



UNIVERSITI PUTRA MALAYSIA

***AVIAN SPECIES RICHNESS, ABUNDANCE AND HABITAT
RELATIONSHIPS IN URBAN PARKS IN KUALA LUMPUR
AND SELANGOR, MALAYSIA***

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By

NURUL AIDA BINTI ZAINUDIN

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

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DEDICATION

*Specially dedicated
To my dad, Zainudin Abd Aziz
To mom, Noraini Hassan
To my brothers, Mohd DzulHilmi, Mohd DzulHakimi and Mohd DzulFikri
To my fiancé Alizarain
Family and friends
Thank you for all the supports, patience and encouragements.
I love you all*



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

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August 2016

Chairman : Badrul Azhar Md Sharif, PhD
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Urbanization is expanding globally due to growing human populations in major cities. This has adversely affected the avian biodiversity in either developed or developing countries. Due to over-urbanization in urban areas and with little attention given on nature conservation, these cities are usually characterized by poor biodiversity. Urbanization causes landscape changes and compromises the ability of urban ecosystem to sustain native species. Thus, more widespread weedy species of plants, and human dependent, commensal species of birds replace natives. Because cities tend to share similar conditions such as urban parks and gardens, the similar urban-adapted species are present in almost all cities. This results in homogenization of species across cities with fewer species being present overall. In contrast to central business district areas, suburbs may support greater levels of biodiversity through the increase in undeveloped green areas. Species richness, abundance, and communities of urban birds were examined in the Klang Valley, Peninsular Malaysia. About 141 points for passerines across 80 parks that were grouped into two different urban zones i.e. central business districts and suburbs were surveyed. Results revealed that bird richness did not differ significantly ($p = 0.994$) between central business districts and suburbs. However, the abundances of birds were significantly greater in suburbs than in central business districts. Bird richness also increased significantly with the increase in size of green areas and park areas, and number of woody trees in both zones. The evidence from this study suggests that creating urban parks in central business districts is able to support similar biodiversity, at least for birds, as to that found in suburbs.

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

**KEPELBAGAIAN SPESIES, KELIMPAHAN, DAN HUBUNGAN
HABITAT BURUNG DI KAWASAN URBAN SEKITAR KUALA LUMPUR
DAN SELANGOR, MALAYSIA**

Oleh

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Pembangunan pesat terjadi disebabkan oleh populasi manusia yang semakin meningkat di bandar-bandar besar di seluruh dunia. Fenomena ini sentiasa mengancam kepelbagaian spesies burung sama ada di negara maju atau membangun. Disebabkan pembangunan yang keterlaluan di kawasan bandar dan tidak mengambil kira pemuliharaan alam, bandar-bandar ini biasanya adalah miskin dari segi biodiversiti. Pembangunan menyebabkan perubahan landskap dan menjejaskan kemampuan untuk mengekalkan spesies asli. Oleh itu, lebih meluas spesies tumbuhan rumpai dan burung spesies komensal yang bergantung kepada manusia, menggantikan yang asli. Oleh kerana bandar-bandar di seluruh dunia cenderung untuk mencerminkan keadaan sama seperti taman bandar, maka spesies burung bandar yang sama akan hadir di setiap bandar. Ini menyebabkan penyeragaman spesies di dalam bandar dan secara keseluruhan hanya sedikit spesies yang akan hadir. Berbeza dengan kawasan pusat bandar, pinggir bandar boleh menampung lebih banyak biodiversiti kerana mempunyai lebih banyak kawasan hijau. Kepelbagaian spesies, kelimpahan, dan komuniti burung bandar telah dikaji disekitar Lembah Klang, Semenanjung Malaysia. Sebanyak 141 titik telah ditinjau di 80 taman yang dibahagi kepada dua zon bandar yang berbeza iaitu daerah pusat bandar dan pinggir bandar. Keputusan menunjukkan bahawa kekayaan burung tidak berbeza dengan ketara ($p = 0.994$) di antara daerah pusat bandar dan pinggir bandar. Bilangan burung didapati adalah jauh lebih besar di pinggir bandar berbanding di daerah pusat bandar. Kepelbagaian burung juga didapati meningkat ketara dengan peningkatan saiz kawasan hijau dan bilangan pokok kayu di kedua-dua zon. Kajian ini membuktikan

bahawa pembinaan taman di daerah pusat bandar mampu menampung biodiversiti yang sama seperti burung yang dijumpai di pinggir bandar.



