores found at the altitude of less than 1,400 m a.s.l has ± 12 sounds variation. Meanwhile, Kancilan Flores observed at an altitude of more than 1,400 m a.s.l has a variation of ± 17 sounds. Kancilan Flores can imitate sounds; therefore, two possible reasons to cause variations in the chirping of Kancilan Flores at higher altitude are: 1) the diversity of vegetation at that altitude is greater so that the diversity of birds and other animals is also higher, 2) more tourism activities at the altitude of 1,400 m a.s.l so that Kancilan Flores may hear more sounds at that altitude. There are many animal sounds and sounds from tourism activities that Kancilan Flores can imitate. Its territory is around the road, making this bird accustomed to the presence of humans and vehicles. Each individual can be distinguished from the chirp and always occupy the same area.

In the morning, Kancilan Flores occupies the upper and middle canopy strata of the tree. The canopy strata preference is related to Kancilan Flores's behaviour when singing to get enough sunlight. The selection of this canopy strata also allows Kancilan Flores to monitor and defend its territory from disturbances by other animals, especially other species of birds.

Figure 3. A female Kancilan Flores

Figure 4. A male Kancilan Flores

During the singing, Kancilan Flores birds move between trees on an area of ± 500 m². When actively singing, the body's position is to the side or opposite the sun's direction. However, when the weather is foggy or cloudy, the Kancilan Flores bird faces the direction of the sunlight.

D. Population and Distribution

Of the 21 transect lines surveyed, Kancilan Flores was found on 19 transects (Figure 5). It is thought that the Kancilan Flores was absent in two transects because the vegetation was homogeneous, dominated by *Eucalyptus urophylla*. This study found 89 encounters with Kancilan Flores individuals (Table 1). Based on the population survey results, from 89 encounters, only 7 were female individuals. It is because the female individual does not sing, so it is very difficult to observe it. Therefore, because the bias was too high, the estimated density of each sex cannot be calculated separately.

The estimated density of Kancilan Flores in the Kelimutu National Park area was 0.53 individuals/ha, with a range of 0.40–0.66 individuals/ha. Therefore, the estimated population size of Kancilan Flores in the Kelimutu National Park is 1,667 individuals, with a population size of 1,245–2,089. The total transects surveyed are ± 168 ha, or about 5.34% of the total natural forest area in the Kelimutu National Park. In the previous study in 2012, the estimated population density of Kancilan Flores was 0.0389–0.3481 individuals/ha or around 186.41–1,668.07 individuals, which is smaller than the population estimate in this study (Kuspriyangga, 2013). The cause of differences in population estimates may be due to differences in the area surveyed.

Based on observations, Kancilan Flores was found in the morning until 10:58 AM. The majority of encounters were when Kancilan Flores singing on *Casuarina junghuhniana*. But besides *Casuarina junghuhniana*, Kancilan Flores was also singing in the big trees on the upper tree crown. These trees include Ampupu/ Timor white gum (*Eucalyptus urophylla*), Gari (*Schefflera lucida*), Longgobaja/Cheese tree (*Glochidion philippicum*), Kelo/common red stem fig (*Ficus variegata*), Teru/elephant's ear tree (*Macaranga gigantea*), Deo/Charcoal tree (*Trema orientalis*), Urubara (*Prunus arborea*) and Keba/beetroot tree (*Elattostachys verrucosa*). This indicates that Kancilan Flores needs high trees to sing, marking its territory.

The distribution of Kancilan Flores was only found in natural forests which have various forest canopy strata. Therefore, observation tracks were only set up in natural forests (primary and secondary). Kancilan Flores is more commonly found at altitudes >1,000 m a.s.l, especially at an altitude of 1,500–1,600 m a.s.l (Figure 7). The air temperature is lower at this altitude, and the relative humidity is

