UNIVERSITI PUTRA MALAYSIA

COMPOSITION OF DIURNAL BIRDS IN THE BUFFER ZONE AROUND KUALA LUMPUR INTERNATIONAL AIRPORT, MALAYSIA

SYAIZWAN ZAHMIR BIN ZULKIFLI

FS 2006 40

COMPOSITION OF DIURNAL BIRDS IN THE BUFFER ZONE AROUND KUALA LUMPUR INTERNATIONAL AIRPORT, MALAYSIA

SYAIZWAN ZAHMIR BIN ZULKIFLI

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirement for the Degree of Master of Science

April 2006

UPM

DEDICATION

This thesis is dedicated to

My wife,

Ferdius @ Ferdaus bt. Mohamat Yusuff

My Daughters,

Syazwina Yasmeen bt. Syaizwan Zahmir

Syazween Dahlia bt. Syaizwan Zahmir

Your motivations, sacrifices, and supports during the period of my academic mission are very much appreciated.

My parents, my brothers and sisters

Your prayers and encouragements

that made me who I am today are very much acknowledged

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

COMPOSITION OF DIURNAL BIRDS IN THE BUFFER ZONE AROUND KUALA LUMPUR INTERNATIONAL AIRPORT, MALAYSIA

By

SYAIZWAN ZAHMIR BIN ZULKIFLI

April 2006

Chairman : Associate Professor Ahmad Ismail, PhD

Faculty : Science

Malaysia is known as one of the countries in the world to have a megadiversity status of flora and fauna. Its' tropical forest has been formed for thousands of years until it reaches the current stability. The changes in the environment will alter the diversity of vertebrate populations including birds. Reports have highlighted that a combination of busy airports with large flocks and the proclivity of many birds to use airports for feeding, roosting and nesting activities has resulted in a risk of bird strike and creates an important safety issue for any airport (e.g., Cleary *et al*., 1999, Linnell *et al*., 1996). Therefore, a study of the bird composition in the buffer zone around KLIA was carried out. A total of 57 bird species from 28 families were identified. There were 38 species of birds that can be classified as resident species, 12 species of migratory birds and the remaining seven species were classified as resident and migrant. In general, bird population and diversity of birds was low compared to other type of forest around Malaysia. From the total bird species, 58% are fully protected and 12% are protected under Malaysian Wildlife Protection Act (1972). The remaining 30% are not under protection of the act. In terms of bird guilds, insectivores were dominant guild group with about 38% of the total 57 species observed, followed by piscivores

(21%), grainivores (14%), omnivores (14%), carnivores (9%), nectarivores (2%) and frugivores (2%). In terms of the feeding habitats, 40% bird species were found to utilize the ground, 26% of bird species were found to use the water courses, 18% capture foods in the air, 9% found below canopy and the remaining 7% utilized the top canopy area. ANOVA showed there was a significant difference in number of bird individuals with respect to transects, daytime intervals and month groups respectively ($P<0.05$). The studies of total number of bird individuals and species richness showed both properties were higher in the morning (peak: 0930 hours observation period) and evening (peak: 1730 hours observation period) sessions. Lowest bird individuals and species richness can be detected at 1430 hours of the afternoon session. In terms of seasonal factor, bird individual and species richness were observed more in Mar-Apr 03 month group and the least was in Jul-Aug 02 and Jul-Aug 03 month groups. Most bird species were abundant in transect T11, T12, T1 and T7, however they were less abundant in transect T9 and T6. The Shannon –Wiener diversity index, *H'*, indicated that the buffer zone has a moderate status of bird diversity. The evenness, *J'*, study indicated that birds were most evenly distributed in transect T1 of May-Jun 03 month group, where as in transect T9 of Sep-Oct 02 month group, the *J'* value was at the lowest point. The study also found 66 species of plants, which was expected to grow naturally in the wild, where as more than 25 species of plants were the man – planted. There were also 31 families and two suborders of insects had been sampled and identified. Coleoptera had the highest number of families. 19 species of insect were able to be identified up to the species level. There were two main groups existed in the buffer zone according to the number of bird individuals and species. Transect T11 and T12, T2 and T3, and T4 and T5 have the closest similarity distance between each pair. It can be concluded that at the moment, bird's population, behaviour, distribution

and habitat selection do not posses any serious threats to aircraft services at KLIA. Further and continuous studies are suggested in order to produce an effective guideline for tropical bird strike prevention strategies.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk ijazah Master Sains

