

**FACTORS AFFECTING THE BIRD COMMUNITY ON
GAYA ISLAND, SABAH, MALAYSIA**



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**FACULTY OF SCIENCE AND NATURAL RESOURCES
UNIVERSITI MALAYSIA SABAH
2019**

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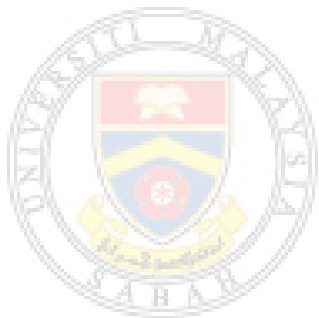
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DECLARATION

I hereby declare that the material in this thesis is my own except for equation and references, which have been duly acknowledged.

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Emily A. Gilbert
26 February 2019



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ABSTRACT

Gaya Island is well known as one of the hot spots for tourist destinations in Sabah. This island harbours both terrestrial and marine wildlife that attracts the tourist in visiting this island. To date, there are only a few studies have been conducted on the impact of the factors influencing the bird community in Gaya Island as the bird act as an important indicator for the health of the island's ecosystem. The purpose of this study is to obtain primary data for Sabah Park to be used as guideline to conserve the bird community in that island in reference to the influencing factor namely the anthropogenic noise and vegetation factors. Hence, this study aims to determine the effect of the influencing factors namely the anthropogenic noise and vegetation on the bird community in Gaya Island. The null hypothesis proposed in this study is that the anthropogenic noise and vegetation does not significantly affect the bird community in Gaya Island. The data collection was conducted for six months in three of the selected sampling sites within the island. The methods that were being used were solely point count sampling, noise measurement and circular plot sampling. Meanwhile, diversity indexes, Spearman's correlation and Mann-Whitney U were used to analyse the obtained data. A total number of 511 individuals from 25 species and 16 families were recorded during the survey. The Shannon_Wiener index showed that the diversity of birds is slightly higher in high anthropogenic noise categories ($H'=2.524$) as compared to the low anthropogenic noise categories ($H'=2.498$) but there was no significant difference of species diversity between two noise categories. Interestingly, according to the result from Mann-Whitney U test, there were eight species of birds showed significant different in terms of abundance at the species level of birds between both types of noise categories ($p<0.05$). In addition, the result of the Spearman's correlation analysis showed that the anthropogenic noise is negatively correlated with the species richness and abundance of birds and it is very significant ($r=-0.054$, $p=0.000$). However, for the tree composition, the result showed that there is no significant correlation between the basal area, stem density and tree diversity with the species richness and abundance of bird in that island. Therefore, the findings from this study showed the anthropogenic noise does play a role in affecting the bird community in Gaya island while there was no statistically significant impact of the basal area, stem density and tree diversity towards the bird community in that island. Nonetheless, further study still needed to be conducted at the other parts of Gaya island in order to get a representative data on the effects of these influencing factors to bird population in that island.