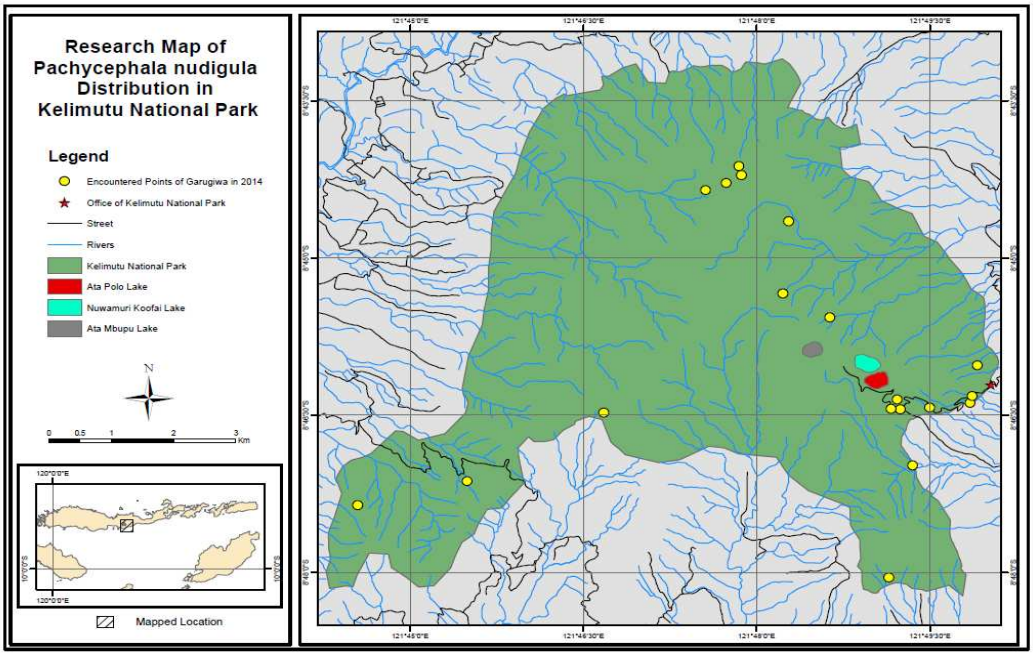

Figure 5. Kancilan Flores encounter locations

Table 1. Encounters with Kancilan Flores in 2009

No.	Track	Male (individual)	Female (individual)	Altitude (m. a.s.l.)	Dominant Vegetation Types
1	Track 01 Post Moni	3	0	1,227	*Casuarina junghuhniana, Cyathea* sp., *Melastoma polyanthum, Pittosporum moluccanum, Eupatorium odoratum*
2	Track 02 Kebun Edelweiss	9	0	1,317	*Casuarina junghuhniana, Melastoma polyanthum, Pittosporum moluccanum, Eupatorium odoratum*
3	Track 03 Perekonde	6	0	1,465	*Casuarina junghuhniana, Cyathea* sp., *Glochidion philippicum, Saurauia nudiflora*
4	Track 04 Arboretum	3	0	1,538	*Litsea resinosa, Prunus arborea, Ficus variegata, Casuarina junghuhniana, Treima orientalis, Macaranga giganteus, Cyathea* sp., *Eupatorium odoratum.*
	Total	21	0		
	Average (individual/ track)	5.25	0		
	Standard deviation	± 2.49	0.00		

Table 2. Encounters with Kancilan Flores in 2014

No.	Track	Male (individual)	Female (individual)	Altitude (m. a.s.l.)	Dominant Vegetation Types
1	Track I Dedumodi	3	0	1,337	*Glochidion philippicum, Eucalyptus urophylla, Cyathea* sp., *Prunus arborea, Eupatorium odoratum*
2	Track II Aemoka	3	1	1,339	*Litsea resinosa, Prunus arborea, Ficus variegata, Glochidion philippicum*
3	Track V Melo	7	0	1,535	*Litsea resinosa, Prunus arborea, Ficus variegata, Glochidion philippicum*
4	Track VI Melo	1	0	1,583	*Prunus arborea, Schefflera lucida, Ficus variegata, Macaranga giganteus*
5	Track VII Melo	6	0	1,494	*Eucalyptus urophylla, Melastoma malabathricum, Melastoma polyanthum, Casuarina junghuhniana,*
6	Track VIII Melo	5	0	1,458	*Eucalyptus urophylla, Casuarina junghuhniana, Melastoma polyanthum, Melastoma malabathricum*
7	Track IX Deturia	5	2	1,635	*Pittosporum moluccanum, Melastoma malabathricum, Casuarina junghuhniana, Eucalyptus urophylla, Eupatorium odoratum*
8	Track X Alotube	5	1	1,631	*Prunus arborea, Litsea resinosa, Glochidion philippicum, Ficus variegata, Eupatorium odoratum*
9	Track XI Okisobe	1	0	1,202	*Ficus variegata, Macaranga giganteus, Cyathea* sp., *Glochidion philippicum, Eupatorium odoratum*
10	Track XII G18	6	1	1,290	*Casuarina junghuhniana. Eucalyptus urophilla, Pittosporum moluccanum, Melastoma polyanthum, Eupatorium odoratum*
11	Track XIII 288-294	7	2	1,557	*Casuarina junghuhniana, Macaranga giganteus, Pittosporum moluccanum, Melastoma polyanthum*