KOMPOSISI BURUNG DIURNAL DALAM ZON PENAMPAN SEKITAR LAPANGAN TERBANG ANTARABANGSA KUALA LUMPUR, MALAYSIA

Oleh

SYAIZWAN ZAHMIR BIN ZULKIFLI

April 2006

Pengerusi : Profesor Madya Ahmad Ismail, PhD

Fakulti : Sains

Malaysia dikenali sebagai salah satu negara di dunia yang mempunyai status megakepelbagaian flora dan fauna. Hutan tropikanya telah terbentuk sejak ribuan tahun dahulu sehingga mencapai kestabilan sekarang. Sebarang perubahan dalam persekitaran akan mengubah kepelbagaian populasi vertebrata termasuk burung. Banyak laporan telah menunjukkan kombinasi sesebuah lapangan terbang dengan kumpulan besar burung-burung, yang menjadikan kawasan lapangan terbang sebagai tempat mencari makanan, bersarang dan berehat, akan menyebabkan risiko rempuhan burung dan menimbulkan satu isu keselamatan yang penting bagi mana-mana lapangan terbang (cth., Cleary *et al*., 1999, Linnell *et al*., 1996). Oleh itu, satu kajian mengenai komposisi burung diurnal di dalam zon penampan sekitar KLIA telah dijalankan. Sebanyak 57 spesies burung daripada 28 keluarga telah dikenal pasti. 38 spesies burung telah dikelaskan sebagai tempatan, 12 spesies sebagai berhijrah and baki tujuh spesies dikelaskan sebagai tempatan dan berhijrah. Secara umumnya, populasi burung dan kepelbagaian burung adalah rendah berbanding dengan jenis-jenis hutan sekitar Malaysia. Dari keseluruhan spesies burung, 58% adalah dilindungi sepenuhnya dan 12% adalah dilindungi di bawah Akta Perlindungan Hidupan Liar

Malaysia (1972). Baki 30% tidak termasuk di bawah akta ini. Dari sudut pemakanan, pemakan serangga adalah jenis pemakanan paling dominan dengan 38% daripada sejumlah 57 spesies yang dijumpai, diikuti dengan pemakan ikan (21%), pemakan bijirin (14%), pemakan pelbagai (14%), pemakan daging (9%), pemakan madu (2%) dan pemakan buah (2%). Dari segi habitat pemakanan, 40% spesies burung didapati menggunakan permukaan tanah, 26% menggunakan kawasan air, 18% menangkap makanan di udara, 9% dijumpai di bawah kanopi dan baki 7% menggunakan atas kanopi. ANOVA menunjukkan bahawa terdapat perbezaan yang nyata dalam bilangan individu burung antara transek-transek, sela-sela masa dan kumpulan-kumpulan bulan. Kajian ke atas keseluruhan jumlah individu dan kekayaan spesies menunjukkan kedua-duanya adalah lebih tinggi pada waktu pagi (puncak: 0930 jam waktu pemerhatian) dan petang (puncak:1730 jam waktu pemerhatian). Bilangan individu dan kekayaan spesies paling rendah dapat dikenal pasti pada 1430 jam waktu tengahari. Dari sudut faktor musim, bilangan individu dan kekayaan spesies lebih banyak dapat diperhatikan dalam kumpulan bulan Mar-Apr 03 dan paling kurang pada kumpulan bulan Jul-Aug 02 dan Jul-Aug 03. Kebanyakan burung begitu banyak di transek T11, T12, T1 dan T7, tetapi kurang di transek T9 dan T6. Indeks kepelbagaian Shannon – Wiener, *H'*, menunjukkan zon penampan mempunyai status sederhana dari sudut kepelbagaian. Kajian kesamaan menunjukkan burung tersebar paling sekata pada transek T1 bagi kumpulan bulan May-Jun 03, tetapi transek T9 bagi kumpulan bulan Sep-Oct 02, nilai *J'* adalah pada tahap paling rendah. Kajian ini juga menjumpai 66 spesies tumbuhan, yang dipercayai tumbuh secara semulajadi, dan juga lebih dari 25 spesies tumbuhan adalah hasil tanaman manusia. Terdapat juga 31 keluarga dan dua suborder serangga telah berjaya disampel dan dikenal pasti. Coleoptera mempunyai jumlah keluarga yang paling banyak. 19 spesies serangga