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I certify that a Thesis Examination Committee has met on 19 August 2016 to conduct the final examination of Nurul Aida binti Zainudin on her thesis entitled "Avian Species Richness, Abundance and Habitat Relationships in Urban Parks in Kuala Lumpur and Selangor, Malaysia" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

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LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
ANOSIM	Analysis of Similarity
ArcGIS	Aeronational Reconnaissance Coverage Geographic Information System
BIOENV	Biota-environment
CBD	Center Business District
DBH	Diameter in Breast Height
DBKL	Dewan Bandaraya Kuala Lumpur
EPP	Entry Point Projects
GenStat	General Statistical
GLM	Generalized Linear Models
GPS	Global Positioning System
hrs	Hours
IUCN	International Union for Conservation of Nature and Natural Resources
KL	Kuala Lumpur
m	Meter
m ²	Square meters
mm	Milimeter
MBPJ	Majlis Bandaraya Petaling Jaya
MBSA	Majlis Bandaraya Shah Alam
MPAJ	Majlis Perbandaran Ampang Jaya
MPK	Majlis Perbandaran Klang
MPKj	Majlis Perbandaran Kajang
MPS	Majlis Perbandaran Selayang
MPS	Majlis Perbandaran Sepang
MPSJ	Majlis Perbandaran Subang Jaya
NMDS	Non-Metric Multidimensional Scaling
PPj	Perbadanan Putrajaya
SE	Standard Error
SIMPER	Similarity Percentage
°c	Degree celsius

CHAPTER 1

INTRODUCTION

1.1 Urban ecosystem

Urban landscapes are expanding rapidly with the increase in human populations (Marzluff and Ewing, 2001; Faeth et al., 2005; Sochat et al., 2006) and in most cases at the expense of flora and fauna species richness (Marzluff and Ewing, 2001; Sandstorm et al., 2006; Melles et al., 2003). Many cities are often lacking in green spaces due to a trade-off for development of more housing estates, commercial buildings and paved roads. Green areas such as urban parks and gardens, if present, are designed to mitigate environmental pollutions, beautify cities and host urban biodiversity (Clarke et al. 2008; Sattler et al. 2011; McDonnell and Hahs 2013). Urbanization may impact wildlife through the loss and degradation of habitats, by eliminating or changing natural habitats, which is widely recognized as a major threat to biodiversity (Clergeau et al., 1998). Due to habitat modification, many species are unable to adapt to urban environment and thus biodiversity is generally low in these urban areas (Crooks et al., 2004; McKinney, 2006). For instance, loss of avian biodiversity has been linked to urbanization and previous studies demonstrated that the densities of some common birds of suburbs as well as ground nesting birds were significantly lower in urban areas (e.g. central business district) (Cam et al., 2000; Manhaes and Loures-Ribeiro, 2005).

Urbanization only benefits some avian populations, although this may be limited to species of open-area and those that are pollution tolerant (Clergeau et al., 1998). Only certain species can adapt and survive in urban environments, which are often lower in numbers than normal populations found in their native habitats (McKinney, 2006). Species commonly found in urban areas (e.g. those in Singapore and Manila) include Rock Pigeon (*Columba livia*), Common Starling (*Sturnus vulgaris*) and House Sparrows (*Passer domesticus*) (McKinney, 2006; Rolando et al., 1997; Siriwardena et al., 2002; Robinson et al., 2005). These species may have the ability to live and forage at bird feeders or to exploit human-related resources (e.g. dump sites and garbage) (Chase & Walsh, 2006). They also build their nests in close proximity to humans (Gabela, 2007).

Absence of natural environment in urban areas may lead to species homogenization (McKinney, 2006). This is due to the urban parks, which are no longer exhibiting the characteristics of natural habitats such as

forests (Margaret, 2009). Most studies related to urban biodiversity reported an increase in avian population density, but a decrease in species diversity as urbanization increased (Beissinger and Osbourne, 1982; Marzluff, 2001).

In suburbs, bird diversity is usually higher than that found in urban centers and sometimes even higher than in non-urban regions; natural habitats or those with minimal urban pollutions (Jokimaki and Suhonen, 1993; Clergeau et al., 1998; Blair, 1996; Blair, 1999). This paradox of higher diversity and abundance of birds in suburbs is because they can provide habitat for both native and introduced species (Blair, 1996). In contrast to suburban areas, urban areas are known to be inadequate (e.g. food and cover) which significantly affect biodiversity, especially birds (Margaret, 2009).

In Southeast Asia, rapid growth in economy has increased the expansion of concrete buildings as well as human activities (i.e. work and business) and cities become more non-natural environment (Grimm et al., 2008; Restrepo and Halffter, 2013). Urban development might affect the distribution of birds. In tropical cities such as Manila, green space area correlates positively with bird richness and abundance as well as preserved avian biodiversity whereas, urbanization tends to result in decreased biodiversity (Benjamin et al., 2008). This can also be observed in Singapore, where urbanization negatively affects richness and abundance of nesting sites and resulted in declined avian biodiversity (Lim and Sodhi, 2004). Ecological studies of urban birds always result in decreasing species richness with increasing urbanization (Sandstorm et al., 2006; Melles et al., 2003).

