The Preliminary Survey of Bird Populations in Kinabalu Park with Different Noise Level

Auddrey Ambrose[1], Jephte Sompud[1*], Oswald Aisat Igau[2], Rimi Repin[3], Alim Biun[3]

1 Forestry Complex, Faculty Science of Natural Resource, Universiti Malaysia Sabah, Jalan UMS, 88400, Kota Kinabalu, Sabah, MALAYSIA
2 Faculty of Business and Economic, Universiti Malaysia Sabah, Jalan UMS, 88400 Kota Kinabalu, Sabah, MALAYSIA.
3 Sabah Parks Boards of Trustees, Lot 45&46 Block H, KK Time Square, 88100, Kota Kinabalu, Sabah, MALAYSIA.
*Corresponding author. E-Mail jephte@ums.edu.my; Tel: +60-88-320-769; Fax: +60-88-320769).

ABSTRACT: Birdwatching activity has become one of the main attractions among tourists in Kinabalu National Park. Therefore, the number of tourists that come inside the park were directly contribute to the increasing number of vehicles inside the park. To date, there is no studies that have been done in Malaysia to investigate the response of birds on traffic noise. Therefore, this research was conducted to study the impact of traffic noise on bird population in Kinabalu Park. The study includes two methods, i.e., traffic noise mapping and bird survey. Traffic Noise Mapping involves identifying High Traffic Noise Zone and Low Traffic Noise Zone based on the existing trails by using a digital sound level meter. High Traffic Noise Zone was classified as noise level above ≥60dB and Low Traffic Noise Zone was classified as noise level below <60dB. One control site was selected which was far from the traffic noise. Bird survey was done by using point count method. A total of 1150 birds were recorded of which were 35 species and 20 families. Pearson Correlation shows very significant and negative correlation of traffic noise with bird's species richness and bird abundance of which were ($r = -0.671$, $p<0.000$) and ($r = -0.753$, $p<0.000$), respectively. The results in this study show birds' population in Kinabalu Park was very significantly reduce both in species richness as well as abundance in High Traffic Noise Zone. We recommend that there should be a mechanism that is established by the Park management to control the number of vehicle that enters the Park. Alternative mode of transportation inside the Park such as electric powered buggy is recommended to address the issue of traffic noise around the park.

KEYWORDS: Kinabalu Park; High Traffic Noise Zone; Low Traffic Noise Zone; Bird Population; Sabah

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INTRODUCTION

Nature tourism has been one of the main attractions in Borneo because of its biodiversity richness. Sabah is one of the well-known state that has huge tropical rainforest and one of the most popular place for tourist is Kinabalu National Park. This park has been recognized among tourist not only because of mountain but also the landscape ranges from lush, green rainforest at the park's lowest altitudes. Kinabalu National Park was Malaysia's first World Heritage Site designated by United Nations Educational, Scientific and Cultural Organization (UNESCO) in December 2000 for its "outstanding universal values" and its role as one of the most important biological sites in the world with varieties species of flora and fauna (Goh & Yusoff, 2010).

One of the main attractions in Kinabalu National Park apart from Mount Kinabalu is birdwatching, where this activity has come to age in Malaysia (Davison & Fook, 2013). According to Davison and Gale (1992), bird watching in the mountains of Malaysia has long been popular, for instance at Fraser's Hill and Cameron Highlands in Peninsular Malaysia as well as of the Park Headquarters on Kinabalu.

TRANSACTIONS ON SCIENCE AND TECHNOLOGY

Due to the increasing of popularity in Kinabalu Park, this has attracted thousands of climbers and visitors. The number of visitor's arrival raised from 829 in the 1965 to 434, 000 in 2005 (Goh & Yusoff, 2010). Hence, this contributes to the number of vehicles that come inside the park. Many tourists come to the Park using vehicles that directly leads to the intensification of traffic noise around the park.

Past studies from other countries documented the relationship between bird population and traffic noise. According to Rheindt (2003), bird's population may be affected by noise pollution because birds rely on acoustic signals for mating and predator evasion. Acoustic interference from noise could hamper the detection of songs by conspecifics making it more difficult for birds to maintain territories and attract mates (Parris & Schneider, 2008). Noise also causes reductions in population densities that have been recorded for several bird species that occur near roads. Birds may be affected by traffic noise because they rely extensively on vocalization communication (Kociolek *et al*., 2011).