No.	Track	Male (individual)	Female (individual)	Altitude (m. a.s.l.)	Dominant Vegetation Types
12	Track XIV 298-300	4	0	1,656	*Eucalyptus urophilla, Casuarina junghuhniana, Pittosporum moluccanum, Melastoma polyanthum, Eupatorium odoratum*
13	Track XV Jalur Trekking	3	0	1,656	*Eucalyptus urophilla, Macaranga giganteus, Pittosporum moluccanum, Melastoma malabathricum, Eupatorium odoratum*
14	Track XVI Rimba	4	0	1,484	*Casuarina junghuhniana, Glochidion philippicum, Prunus arborea, Ficus variegata*
15	Track XVII Kelibara	2	0	1,656	*Ficus variegata, Glochidion philippicum, Litsea resinosa, Casuarina junghuhniana*
16	Track XVIII Nira Roa	5	0	1,666	*Glochidion philippicum, Prunus arborea, Litsea resinosa, Cyathea* sp., *Casuarina junghuhniana*
17	Track XIX Post Moni - Kebun Edelweis	4	0	1,351	*Casuarina junghuhniana, Cyathea* sp., *Melastoma polyanthum, Pittosporum moluccanum, Eupatorium odoratum*
18	Track XX Jalan baru Pemo – km 11	7	0	1,477	*Casuarina junghuhniana, Ficus variegate, Cyathea* sp., *Melastoma polyanthum, Eupatorium odoratum*
19	Track XXI Arboretum	4	0	1,583	*Litsea resinosa, Prunus arborea, Ficus variegata, Casuarina junghuhniana, Treima orientalis, Macaranga giganteus, Cyathea* sp., *Eupatorium odoratum.*
	Total	82	7		
	Average (individual/track)	4.32	0.37		
	Standard deviation	± 1.81	± 0.67		

high, and there is little disturbance to human activities. Bird abundance can be correlated with vegetation type and altitude (Champness et al., 2019; Domokos & Domokos, 2016; Girma et al., 2017).

In addition, the lower the altitude in the Kelimutu National Park area, the closer it is to gardens and residential areas. Meanwhile, at an altitude of >1,600 m a.s.l, the canopy cover is increasingly open as it approaches the top of

a mountain or lakes crater. At this altitude, some of the plants are Arngoni (*Vaccinium varingiaefolium*) and Turuwara (*Rhododendron renschianum*).

E. Habitat

The research location is a sub-montane ecosystem. This is related to the type of vegetation covered and the area of activity of Kancilan Flores. The existence of sufficient cover allows the emergence of insect species, the main food of Kancilan Flores (Jønsson et al., 2010).

The Kancilan Flores is found mostly in the upper canopy. Based on observations, 48.15% of Kancilan Flores birds carried out activities in the upper canopy. Meanwhile, 28.40% of Kancilan Flores activities were in the middle canopy. The remaining 23.46% of Kancilan Flores activities were in the lower canopy. At the time of chirping, Kancilan Flores occupies the upper canopy strata at 06.00 AM and the middle crown at 08.30 AM. The Kancilan Flores occupies the same area during their singing activities, covering an area of ± 500 m². The upper and middle canopies are ideal territories for singing activity (Ario, 2011). Utilization of the upper canopy dominates during the chirping activities. However, towards noon, Kancilan Flores often descends to the lower canopy (Figure 6).

Based on observations, Kancilan Flores was not found at an altitude of <1,000 m a.s.l or near the border of the national park and residential areas. Kancilan Flores only can be found at altitudes above 1,100 m a.s.l (Figure 7).

