Malays. Appl. Biol. (2018) 47(1): 217–222

A SURVEY OF UNDERSTORY BIRDS AT A RICE FIELD AND A MIXED DIPTEROCARP FOREST IN KUCHING, SARAWAK

KARIM NURQAMAREENA[1*], YEE LING CHONG[1*], JAYASILAN MOHD-AZLAN[1] and MOHAMAD FIZL SIDQ RAMJI[1]

[1]*Faculty of Resource Science and Technology, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia*
[*]*E-mail: neenakarim1010@gmail.com, ylchong@unimas.my*

Accepted 13 February 2018, Published online 31 March 2018

ABSTRACT

Habitat modification can lead to reduction of biodiversity. This survey aimed to determine the diversity of understory birds and their feeding guilds at rice field plantation and mixed dipterocarp forest. The understory birds were mist-netted from March to May 2017 and resulted in 110 individual birds of 32 species from 19 families. Among them, five species are legally protected and three species are considered Near Threatened under the IUCN Red List (2017). Preliminary analysis suggests most birds are habitat specialist. Only two omnivore species [i.e. Yellow-vented Bulbul (*Pycnonotus goiavier*) and Pied Fantail (*Rhipidura javanica*)] were caught at both habitats. Cream-vented Bulbul (*Pycnonotus simplex*) and Brown-throated Sunbird (*Anthreptes malacensis*) were the most predominant bird species captured in Santubong National Park (SNP), whereas Chestnut Munia (*Lonchura atricapilla*) was the dominant species at rice field in Stunggang Melayu Village, Lundu. Although omnivores and insectivores dominated both habitats, three species of nectarivores were caught at SNP. SNP showed higher bird species diversity and mean richness (H'=3.045; 0.935) compared to rice field (H'= 2.565; 0.7257) (t-test; $p = 1.1432x10^{-6}$). This preliminary study provides baseline information on bird species diversity and habitat preference at two different habitats in Western Sarawak.

Key words: Bird diversity, feeding guild, species richness, paddy plantation, Santubong National Park

INTRODUCTION

Borneo comprises of 673 species of birds, including 61 endemic species (Phillipps & Phillipps, 2014). Birds are essentials in maintaining the ecosystem as they have several significant roles in plant distribution, agriculture and biological conservation (Tabur & Yusuf, 2010). Rapid changes in an environment can cause the population of birds to decline. For instance, land-conversions such as urbanization, deforestation, industrial and agri-cultural activities have altered massive amount of Earth's land surface and brought negative impacts on biodiversity (Vitousek *et al*., 1997; Sala *et al*., 2000; Jóhannesdóttir, 2013). The decrease in the number of bird species and alteration in the bird community structure was due to resource utilization and niche partitioning (Voon *et al*., 2014). Agri-cultural practices such as drainage, harvesting, monoculture plantation and intense use of chemical fertilizers on the crops are the extreme stimulation of the reduction of the biodiversity quality (Amano, 2009). On the second half of 20th century, the population of birds has declined because of increasing agricultural activities during the period (Fuller *et al*., 1995; Donald *et al*., 2001; Jóhannesdóttir, 2013).

Most of the birds can live in several areas that have ecologically different environments whereas some birds are extremely sensitive to habitat degradation (Willson *et al*., 1994). Bird species such as the Great Tit (*Parus major*) is able to adapt to the surroundings of ecologically different landscapes by having a change in behaviour and physiological adaptation in order to survive (Shochat *et al*., 2010; Strasser, 2013). On the other hand, distribution of invertebrate eaters [e.g. Yellow-bellied Prinia (*Prinia flaviventris*), etc.] is easily affected by habitat loss that may remove some invertebrate species preferred by them (Ford *et al.*, 2001; Laurence *et al*., 2004; Mansor & Mohd-Sah, 2012). Feeding guild, one of the bird traits, is very

* To whom correspondence should be addressed.

sensitive to habitat modification as the quantity of food resources might be affected (Cleary *et al*., 2007; Renner *et al*., 2012; Banks *et al*., 2017). Birds that can be found at rice field plantation often use rice seeds, fishes, tadpoles and aquatic insects as their main food sources (Fernando, 1993; Nur Munira *et al*., 2014).