To date, there is no studies that have been done in Malaysia to investigate the response of birds on traffic noise. The objective of this study is to investigate the response bird's population on traffic noise in Kinabalu Park Headquarters.

METHODOLOGY

Study Site

This study was conducted at Kinabalu Park Headquarters which was located on the southern slope of Mount Kinabalu at an elevation of 1500 meter above sea level. Kinabalu National Park covers an area of 754 square km and was gazette in 1964 (Goh & Yusoff, 2010). This park was located within the Ranau District and is about 56km away from Kota Kinabalu.

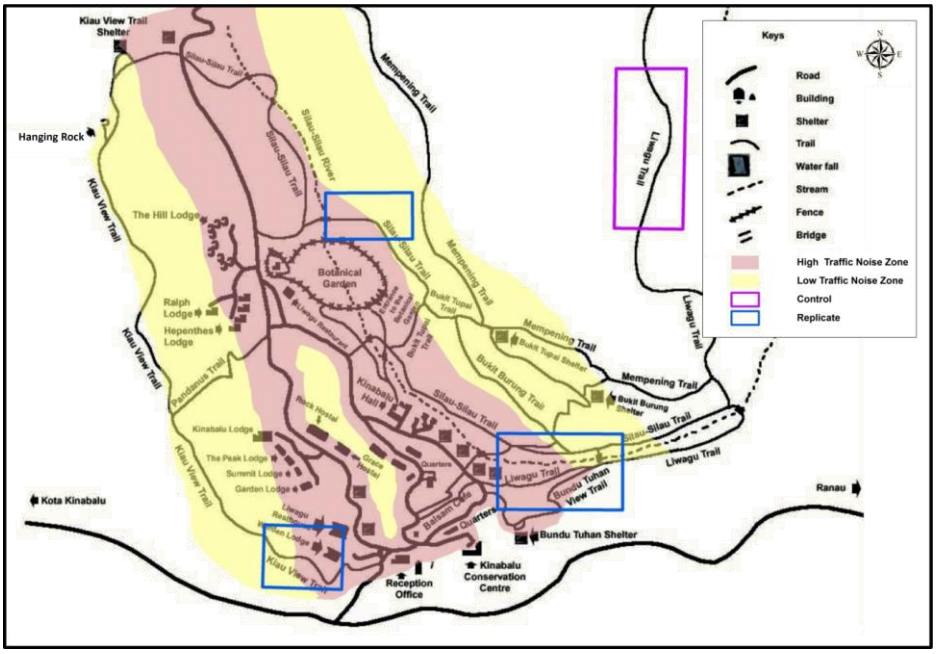

Figure 1. Map of Kinabalu Park Headquarters Nature Trails (Information Centre Kinabalu Park Headquarters, 2015)

There are several well-maintained existing trials available in this park (Nakayasu *et al.*, 1996). Many species of birds can be easily found inside the trails. Besides, a slow quiet walk around the Park Headquarters during the morning or afternoon should reveal a variety of birds (Davison & Gale, 1992). Three trails were selected; Kiau View Trail, Silau-Silau Trail and Liwagu Trail (Figure 1). One trail was selected as Control site which was far from the road to avoid any traffic noise.

The study involves two methods of which were traffic noise mapping and bird survey.

Traffic Noise Mapping

There were four study areas that were selected at Kinabalu Park including one Control Site based on the existing trail in the park. Each study site has two zones; High Traffic Noise Zone and Low Traffic Noise Zone. High Traffic Noise Zone was classified as noise level above 60dB (≥60dB) and Low Traffic Noise Zone was classified as lower than 60dB (<60dB). One Control site was selected. It was located far away from the road, of which no traffic noise can be heard. In each trail, there were twelve point marked for point count station with 50m interval in 600m of the trail. Traffic noise was measured in decibels (dB) with a digital sound level meter at each of the point count stations. Sound level meter was held aiming towards the traffic noise and was set in the fast (A/C) data recording mode as follow Herrera-montes and Aide (2011). Traffic noise were recorded before the bird survey and after the bird survey for each month to calculate the average of the traffic noise. Data was systematically recorded in standard data sheet.