F. Birdwatching

Birdwatching tourism has large market potential and can last all year round (Kronenberg, 2016; Li et al., 2013; Ocampo-Peñuela & Winton, 2017). The Kancilan Flores bird watching locations are divided into 2 (two) different places: 1) Kelimutu National Park tourism regular road (2 locations), and 2) Arboretum area (2 locations). The location selection is based on the availability of access to the road. These locations are accessible and have a natural landscape that does not need much modification. However, birdwatchers must be mindful because nature tourism can also harm bird populations, physiological changes, behaviour, and reproduction (Bateman & Fleming, 2017; Geffroy et al., 2015; Putri et al., 2020).

From observations along the regular route of Kelimutu National Park tourism, three locations can be used as places of interest for observing Kancilan Flores birds, namely:

a. Edelweiss Garden

In the area around the Edelweiss Garden, Kancilan Flores birds can be observed directly at a distance of 20 meters from the side of the road. The road above the ridge will make it easier to observe Kancilan Flores birds

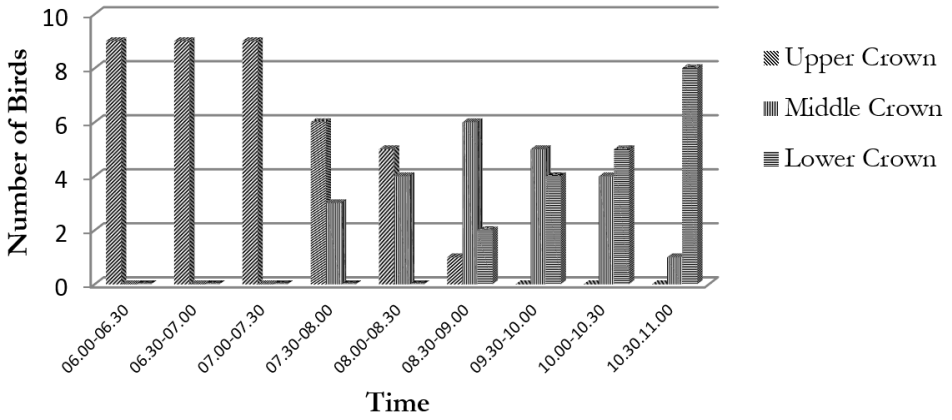

Figure 6. Utilization of tree crown by Kancilan Flores from 06 AM to 11 AM

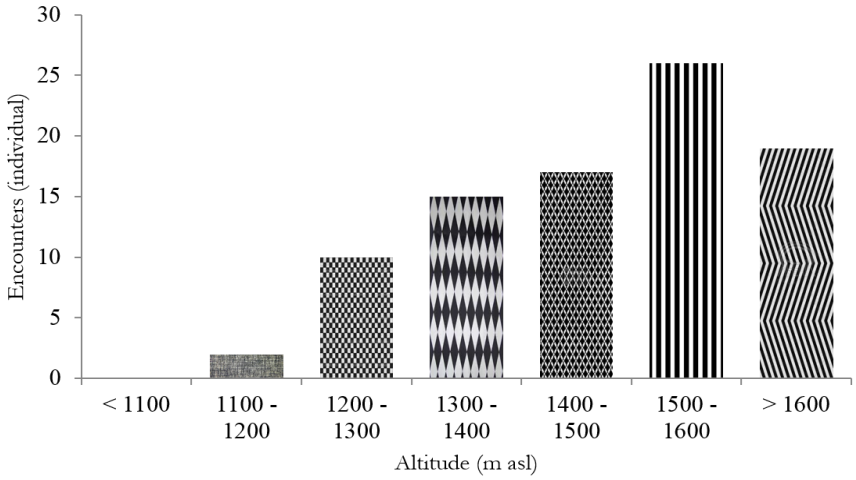

Figure 7. Kancilan Flores's distribution at different altitudes

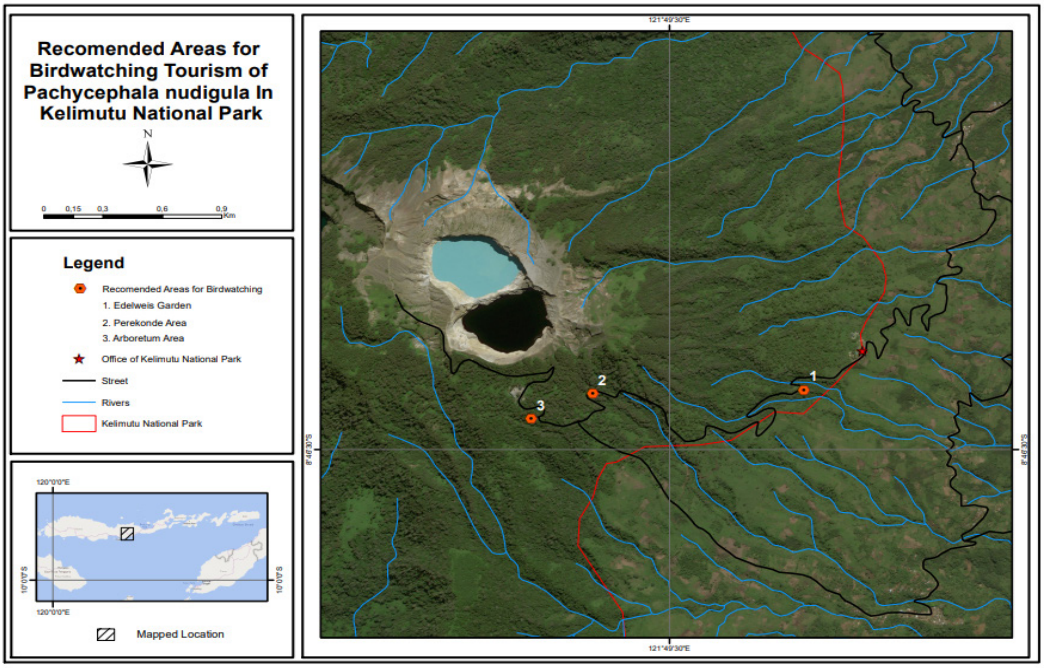

Figure 8. Recommended areas for Kancilan Flores birdwatching

during their chirping activity in the morning on the top canopy of *Casuarina junghuhniana*. In addition, visitors can at the same time see the sunrise emerging from behind the mountains on the east side. Edelweiss garden is located at the top of the ridge, allowing visitors to see the valley below and the mountains and sea in the distance. If this Edelweiss Garden area has developed well, it will become a combination of birdwatching, landscape and sunrise sightseeing spot, and agricultural/agro-tourism areas.

b. Perekonde