ABSTRAK

FACTORS AFFECTING THE BIRD COMMUNITY ON GAYA ISLAND, SABAH, MALAYSIA

Pulau Gaya sangat terkenal sebagai salah satu destinasi pelancongan di Sabah. Pulau ini mempunyai hidupan liar daratan dan lautan yang menjadi tarikan kepada pelancong untuk datang berkunjung. Namun, hanya terdapat beberapa kajian yang dilakukan berkenaan dengan kesan faktor-faktor yang mempengaruhi komuniti burung di Pulau Gaya kerana burung memainkan peranan sebagai penunjuk bagi kesihatan ekosistem pulau. Tujuan kajian ini dilakukan adalah untuk memperolehi Data primer bagi pihak Taman Sabah untuk digunakan sebagai panduan dalam bagi konservasi komuniti burung dengan merujuk kepada kesan faktor iaitu faktor bunyi antropogenik dan vegetasi di pulau tersebut. Oleh itu, kajian ini dilakukan bagi menentukan kesan faktor seperti bunyi antropogenik dan vegetasi terhadap komuniti burung di Pulau Gaya. Hipotesis nol yang telah dicadangkan dalam kajian ini adalah bunyi antropogenik dan vegetasi tidak mempunyai kesan yang ketara terhadap komuniti burung di Pulau Gaya. Pengumpulan data telah dilakukan selama enam bulan di tiga kawasan kajian di pulau tersebut. Kaedah yang digunakan adalah "point count sampling", "noise measurement" dan "circular plot sampling". Sementara itu, index kepelbagaian, "Spearman's correlation" dan "Mann-Whitney U test" digunakan untuk menganalisa data yang diperolehi. Sebanyak 511 individu daripada 25 spesis dan 16 keluarga burung yang telah direkod. Index "Shannon_Wiener" menunjukkan nilai kepelbagaian adalah lebih tinggi di kawasan kategori tinggi bunyi antropogenik ($H' = 2.524$) berbanding kawasan kategori rendah bunyi antropogenik ($H' = 2.498$) namun tidak ada perbezaan ketara mengenai kepelbagaian burung di kedua kawasan. Analisis Mann-Whitney U test menunjukkan terdapat lapan spesis burung yang menunjukkan perbezaan ketara dari segi "abundance" pada peringkat spesis burung di kedua-dua jenis kategori bunyi ($p < 0.05$). Tambahan pula, keputusan "Spearman's correlation" menunjukkan bunyi antropogenik berkorelasi dengan "species richness" dan "abundance" burung dan ianya sangat ketara ($r = -0.054$, $p = 0.000$). Walaubagaimanapun, bagi komposisi pokok, hasil kajian menunjukkan bahawa tiada korelasi yang ketara diantara "basal area", "stem density" dan "tree diversity" dengan "species richness" dan "abundance" burung di pulau tersebut. Oleh yang demikian, hasil daripada kajian ini menunjukkan bahawa bunyi antropogenik memainkan peranan dalam memberi kesan terdapat komuniti burung di Pulau Gaya. Selain daripada itu, tiada kesan yang ketara secara statistik yang ditunjukkan oleh "basal area", "stem density" dan "tree diversity" terhadap komuniti burung di pulau tersebut. Walaubagaimanapun, kajian susulan masih perlu dilakukan di kawasan lain sekitar Pulau Gaya bagi memperolehi data yang dapat menunjukkan kesan faktor-faktor tersebut terhadap burung secara keseluruhan.

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CHAPTER 1

INTRODUCTION

1.1 Bird Community in an Island Habitat

Islands of which, are smaller in size as compared to the continents have its' own functional ecosystem within the confined areas (Taylor & Kumar, 2016). Apart from that, islands do not only offer beautiful geological landscape but also harbour wildlife such as the birds. The main attraction of the island is the marine tourism (Sompud, *et al.*, 2019) while the bird is not the main tourist attraction in this island as opposed to the birds in Kinabalu National Park. However, bird has become important to the environment as it involves in balancing the ecosystem through its roles such as pollinator, predators and seed disperser (Peh *et al.*, 2005) in the food chains (Basnet *et al.*, 2016). The birds found in islands were also used as the model in the theory of Island Biogeography by MacArthur & Wilson (1967).

The ability of the bird in detecting changes in its' surrounding environment (Yap *et al.*, 2007; Kumar & Shahabuddin, 2006) and forest health (Miller *et al.*, 2004) shows the potential of bird as an effective biodiversity indicator (Sodhi *et al.*, 2005). Therefore, changes of the bird community in an island by looking at the abundance

and species richness due to the surrounding factors such as vegetation as well as the human-made noise will provide beneficial information on the fundamental understanding of the relationship of these factors to bird community of the island. Hence, this information will assist in establishing effective management plan (Yorke, 1984) for the conservation purpose of the bird community in that island.

1.2 Anthropogenic Noise

Anthropogenic noise perceived from the human activities can cause various impacts (Thomsen, 2014) especially towards the wildlife across the universal landscape (Blickley & Patricelli, 2010). The impact of this new emerging factor towards the ecosystem (Forman & Alexander, 1998) in a large scale of the natural environment (Barber *et al.*, 2009) had raised concern towards the wildlife especially those that depends highly on acoustic signal as communication (Evans, 2015). This is because according to Dooling & Popper (2007), this noise can interfere or mask the signal of a sound from being detected by the receiver.

Wildlife particularly the birds use the acoustic communication to conduct their social behaviours such as for defending their territories, attracting their mating partner and sensing the predators (Nemeth *et al.*, 2013; Herrera-Montes & Aide, 2011). Apart from that, the transmission of the acoustic signal also used by the birds for foraging (Curtin & Wilkes, 2005). This shows the importance of their acoustic communication especially in terms of the birds' survival. Therefore, it highlights the needs to focus on understanding the impact of the noise in this study.