telah berjaya hingga ke peringkat spesies. Terdapat dua kumpulan utama wujud di zon penampan berdasarkan bilanagn individu burung dan spesies. Transek T11 dan T12, T2 dan T3, serta T4 dan T5 mempunyai jarak kesamaan paling rapat antara pasangan masing-masing. Dapat disimpulkan bahawa pada ketika ini, populasi burung, sifat, sebaran dan pemilihan habitat tidak memberikan ancaman yang serius terhadap perkhidmatan kapal terbang di KLIA. Kajian lanjut dan berterusan dicadang supaya dilaksanakan bagi menghasilkan garis panduan yang efektif untuk strategi menghalang rempuhan burung kawasan tropika.

ACKNOWLEDGMENTS

A study such as this is never accomplished single-handedly. It is especially challenging to start a study with few references. It is with this knowledge that I would like to submit the following acknowledgements. I received a scholarship (PASCA) from the Malaysian Ministry of Science, Technology and Environment for three semesters during my master's research.

A mere enumeration of the people who have contributed to the development of this thesis does little to express my gratitude to those involved. Associate Professor Dr. Ahmad Ismail, who directed the research, provided constant encouragement and advice, as did the other members of my supervisory committee, Associate Professor Dr. Mohamed Zakaria Hussin and Associate Professor Dr. Abdul Rahim Ismail.

I also received field support from Mohd Nor Azwan during my first year of research. Many of my fellow graduate friends offered suggestions and encouragement. In particular Nik Mohd Shibli, Mohd Hisyammudin, Bintal Amin, Wan Siti Fatimah, Jazlina and Mohd Ikram provided ideas and criticisms of the research from its inception to its present form.

Other members of the Biology Department also contributed their roles and skills to the research, especially the Head of Department, Associate Professor Dr Siti Shapor Siraj, whom giving a consideration in terms of my teaching duty in the department. I also received some helps from laboratory assisstants, such as En Shaharom and Puan Salimah in terms of technical supports.

Last but not least, I am especially grateful for their prayers, support, encouragement, patience and advice from my beloved wife, Ferdius @ Ferdaus Mohamat Yusuff, my daughters, Syazwina Yasmeen and Syazween Dahlia, my beloved parents, Zulkifli Puteh and Saayah Din, and my beloved parents in law, Mohamat Yusuff and Aisah, without whom I would not have been able to finish.

I certify that an Examination Committee has met on 13 April 2006 to conduct the final examination of Syaizwan Zahmir bin Zulkifli on his Master of Science thesis entitled "Composition of Diurnal Birds in the Buffer Zone around Kuala Lumpur International Airport, Malaysia" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

Misri Kusnan, PhD
Lecturer
Faculty of Science
Universiti Putra Malaysia
(Chairman)

Ahmad Said Sajap, PhD
Professor
Faculty of Forestry
Universiti Putra Malaysia
(Internal Examiner)

Hafidzi Mohd. Noor, PhD
Lecturer
Faculty of Agriculture
Universiti Putra Malaysia
(Internal Examiner)

Zubaid Akhbar Mukhtar Ahmad, PhD
Professor
Faculty of Science and Technology
Universiti Kebangsaan Malaysia
(External Examiner)

_____

HASANAH MOHD. GHAZALI, PhD
Professor/Deputy Dean
School of Graduate Studies
Universiti Putra Malaysia

Date:

This thesis submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee are as follows:

Ahmad Ismail, PhD
Associate Professor
Faculty of Science
Universiti Putra Malaysia
(Chairman)

Mohamed Zakaria Hussin, PhD
Associate Professor
Faculty of Forestry
Universiti Putra Malaysia
(Member)

Abdul Rahim Ismail, PhD
Associate Professor
Faculty of Science
Universiti Putra Malaysia
(Member)

_____

AINI IDERIS, PhD
Professor/ Dean
School of Graduate Studies
Universiti Putra Malaysia

Date:

DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations, which have been duly acknowledged. I also declare that it has not been previously or currently submitted for any other degree at UPM or other institutions.