In western Sarawak, rice plantations are operated in small-scale by indigenous people. Limited information is known on the bird species distribution and their feeding guild at rice fields in western Sarawak. Thus, this pilot study aimed to reveal the diversity of birds and their feeding guild at different habitat namely rice field and mixed dipterocarp forest.

MATERIALS AND METHODS

Sampling sites

Bird samplings were conducted at two types of habitats in Kuching Division, Western Sarawak. For mixed dipterocarp forest (MDF), sampling was conducted in Santubong National Park (SNP), Kuching (01°44'33.7" N, 110° 19'16.4" E). SNP mostly comprised of mixed dipterocarp forest with small riverine area and forest patch. While for the monoculture plantation, sampling was conducted at rice fields in Stunggang Melayu Village (SMV), Lundu (1°39'0" N, 109°51'0" E) (Figure 1). The rice fields are temporary man-made wetland habitat with muddy area and water puddles. The distance between these two sampling sites is 55.9 kilometers.

Bird sampling and identification

The bird survey was done using mist nets. A total of 15 to 30 mist nets (2.5 m × 12 m × 36 mm mesh) with four shelves were set up with interval of 100-200 m for 15 non-consecutive days between March and May 2017. The mist nets were set up at 0.5 m above the ground to reduce the risk of trapped birds at the bottom shelf being preyed upon by ground-dwelling predators and also to avoid the net from becoming wet at rice field area. The nets were checked every two hours and the trapped birds were measured. The basic morphological measurements (e.g. bill length, head, wing, tail and tarsus) were recorded and the birds were ringed. Bird identification was based on the physical appearances by referring to Book of Field Guide to the Birds of Borneo by Phillipps and Phillipps (2014). Bird feeding guilds were identified based on Hassan-Aboushiba *et al*. (2011), Phillipps and Phillipps (2014) and Voon *et al*. (2014). The mist nets were operated between 0600 and 1700. The total sampling efforts were 1650 net-hours for each site (5 sampling days with 30 mist nets for rice fields in SMV; and 10 sampling days with 15 mist nets for mixed diterocarp forest in SNP). Hence, the total effort for 15 days sampling was 3300 net-hours.

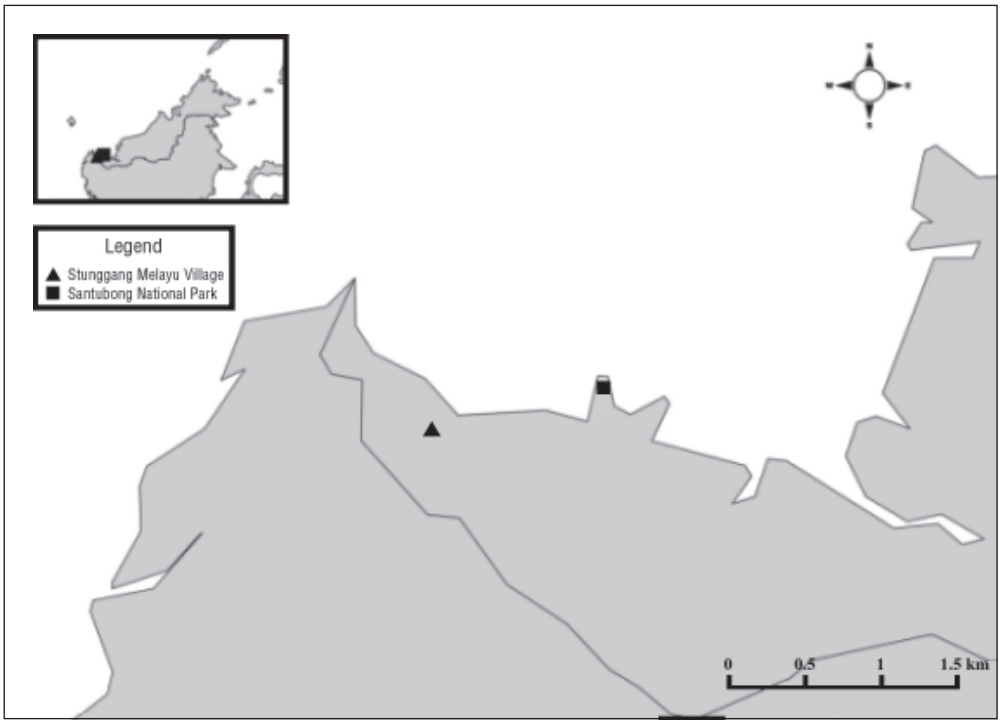

Fig. 1. Bird sampling locations at a rice field in Stunggang Melayu Village, Lundu and a mixed dipterocarp forest in Santubong National Park, Kuching, Western Sarawak. Upper left corner insert shows the map of Sarawak, Malaysia.