1.3 Vegetation Structure

The tropical forest is already well known in supporting more species of birds as compared to the temperate forests (MacArthur & MacArthur, 1961). The vegetation structure of a forest area has been seen in playing significant part as it can influence the species richness of birds such as via the availability of food resources (Hulbert,

2004; Lewis & Starzomski, 2015; Ferger *et al.*, 2014; Cueto & Casenave, 1999; Martin & Blackburn, 2010). Apart from that, forest vegetation also influences the abundance of the bird population (Loiselle & Blake, 1999; Estades & Temple, 1999). This is proven as the species richness of birds that correlate positively with species diversity of trees (Huang *et al.*, 2015) and the total vegetation volume (Fleishman *et al.*, 2003).

According to Santamaría-Rivero *et al.*, (2016), the availability of the food resource in the vegetation structure influence the bird communities. This indicates that the variation in feeding guilds of the birds is also determined by vegetation structure of the forest habitat (Azman *et al.*, 2012; Styring *et al.*, 2011). Furthermore, the vegetation of the forest habitat enables the birds to conduct their social activities such as nesting, foraging and even for protection (DeWalt *et al.*, 2003).

Anderson *et al.*, (1983) state that vegetation factor is an important indicator for measuring the density and diversity of bird. Thus, variation of the vegetation structure will affect the community of the birds (Ramachandran & Ganesh, 2012). Hence, it shows that vegetation is an important predictor of the distribution of birds.

1.4 Problem Statement

Tourism has become one of the important driver for economic growth. To date, construction of more resorts in Gaya Island had recently been proposed by the Sabah Park organization in order to promote the island as a hot tourist destination and increase the island's revenue. Intensive development of the Gaya Island can incur changes toward the biodiversity of the island's ecosystem especially on wildlife. This has been proven through the findings of the preliminary study done by Sompud *et al.*, (2015) whereby there is a negative impact of the development towards bird population through the anthropogenic noise that were being produced.

The influence of the noise on birds is difficult to be fully determined as there is also habitat variables such as the tree composition that can influence the distribution of birds. Nonetheless, there is no published research regarding the spectrum of impact of these factors on bird population in primary forest of Gaya Island. Moreover, lack of reliable information that can serve as a holistic data has caused a great constraint to the Sabah Park organization in terms of decision making in allowing the developers to develop the island as the proposed plan are currently being on hold. In addition, it will also lead in resurfacing of the proposed development project if there is no urgent study being conducted in regards with the impact of these factors on the biodiversity of the island through the chosen indicator that is the bird population.

1.5 Justification

This study plays a crucial part by filling up the gap of obtaining primary data for the Park management that can assist them in decision making about the development project in Gaya Island as this study will provide insight about the range of influence of the anthropogenic noise and tree composition on the distribution of the bird population. Birds are sensitive and highly vulnerable (Lambert & Collar, 2002) towards changes of their environment (Kumar & Shahabuddin, 2006). Moreover, potential indicator will also be able to be determined to provide crucial information especially on the spectrum of impact of the aforementioned factors. Hence, the data from this study can be used as guideline by the Park management to establish a sustainable plan that incorporates the noise management as well as the wildlife management policy that comply with the management plan.

1.6 Objectives

The objectives of this study are:

1. To identify the influence of anthropogenic noise towards the bird community in Gaya Island.

2. To identify the influence on diversity of tree, stem density and basal area towards bird community in Gaya Island.

1.7 Hypothesis

There are two null hypothesis and two alternative hypothesis in this study:

1. H_{null} : The anthropogenic noise does not significantly affect the bird community in Gaya Island.

$H_{\text{alternative}}$: The anthropogenic noise does significantly affect the bird community in Gaya Island.

2. H_{null} : The diversity of tree, stem density and basal area does not significantly affect the bird community in Gaya Island.

$H_{\text{alternative}}$: The diversity of tree, stem density and basal area does significantly affect the bird community in Gaya Island.