Malaysia's capital city, Kuala Lumpur has progressed into becoming one of Southeast Asian most prominent, modern and sophisticated cities. To become a world top-20 liveable city, Kuala Lumpur needs to significantly increase its green space. Today, the amount of green space per person in the city centre is only 11 m², which falls behind other leading liveable cities. Vancouver, for example, has 22 m² of green space per person.

The target of 100,000 trees by 2020 emphasizes on large coverage trees to create the scenery of green corridors. Greening the city will improve liveability by creating a more comfortable living environment and providing spaces for healthy recreational activities. Most importantly, it creates a sustainable environment and may benefit biodiversity in the city by reducing inner city temperature and greenhouse gases.

Malaysia's local authorities such as Kuala Lumpur City Hall (DBKL), Selayang Municipal Council (MP Selayang), Klang Municipal Council (MPK), Shah Alam City Council (MBSA), Petaling Jaya City Council (MBPJ), Ampang Jaya Municipal Council (MPAJ), Subang Jaya Municipal Council (MPSJ), Kajang Municipal Council (MPKj), Sepang Municipal Council (MPS) and Putrajaya Corporation (PPj) support the initiative to increase the greenery in the city by planting the trees. The Kuala Lumpur City Hall (DBKL) has planted 31,447 trees, exceeding the 2011 target. Trees planted to date have the potential to cover up to 668,000 square feet of shaded areas throughout Kuala Lumpur. The Greener KL initiative also invites private participation in its efforts to green the city and has also exceeded the target of 5,000 trees funded by private sector in 2011.

In 2012, Greener KL will continue in its efforts to plant another 30,000 trees within Kuala Lumpur. In addition, Greener KL will increase its efforts to draw private participation in its efforts through increased sponsorship of trees and participation in park maintenance as well as encouraging developments that support the Entry Point Projects (EPP) objective. Kuala Lumpur offers an ideal opportunity to study the effects of area urban habitats and provide baseline data on bird species diversity and community composition. It is relatively small land area, yet is the most densely populated area in central Selangor state.

1.2 Birds as ecological indicators

Ecological indicators are required to evaluate natural biodiversity and to estimate environmental modifications (Canterbury *et al.*, 2000). Birds score very highly in many of the general criteria defined for selecting indicator group (Croonquist and Brooks, 1991). Birds are also well known, and their populations are readily surveyed. Birds are widely distributed, occurring almost all over in the biosphere. There are abundant bird's species to show significant forms (Whitford *et al.*, 2001). Birds are relatively sensitive to changes in habitat structure and composition and are therefore tremendous indicators of changes and disturbance in the urban ecosystem. Birds response to ecological change can enhance our understanding on the impacts of human disturbance and landscape modification on the terrestrial ecosystem (Bibby *et al.*, 2000). Thus, more urban ecological studies have been done previously and documented urban features such as parks and gardens are important in structuring biodiversity in urban ecosystem especially for urban bird communities (Clergeau *et al.*, 1998).

1.3 Problem statement

Urbanization causes some of the greatest local extinction rates and frequently eliminates the large majority of native species (Marzluff, 2001). Although much urban bird research has been conducted recently and understands a lot more about the causes for population declines in urban birds than previously, information on some regional variability in habitat relationships still was lack. Identifying the impacts of fragmentation by assessing the influence of different variables on urban bird populations will help to determine the best management and conservation measures for urban parks and gardens. This research was conducted at Klang Valley area in Selangor will help understand factors influencing avian occurrence and abundance and will contribute to conservation and management of both birds and parks.

1.4 Objectives of the study

This study aimed to quantify avian biodiversity such as species composition at urban parks in Kuala Lumpur and Selangor. The relationship between species diversity and vegetation structure and other environmental variables also were examined. The specific objectives are as follows:

- I. To determine urban bird species richness, abundance, and composition according to different management zones i.e. central business districts and suburbs. Suburbs or urban outskirts were predicted to support greater species richness, abundance and more diverse species composition of birds compared to central business districts.
- II. To study the relationship between bird richness and habitat quality at local and landscape levels.
- III. To examine urban bird composition based on key environmental attributes.
- IV. To provide recommendations for a better park management and conservation of urban birds in the tropical regions.

1.5 Hypothesis of study

- I. Bird diversity in suburbs is significantly higher than Central Business District (CBD).
- II. Bird richness and abundance correlates positively with green space area.
- III. Bird assemblages in suburbs are significantly more diverse than in CBD.

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