_____

SYAIZWAN ZAHMIR BIN ZULKIFLI

Date:

TABLE OF CONTENTS

		Page
DEDICATION		ii
ABSTRACT		iii
ABSTRAK		vi
ACKNOWLEDGEMENTS		ix
APPROVAL		xi
DECLARATION		xiii
LIST OF TABLES		xvi
LIST OF FIGURES		xvii
LIST OF ABBREVIATIONS		xix
CHAPTER		
I	**INTRODUCTION**	1
	General Introduction	1
	Statement of Problem and Justification	2
	Objectives	5
II	**LITERATURE REVIEW**	6
	Habitat Alteration in Malaysia	6
	Birds in Malaysia	7
	Bird Migration	9
	Classifications of Birds' Occupied Habitats	10
	Factors Affecting Bird Distribution	11
	Altitude	12
	Vegetation	13
	Water Courses	14
	Bird as a Monitoring Organism	14
	Habitat Monitoring	17
	Weather Forecasting	18
	Monitoring Climate Change	18
	Bird Strikes	18
	Recognizing Attractants near Airport	26
	Waste Disposal Operation	26
	Wastewater Treatment Facilities	28
	Wetlands	30
	Agricultural Practices	31
	Available Bird Control Strategies and Techniques at Airports	32
	Flight Schedule Modification	33
	Habitat Modification and Exclusion	33
	Repellent Techniques	37
	Bird Removal Techniques	41
III	**MATERIALS AND METHODS**	43
	Description of the Study Area	43

	Bird Observations	46
	Survey for Vegetations	55
	Insect Sampling	56
	Data Analysis	57
IV	**RESULTS AND DISCUSSION**	60
	Birds in the Buffer Zone around KLIA	60
	Composition of Birds in the Buffer Zone	60
	Composition of Bird Species according to Wildlife Protection Act (1972)	70
	Composition of Birds According to Feeding Behavior	72
	Composition of Birds According to Feeding Habitat	74
	Bird Individuals and Species with Respect to Daytime Intervals	80
	Bird Individuals and Species with Respect to Transects	86
	Bird Individuals and Species with Respect to Month Groups	96
	Density, Relative Abundance and Abundant Classification of Birds around the Buffer Zone of KLIA	105
	Shannon–Wiener Diversity Index (*H'*) and Evenness (*J'*)	114
	Vegetations in the Buffer Zone around KLIA	120
	Insects in the Buffer Zone around KLIA	124
V	**CONCLUSION**	129
VI	**RECOMMENDATION**	131
REFERENCES		134
APPENDICES		148
BIODATA OF THE AUTHOR		191

LIST OF TABLES

Table		Page
2.1	Selected cases of bird strike casualties around the world (civil and military aircrafts)	20
2.2	Civil aircraft components reported as being struck and damage by birds	24
3.1	Dates and locations of bird observations conducted around KLIA	49
4.1	List of birds observed in the buffer zone around Kuala Lumpur International Airport from July 2002 until December 2003	60
4.2	Comparison of bird population in various types of habitats in Malaysia and Singapore	67
4.3	Number of bird species found in different habitat types around KLIA area	76
4.4	Potential threat species of birds to aircrafts found around KLIA ground	78
4.5	The relative abundance and classification of birds around KLIA	109
4.6	Daily evenness (*J'*) per month for all transects around KLIA buffer zone	119
4.7	List of vegetations in buffer zone around KLIA	120
4.8	List of insects found in buffer zone around KLIA (according to order, suborder and family)	125
6.1	Integrated management program (Brown *et al*., 2001)	133