Data analysis

Analysis of data was done by using Paleontological Statistics (PAST) version 3.04 (Hammer *et al.*, 2001). Species diversity indices of birds from these two habitats were calculated based on Shannon's species diversity index (H'). The index value ranged from 0 to 1, hence showing that the higher the value, the higher the diversity in the area. Simpson's index (1-D) was used as diversity indices to calculate species richness of the birds that were caught at those areas. Species richness will indicate the number of species within the area without taking account the abundance of the species' individuals (Brown *et al*., 2007). Zar t-test was used to compare whether there was any significant difference between the two sites.

RESULTS AND DISCUSSION

A total of 110 individual birds from 32 species and 19 families were captured from 15 non-consecutive sampling days at two sites (Rice field: n=74; 13 species; 10 families and MDF: n=36; 21 species; 12 families) (Table 1). The most dominant species caught at rice field area were from the family Estrildidae with 33 individuals (44.6%) of Chestnut Munia (*Lonchura atricapilla*) and 18 individuals (24.30%) of Scaly-breasted Munia (*Lonchura punculata*). The least diverse bird families caught at rice field were Meropidae, Passeridae, Scolopacidae and Rhipiduridae. These families were absent at mixed dipterocarp forest, except Rhipiduridae. To note, seven bird species in rice field area were only represented by singletons. As for MDF, four individuals each from Cream-vented Bulbul (*Pycnonotus simplex*) and Brown-throated Sunbird (*Anthreptes malacensis*) were the most frequently encountered birds (11.11%). A total of seven families and 13 species were represented by singletons.

Of thirty-two species caught, 13.9% are legally protected in Sarawak. This study showed that five of the bird species caught are protected under the Sarawak Wildlife Protection Ordinance 1998 (Table 1). Two species from the family Ardeidae [Cinnamon Bittern (*Ixobrychus cinnamomeus*) and Yellow Bittern (*Ixobrychus sinensis*)], which were only recorded in rice field area, were under this category. For The International Union for Conservation of Nature (IUCN) Red List (2017), only three species were considered as Near Threatened and caught in MDF (Table 1).

The bird species observed in different habitats may reflect the availability of food resources at those areas. Rice field was dominated by both omnivores (four species; 30.77%) and insectivores (four species; 30.77%) followed by granivores (three species; 23.07%) and piscivores/insectivores (two species; 15.38%) (Figure 2). Eleven species of birds captured at rice field was not recorded in MDF. Most of the granivores caught at the rice field are considered as pest as they bring damages during the ripening stage of the crops (Bambaradeniya *et al*., 1998). These include Chestnut Munia (*Lonchura atricapilla*), Scaly-breasted Munia (*Lonchura punculata*) and Eurasian Tree Sparrow (*Passer montanus*) that were caught only at rice field area in this study. For omnivores such as Swinhoe's Snipe (*Gallinago megala*), Baillon's Crake (*Porzana pusilla*) and White-breasted Waterhen (*Amaurornis phoenicurus*), they feed on the aquatic organisms on the water puddles and mud pools at the rice field area and occasionally feed on the seeds (Hassan-Aboushiba *et al*., 2011).