In the Perekonde area, visitors can see Kancilan Flores and a cultural site (an offering area for the ancestors' spirits). This location is a combination of nature tourism and cultural tourism. At the same time, visitors can experience the relationship between nature (Kelimutu National Park area) and the culture of the people around the area. In this area, observing Kancilan Flores birds is combined

with observing plants and forests as their habitat.

c. Arboretum

In the centre of the Arboretum, visitors can immediately see Kancilan Flores birds on the trees. Observations can be made from 2 circular paths in the middle of the Arboretum. At the lower Arboretum, visitors can see the Kancilan Flores in their chirping territory at the end of the road. Kancilan Flores in this area are often found at a distance of 70 meters.

The Arboretum has a high diversity of species. There are 37 species of woody plants consisting of 23 families. The family with the highest number of plant species is the Euphorbiaceae (Fauzi, 2016). In addition to the high diversity of flora, the Arboretum is also equipped with trekking routes to observe flora and fauna (Djou, Baiquni, Widodo, & Fandeli, 2017).

IV. CONCLUSION

Kancilan Flores, one of the icons in Kelimutu National Park, is identified as *Pachycephala nudigula nudigula*. The estimated population size of Kancilan Flores in the Kelimutu National Park is 1,667 individuals, with a population size of 1,245–2,089 individuals. The population density of Kancilan Flores birds is estimated at 0.53 individuals per hectare. Kancilan Flores is most commonly found at an altitude of 1,500–1,600 m a.s.l. There are 4 recommended areas for birdwatching Kancilan Flores locations: 1) the Edelweiss Garden, 2) the Perekonde area, 3) the Centre Arboretum, and 4) the Lower Arboretum. Therefore, it is necessary to protect the population of Kancilan Flores birds by strictly prohibiting hunting and habitat conversion. In addition, research on the breeding ecology of Kancilan Flores birds is needed to support its conservation efforts.

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