LIST OF FIGURES

Figure		Page
2.1	Bird strike illustration towards radome area	22
2.2	Smooth Particle Hydrodynamic simulation of different core thickness affect penetration after bird impact on rigid plate (M=1.82 kg, V_o=225 m/s)	23
3.1	Location of Kuala Lumpur International Airport in Peninsular Malaysia	44
3.2	Estimated buffer zone around Kuala Lumpur International Airport	45
3.3	Location of transects (red lines) around the buffer zone of Kuala Lumpur International Airport (KLIA)	47
3.4	Oil palm plantation near Kuala Lumpur International Airport	47
3.5	The South Balancing Pond located near Runway 1 of KLIA	48
3.6	The landscaping plants planted around the control tower of KLIA	48
4.1	Percentage for each protection status of Malaysian birds under Wildlife Protection Act No. 76 (1972) found around KLIA	70
4.2	Guilds of birds in the buffer zone around KLIA	72
4.3	Classification of birds found in the buffer zone around KLIA according to their feeding habitat	74
4.4	Means with standard error bars of bird individuals recorded for all daytime observations	80
4.5	Means with standard error bars bird species recorded for all daytime intervals	81
4.6	Result of a cluster analysis showing the similarities of bird assemblages in terms of daytimes in the buffer zone around KLIA	82
4.7	Means with standard error bars of bird individuals observed in all transects and areas	86

4.8	Data distribution for number of bird individuals versus transects of different observation time intervals	88
4.9	Mean numbers of bird species with standard error bars in all transects and areas	89
4.10	Data range for number of bird species versus transects of different observation time intervals	91
4.11	Result of a cluster analysis showing the similarities of bird assemblages in terms of transects in the buffer zone around KLIA	93
4.12	Mean numbers of bird individuals with standard error bars observed for each month groups	96
4.13	Data range for number of bird individuals versus month groups of different observation time intervals	98
4.14	Means with standard error bars for number of bird species versus month groups	100
4.15	Data range for number of bird species versus month groups of different observation time intervals	103
4.16	Result of a cluster analysis showing the similarities of bird assemblages in terms of month groups in the buffer zone around KLIA	104
4.17	Density of birds versus transects for all paired months of bird observation	106
4.18	Mean Shannon-Wiener Diversity Index (*H'*) values with standard error bars versus (a) transects, (b) daytime intervals, and (c) group months	114

LIST OF ABBREVIATIONS

%	Percentage
$\sum$	Summation
mm	Milimeter
cm	Centimeter
m	Meter
^{o}	Degree
^{o}C	Degree Centigrade
e.g.	For example
H'	Shannon-Wiener Diversity Index
J'	Pielou's Evenness Index
ha	Hectare
km^2	Kilometer Square
KLIA	Kuala Lumpur International Airport
sp.	Species
ind.	Individuals
U.S.	United States
U.K.	United Kingdom

CHAPTER I

INTRODUCTION

General Introduction

Development of the country has been the main focus among the developing countries. Malaysian people have been working hard in order to attain a developed country status since they obtained their independence in 1957. Their works showed a promising result when Malaysia had attained levels of per capita national income comparable with those of Eastern Europe. More significantly, the growth rates of their gross domestic product (GDP) over the period 1973-84 put these countries among the eight most rapidly growing economies in the developing world (World Bank, 1988). In early 1990's, the Malaysian government has make a major paradigm shift by launching the Vision 2020 plan by which aiming Malaysia to become a developed country by the year 2020, where the industries and technologies will be the main activities in the country. A strategic plan has been implemented and still in progress to achieve the vision. To date, developments on all fronts are proceeding at a rapid pace in order to achieve the nation's socio-economic goals. This has inevitably led to adverse changes in the natural environment although there have been regulations enforced in order to prevent serious negative effects to human and environment. Humankind has profoundly influenced global biodiversity by the dramatic redistribution of species outside their native geographic ranges (Kolar and Lodge, 2001). The result is that naturally occurring changes in species' distributions have been superceded, and the Earth's biotas are becoming characterized by collections of

species that are globally widespread and often intimately associated with human (Lockwood *et al*., 2000).

The world's biodiversity is being destroyed rapidly (Balmford *et al.* 2003; Jenkins *et al.* 2003). Transformation of natural vegetations to other land-use, such as crop cultivation and urban development, presents the most important threat to biodiversity because organisms do not simply fine-tune their functional efficiency in a static set of environmental condition. Human-dominated landscapes occupy a large and increasing proportion of the Earth's land area (Vitousek *et al*., 1997), and use a substantial portion of global biological diversity (Pimentel *et al*., 1992). For instance, the proportion of all humans living in urban areas will soon surpass 50% worldwide (80% in more developed regions), and is expected to continue rising for several decades (United Nations Population Division, 2001). Accordingly, the areas in which we live, work, and play, if managed appropriately, can play an increasingly vital role in sustaining the world's species. Environmental changes may be due to natural, man-made, or a combination of the two may have direct impacts on a species or may have indirect consequences.