Birds caught in MDF had slightly different feeding guilds compared to those caught at rice field. Omnivores dominated MDF (nine species; 42.86%), followed by insectivores (seven species; 33.33%), nectarivores (three species; 14.29%) and both piscivores/insectivores and frugivores (one species each; 4.76%) (Figure 2). Among them, 19 species were only observed in SNP but absent at rice area. Of these, three nectar-feeding birds, represented by Brown-throated Sunbird (*Anthreptes malacensis*), Purple-naped Sunbird (*Hypogramma hypogrammicum*) and Little Spiderhunter (*Arachnothera longirostra*) along with frugivorous bird [Emerald dove (*Chalcophaps indica*)] were successfully caught in MDF. MDF may provide more food resources and nesting areas to attract different species of birds (Walwert *et al*., 2004). These explain the high number of bird's species at mixed dipterocarp forest compared to rice field area. This study also showed that many bird species were not sharing habitats at rice field and MDF. Yellow-vented Bulbyl (*Pycnonotus goiavier*) and Pied Fantail (*Rhipidura javanica)* were the only two species that had been caught at both sites which suggested that they are generalist species. Yellow-vented bulbul is commonly found on the garden and open grassland area (Kerdkaew, 2014) meanwhile Pied Fantail inhabits forest-edge and secondary forests. Stunggang Melayu's paddy field is surrounded by small forest patches and near to the small riverine area. Thus, Pied Fantail favours these forest edges and occasionally wanders within the paddy field. Most of the birds caught are residents meanwhile some of the birds are known as both residents and migratory birds such as Cinnamon Bittern (*Ixobrychus cinnamomeus*), Yellow Bittern (*Ixobrychus sinensis*), Ricefield Pipit (*Anthus rufulus*), Baillon's Crake (*Porzana pusilla*), and Swinhoe's Snipe (*Gallinago megala*).

Table 1. Comparison of birds captured at a rice field in Stunggang Melayu Village (RF) and a mixed dipterocarp forest in Santubong National Park (MD), Western Sarawak

Family	Species	Common Name	RF	MD	Feeding Guild	DF	SWLPO 1998	IUCN 2017
Alcedinidae	*Ceyx rufidorsa rufidorsa*	Rufous-backed Kingfisher	–	1	P/I	R	P	LC
Ardeidae	*Ixobrychus cinnamomeus*	Cinnamon Bittern	2	–	P/I	R/M	P	LC
	Ixobrychus sinensis	Yellow Bittern	1	–	P/I	R/M	P	LC
Cisticolidae	*Orthotomus sericeus*	Rufous-tailed Tailorbird	–	3	I	R	NL	LC
	Prinia flaviventris	Yellow-bellied Prinia	1	–	I	R	NL	LC
Columbidae	*Chalcophaps indica*	Emerald Dove	–	2	F	R	NL	LC
Dicaeidae	*Dicaeum trigonostigma*	Orange-bellied Flowerpecker	–	3	O	R	NL	LC
Dicruridae	*Dicrurus paradiseus*	Greater Racquet-tailed Drongo	–	2	I	R	NL	LC
Estrildidae	*Lonchura atricapilla*	Chestnut Munia	33	–	G	R	NL	LC
	Lonchura punculata	Scaly-breasted Munia	18	–	G	R	NL	LC
Muscicapidae	*Copsychus malabaricus*	White Rumped Shama	–	1	O	R	P	LC
	Copsychus saularis musicus	Magpie Robin	–	1	I	R	NL	LC
Meropidae	*Merops viridis*	Blue-throated Bee-eater	1	–	I	R	NL	LC
Motacillidae	*Anthus rufulus*	Ricefield Pipit	1	–	I	R/M	NL	LC
Nectariniidae	*Anthreptes malacensis*	Brown-throated Sunbird	–	4	N	R	NL	LC
	Hypogramma hypogrammicum	Purple-naped Sunbird	–	1	N	R	NL	LC
	Arachnothera longirostra	Little Spiderhunter	–	2	N	R	NL	LC
Oriolidae	*Irena puella*	Asian Fairy Bluebird	–	1	O	R	NL	LC
Passeridae	*Passer montanus*	Eurasian Tree Sparrow	5	–	F	R	NL	LC
Picidae	*Meiglyptes tukki*	Buff-necked Woodpecker	–	1	I	R	P	NT
Pycnonotidae	*Pycnonotus simplex*	Cream-vented Bulbul	–	4	O	R	NL	LC
	Pycnonotus plumosus	Olive-winged Bulbul	–	1	O	R	NL	LC
	Pycnonotus brunneus	Red-eyed Bulbul	–	1	O	R	NL	LC
	Pycnonotus goiavier	Yellow-vented Bulbul	7	1	O	R	NL	LC
	Pycnonotus erythropthalmos	Spectacled Bulbul	–	1	O	R	NL	LC
	Iole olivacea	Buff-vented Bulbul	–	1	O	R	NL	NT
Rallidae	*Porzana pusilla*	Baillon's Crake	1	–	O	R/M	NL	LC
	Amaurornis phoenicurus	White-breasted Waterhen	1	–	O	R	NL	LC
Rhipiduridae	*Rhipidura javanica*	Pied Fantail	1	1	I	R	NL	LC
Scolopacidae	*Gallinago megala*	Swinhoe's Snipe	2	–	O	R/M	NL	LC
Timaliidae	*Macronous bornensis bornensis*	Bold-striped Tit Babbler	–	3	I	R	NL	LC
	Trichastoma rostratum	White-chested Babbler	–	1	I	R	NL	NT