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1.8 Scope of Study

The research design is illustrated at the Figure 1.1

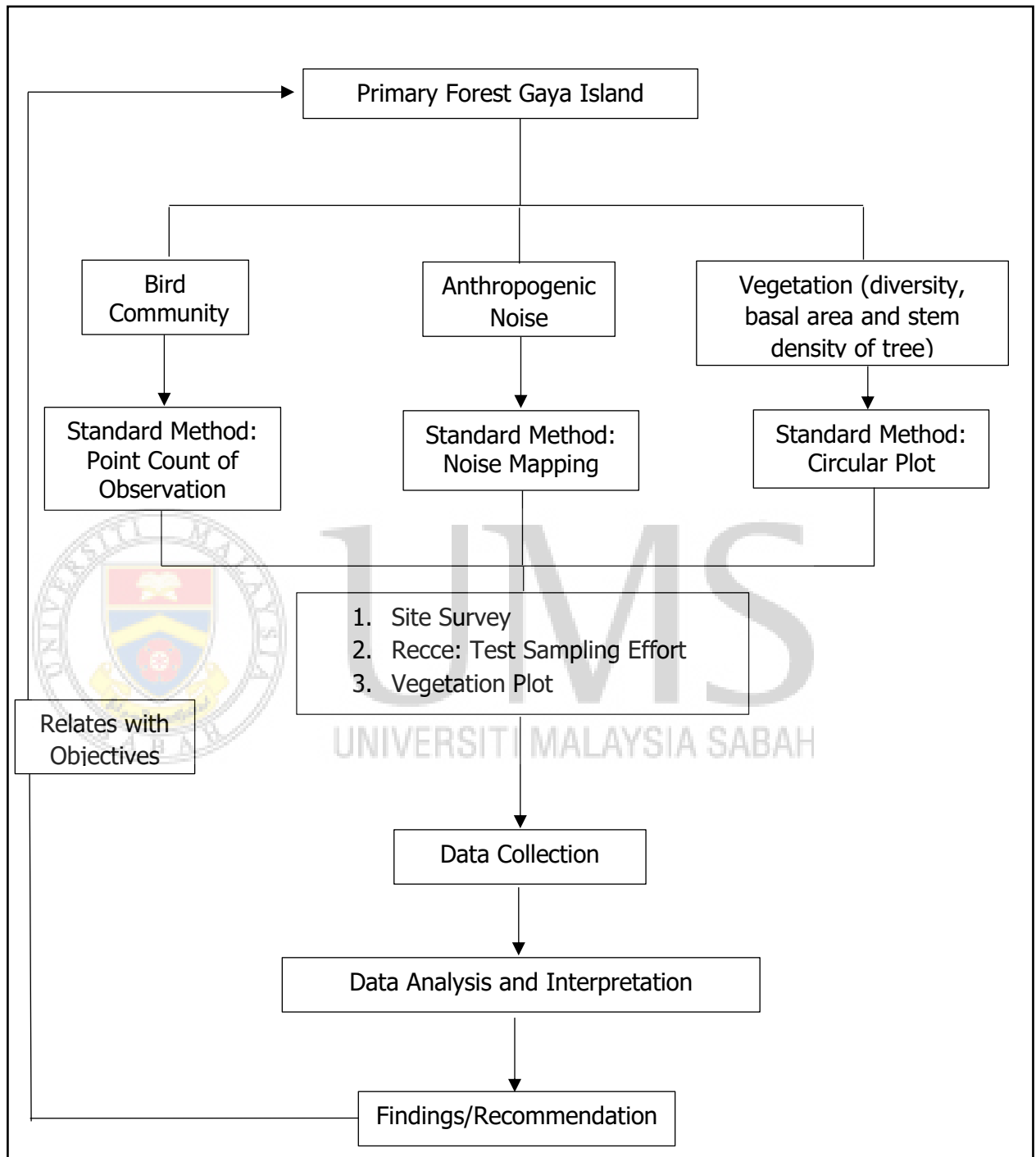


Figure 1.1: Factors Affecting the Bird Community on Gaya Island, Sabah, Malaysia

CHAPTER 2

LITERATURE REVIEW

2.1 Bird Community in Gaya Island

Past studies have shown that islands are crucial site as transit location for birds especially the migratory (David *et al.*, 2016) and also threatened species of birds (Rodrigues & Cunha, 2012). Several past studies about birds have been done in small islands at Peninsular Malaysia such as (Hamza *et al.*, 2018; David *et al.*, 2016; Taib *et al.*, 2019; Ramli *et al.*, 2008). Nonetheless, these studies were only focusing on updating the bird species that were found in the small islands.

In Sabah, Gaya Island is one of hotspot for tourism destination and well known for snorkelling, diving and parasailing activities. As such the main attraction in Gaya Island is the marine sport. Past study done by Stedl & Powell (2006) mentioned that island's tourism activities is one of the sources of anthropogenic noise. The boating activities including bringing in the tourists into the Gaya Island produces anthropogenic noise coming from the sound of the boats' engines. According to Diaz *et al.* (2011), the anthropogenic can affect the birds by masking their acoustic signals. Apart from the anthropogenic noise, the forest vegetation can also affect the birds as the birds depends on the vegetation not only for food resource but also space for perching and nesting (Gandiwa *et al.*, 2013). Nonetheless, there was one published study that was conducted in Gaya Island looking on the impact