Statement of Problem and Justification

It is well known that airports create or modify certain habitat types, which attract various species of birds, some of which prove hazardous to aircraft using the airports. The issue at hand is essentially an ecological one, namely the relation between birds and habitat which are available to them on or near the airfield or airport. Needless to

say, and as with most ecological matters, the issue is a complex one. In addition, the impact of airports on bird populations may be quite significant. For example, recent research on grassland birds at some airports in the USA has indicated that airports may be acting as population "sink" for grassland birds by serving as ecological traps for some species, thereby possibly contributing to regional declines in some species (Kershner and Bollinger, 1996).

The bird strike cases are not a newly occur events. The events have given serious consequences to both humans and animals almost from the beginning of aviation. Such incidents at or near airports are not new, and have been evident since the inception of airports (Faulkner, 1963; Solman, 1973; Blokpoel, 1976). Several literatures confirms that, despite all the attention, the threat that birds pose to aircraft still persists world-wide although several measures have been taken to eradicate such incidence (Milsom, 1990; Skira and Wapstra, 1990; Thorpe, 1996a). When birds collide with aircraft, there is usually considerable damage to the aircraft as well as the occasionally loss of human lives (Burger, 1983). Bird strikes exact a heavy toll on the aircraft industry. This includes aircraft repair costs, and untold losses in terms of delays to passengers and lost revenue while planes are being repaired. It is estimated that birds cost the world wide aviation fleet US$ 1 billion per year (Short and Seamans, 1998). Therefore, the aviation industry throughout the world increasingly recognizes that bird strikes have become a seriously safety risk.

At best, some reduction in bird strike rates has been achieved in places, but the problem has certainly not been eradicated. In fact, it has increased in places. Problem species vary according to location and to prevailing conditions, and it is well known

that a management action for one problem species may be successful but may create a problem with another species. There is clearly no magic bullet to deal with the hazards posed to aircraft and passengers by birds.

Birds are attracted to airport grounds for a number of reasons including the presence of roosting and feeding areas, and a paucity of predators (Blokpoel, 1976). Furthermore, they often also fly over the area from feeding or roosting sites. They are also becoming habituated to the noise and traffic. Birds will frequent airport grounds unless the basic attractants are removed from the area. There have been many attempts to control bird presence at airport with varying success. These approaches include reduction by elimination and dispersal involving the harassment or frightening of birds so that they leave, and do not fly around the airport. These methods include auditory, visual and chemical scaring devices and animals (Burger, 1983). In addition, habitat manipulation and management to reduce the carrying capacity of the environment and decrease the number of birds present have been implemented (Brough and Bridgman, 1980; Buckley and McCarthy, 1994).

As for Malaysia's state of affairs, bird strikes have been recorded in almost all airports. Numbers of collisions are varied among the airports. This is due to biological and non-biological factors that contribute to the presence of birds around (in and outside) the airport grounds. Now that the air traffic in Malaysia is becoming busier than the past years with more local and international aircrafts to use our airports, it is essential to ensure that international air safety standards are maintained. Little actions have been done in the past to co-ordinate the management of bird related safety risks at Malaysian airports. Although the Environmental Impact Assessment (EIA) report

(Anon, 1993a) has been presented to the government, the continuous efforts have to be done in order to prevent bird strikes. Prolong studies in the specific area around the airport ground can be useful to give some ideas and prediction of how to deal with the problem. Therefore, studies on birds and related fields must be conducted to achieve the following objectives.

Objectives

To address the above issue, this study has the following objectives: -

i) To prepare a list of diurnal bird species existing within the buffer zone around KLIA, and estimate the density, relative abundance and distribution of birds in different time scales and habitats within the buffer zone around KLIA

ii) To determine bird assemblage in different daytime intervals, habitats and month groups, and

iii) To prepare a preliminary list of vegetations and insects existed within the buffer zone around the airport.