Feeding guild types (O = Omnivores; I = Insectivores; F = Frugivores; N = Nectarivores; P = Piscivores; G = Granivores). Distribution status, DF (R = Resident bird; M = Migratory bird). The conservation status of bird species according to the Sarawak Wild Life Protection Ordinance 1998 (SWLPO; P = Protected; NL = Not Listed) and International Union for Conservation of Nature (IUCN 2017; NT = Near Threatened; LC = Least Concern) are listed here.

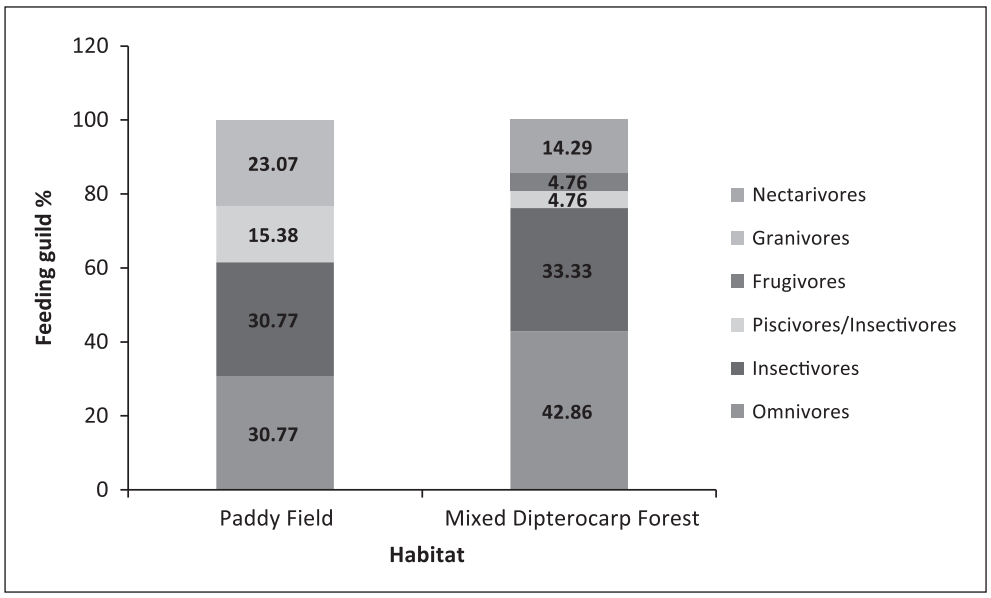

Fig. 2. Percentage of feeding guild of birds caught at a rice field in Stunggang Melayu Village, Lundu and a mixed dipterocarp forest in Santubong National Park, Western Sarawak.

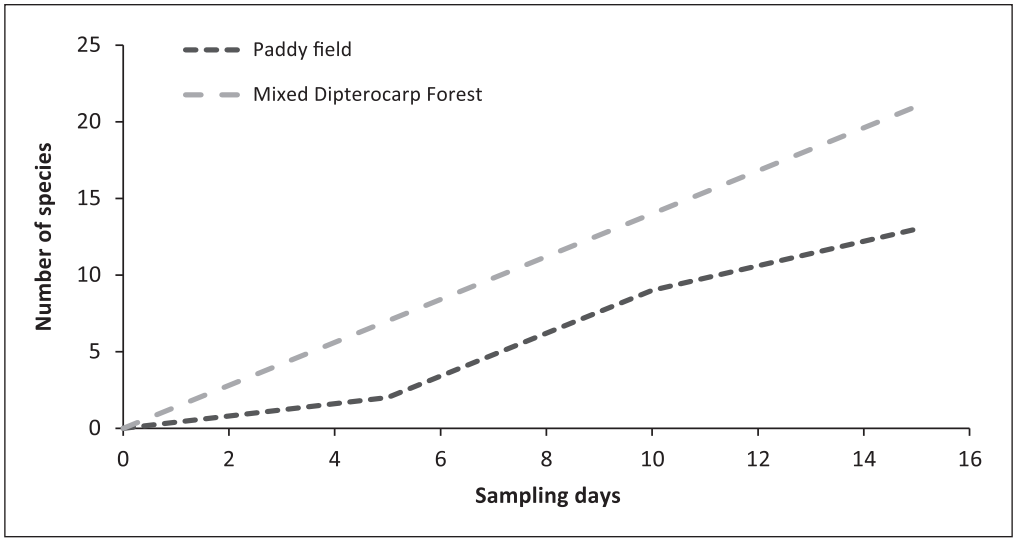

Fig. 3. Species accumulation curve for mist-netted birds at a rice field in Stunggang Melayu Village, Lundu and a mixed dipterocarp forest in Santubong National Park, Western Sarawak.

Between the two sampling locations, MDF dipterocarp forest at SNP showed significant higher species diversity index and species richness of birds (H'= 2.885; 0.935) compared to rice field (H'= 1.711; 0.726) (Zar t-test with p-value = 1.143×10^{-6}). The rice field habitat was only attracted by small group of bird species and was dominated by the Estrildidae (munia) family, which exclusively inhabit the paddy field area. However, the checklist of bird species in both areas was incomplete and more species could be discovered as the species accumulation curves for both sites yet to reach an asymptote (Figure 3). The numbers of species captured were increasing until the last day of sampling indicated that if longer period of sampling or more mist nets were used, this would probably change the total number of individual birds and species captured.

CONCLUSION

Mixed dipterocarp forest has higher bird species diversity and richness compared to rice field. Habitat and food resource availability may influence the diversity of birds.

ACKNOWLEDGEMENTS

This paper is supported by the Malaysia Ministry of Education under Niche Research Grant Scheme (NRGS/1088/2013(02)). The authors would like to thank Forest Department Sarawak, Sarawak Forestry Corporation and Santubong National Park management for their help and allowing us to sample in those National Parks with Permit Number NPW.907.4.4 (JLD.14)-123 and Park Permit Number WL64/2017. We are grateful to Stunggang Melayu villagers who allowed us to sample at their rice fields. Special thanks to staff at Faculty of Resource Science and Technology, UNIMAS, especially Isa Sait, Fatimah Bt. Husnin, Shafri bin Semawi and Aktikah binti Jumaa't for their field assistance.

REFERENCES

Amano, T. 2009. Conserving bird species in Japanese farmland: past achievements and future challenges. *Biological Conservation*, **142**: 1913-1921.

Bambaradeniya, C.N.B., Fonscka, K.T. & Ambagahawatte, C.L. 1998. A preliminary study of fauna and flora of a rice rice field in Kandy, Sri Lanka. *Cey. Journal of Science (Biological Science)*, **25**: 1-22.

Banks, J.E., Jackson, C.H.W., Gagic, V., Baya, A. & Ngala, D. 2017. Differential responses of bird species to habitat condition in a Coastal Kenyan Forest Reserve: implications for conservation. *Tropical Conservation Science*, **10**: 1-13.

Brown, R., Jacobs, L.A. & Peet, R.K. 2007. Species Richness: small Scale. *Encyclopedia of life Science*, **2007**: 1-8.

Cleary, D.F.R., Boyle, T.J.B., Setyawati, T., Anggraeni, C.D., Van Loon, E.E. & Menken, S.B.J. 2007. Bird species and traits associated with logged and unlogged forest in Borneo. *Ecological Applications*, **17**: 1184-1197.

Donald, P.F., Sanderson, F.J. & Heath, M.F. 2001. Agricultural intensification and the collapse of Europe's farmland bird populations. *Proceedings of the Royal Society of London Series B-Biological Sciences*, **268**: 25-29.

Fernando, C. 1993. Rice field ecology and fish culture- an overview. *Hydrobiologia*, **259**: 91-113.

Ford, H.A., Barrett, G.W., Saunders, D.A. & Recher, H.F. 2001. Why have birds in the woodlands of Southern Australia declined? *Biological Conservation*, **97**: 71-88.

Fuller, R., Gregory, R., Gibbons, D., Marchant, J., Wilson, J., Baillie, S. & Carter, N. 1995. Population declines and range contractions among lowland farmland birds in Britain. *Conservation Biology*, **9**: 1425-1441.

Hammer, Ø., Harper, D.A.T. & Ryan, P.D. 2001. PAST: paleontological statistics software package for education and data analysis. *Palaeontologia Electronica*, **4(1)**: 9-226.

Hassan-Aboushiba, A.B., Ramli, R. & Sofian-Azirun, M. 2011. Species composition and feeding guilds of birds utilizing palm oil mill effluent (POME) area in Carey Island, Malaysia. *2nd International Conference on Environmental Science and Technology*, **6**: 28-31.

IUCN. 2017. Summary statistics - IUCN red list of threatened species. Retrieved on [July 13, 2017], http://www.iucnredlist.org/about/summary-statistics.

Jóhannesdóttir, L. 2013. Comparing biodiversity of birds in different habitats in South Iceland. Msc. Thesis. Unpublish report. Agricultural University of Iceland, Iceland.

Kerdkaew, T. 2014. Diet, home range and habitat use effects on seed dispersal of a pioneer tree by two bulbul species. Msc. Thesis. Unpublish report. Prince of Songkla University, Thailand.

Laurence, S.G.W., Stouffer, P.C. & Laurence, W.F. 2004. Effects of road clearings on movement patterns of understory rainforest birds in central Amazonia. *Conservation Biology*, **18**: 1099-1109.

Mansor, M.S. & Mohd Sah, S.A. 2012. The influence of habitat structure on bird species composition in lowland Malaysian rain forests. *Tropical Life Sciences Research*, **23(1)**, 1-14.

Nur Munira, A., Nurul Salmi, A.L., Shahrul Anuar, M.S., Mohd Abdul Muin, M.A., Amirrudin, A. & Nur Juliani, S. 2014. Diversity and temporal distribution of birds in rice-growing landscape, Northern Peninsular Malaysia. *Sains Malaysiana*, **43(4)**: 513-520.

Phillipps, Q. & Phillipps, K. 2014. Phillipps' field guide to the birds of borneo: Sabah, Sarawak, Brunei and Kalimantan. John Beaufoy Publishing Ltd, Oxford.

Renner, S.C., Baur, S., Possler, A., Winkler, J., Kalko, E.K.V., Bates, P.J.J. & Mello, M.A.R. 2012. Food preferences of winter bird communities in different forest types. *PlosOne*, **7(12)**: 1-10.

Sala, O.E., Chapin, F.S., Armesto, J.J., Berlow, E., Bloomfield, J., Dirzo, R., Huber-Sanwald, E., Huenneke, L.F., Jackson, R.B., Kinzig, A., Leemans, R., Lodge, D.M., Mooney, H.A., Oesterheld, M., Poff, N.L., Sykes, M.T., Walker, B.H., Walker, M. & Wall, D.H. 2000. Biodiversity – global biodiversity scenarios for the year 2100. *Science*, **287**: 1770-1774.

Shochat, E., Lerman, S. & Fernández-Juricic, E. 2010. Birds in urban ecosystems: population dynamics, community structure, biodiversity, and conservation. In: *Urban Ecosystem Ecology*. J. Aitkenhead-Peterson and A. Volder (Eds.). ASA-CSSA-SSSA, Madison. pp. 75-86.

Strasser, A.R. 2013. One Little bird that might adapt to a changing climate. Retrieved on [July 15, 2017], https://thinkprogress.org/one-little-bird-that-might-adapt-to-a-changing-climate-a806f5fdd967.

Tabur, M.A. & Yusuf, A. 2010. Ecological importance of birds. *International Symposium on Sustainable Development*, **2**: 560-585.

Vitousek, P.M., Mooney, H.A., Lubchenco, J. & Melillo, J.M. 1997. Human domination of Earth's ecosystems. *Science*, **277**: 494-499.

Voon, A.E.F., Ku Nasradhi, K.N.A., Abdul Rahman, M. & Mohd-Azlan, J. 2014. Bird diversity, density and foraging activities in a university campus landscape in Sarawak. *Borneo Journal of Resource Science and Technology (2014)*, **4(2)**: 9-20.

Walwert, M., Mardiastuti, A. & Muhlenberg, M. 2004. Effects of land use on bird species richness in Sulawesi, Indonesia. *Conservation Biology*, **18**: 1339-1346.

Willson, M., De Santo, T., Sabag, C. & Armesto, J. 1994. Avian communities of fragmented south-temperate rainforests in Chile. *Conservation Biology (UK)*, **8(2)**: 508-520.