Bird Survey

Bird survey was carried out at the same point count station where the traffic noise data was recorded. Surveys were conducted for a period of six months (i.e. June to November 2015) and were carried out from 0700 hours to 1100 hours. Rajpar and Zakaria (2015), suggest that this period of time is suitable for observing birds because they are active early in the morning. Point count technique was used for bird survey. The birds were observed and identified by using field binocular Minox 10x42. All observed birds were counted and identified to species level within 5 minutes sampling period. Bird species was identified by using Bird of Borneo by Phillipps and Phillipps (2014). The data obtained from this study were analyzed using descriptive analysis and statistical analysis using Regression and Correlation analysis.

RESULT

A total of 1150 birds (included unidentified ones) were recorded during data collection period. There were 35 species and 20 families recorded. Table 1 shows the number of bird's species and number of bird's individual by family based on zones but the unidentified birds were not included. Control site has the highest number of bird's species and number of bird's individual. High Traffic Noise Zone has the lowest number of bird's species and number of bird's individual. Based on the table, only Nectariniidae can be found in High Traffic Noise Zone. Meanwhile, family Campephagidae, Columbidae and Megalaimidae can be found in Low Traffic Noise Zone and Control site but not in the High Traffic Noise Zone. On the other hand, Family Picidae, Pittidae and Trogonidae can only be found in Control site.

Table 1. Number of species and number of individual (in bracket) by family based on three zones; High Traffic Noise, Low Traffic Noise and Control

No	Family	High Noise	Low Noise	Control
1	Nectariniidae	1(3)	0	0
2	Campephagidae	0	2(18)	2(8)
3	Columbidae	0	1(4)	2(19)
4	Megalaimidae	0	1(3)	1(3)
5	Picidae	0	0	3(4)
6	Pittidae	0	0	1(1)
7	Trogonidae	0	0	1(2)
8	Cettidae	1(7)	2(7)	2(12)
9	Corvidae	1(12)	2(18)	2(10)
10	Dicaeidae	1(1)	0	1(2)
11	Dicruridae	1(2)	1(5)	1(20)
12	Leiothrichidae	1(24)	2(33)	2(30)
13	Muscicapidae	2(39)	5(39)	5(95)
14	Pachycephalidae	1(3)	1(3)	1(3)
15	Phasianidae	1(1)	1(4)	1(4)
16	Phylloscopidae	1(15)	2(19)	2(28)
17	Pycnonotidae	2(7)	1(7)	1(6)
18	Rhipiduridae	1(9)	1(13)	1(1)
19	Timaliidae	2(38)	1(1)	2(20)
20	Zosteropide	1(113)	1(122)	2(175)
	Total	**17(274)**	**24(296)**	**33(443)**

Table 2 showed the Diversity Index analysis of bird's population in three different zones. Shannon Weiner diversity index was higher at Control site (H'= 2.527), followed by Low Traffic Noise Zone (H'= 2.286) and High Traffic Noise (H'= 2.058). Meanwhile, Simpson Index of Diversity was also the highest at Control site (1-D = 0.838), followed by Low Traffic Noise Zone (1-D = 0.798) and High Traffic Noise Zone (1-D = 0.788).

Table 2. Diversity indices of bird's population in high traffic noise, low traffic noise and control

Diversity Indices	High Traffic Noise	Low Traffic Noise	Control
Shannon Weiner Index (H')	2.058	2.286	2.527
Simpson Index of Diversity (1-D)	0.788	0.798	0.838

The results of Pearson Correlation analysis of bird's species richness and traffic noise was shown in Table 3. The analysis shows a negative relationship and was very significant ($r = -0.671$, $p<0.000$). The strength of the relationship was moderately high (Cohen, 1988). Meanwhile, Figure 2 shows the scatter plot of traffic noise and bird's species richness. Based on the figure, the number of bird's species richness decrease when the traffic noise increase.

Table 3: Correlation between number of bird's species and traffic noise

		Bird's Species	Traffic Noise
Pearson Correlation	Bird's Species	1	-0.671**
	Traffic Noise	-0.671**	1
Sig. (2-tailed)	Bird's Species	.000	0
	Traffic Noise	0	0.000
N	Bird's Species	52	52
	Traffic Noise	52	52

**Correlation is significant at the 0.001 level (2-tailed)

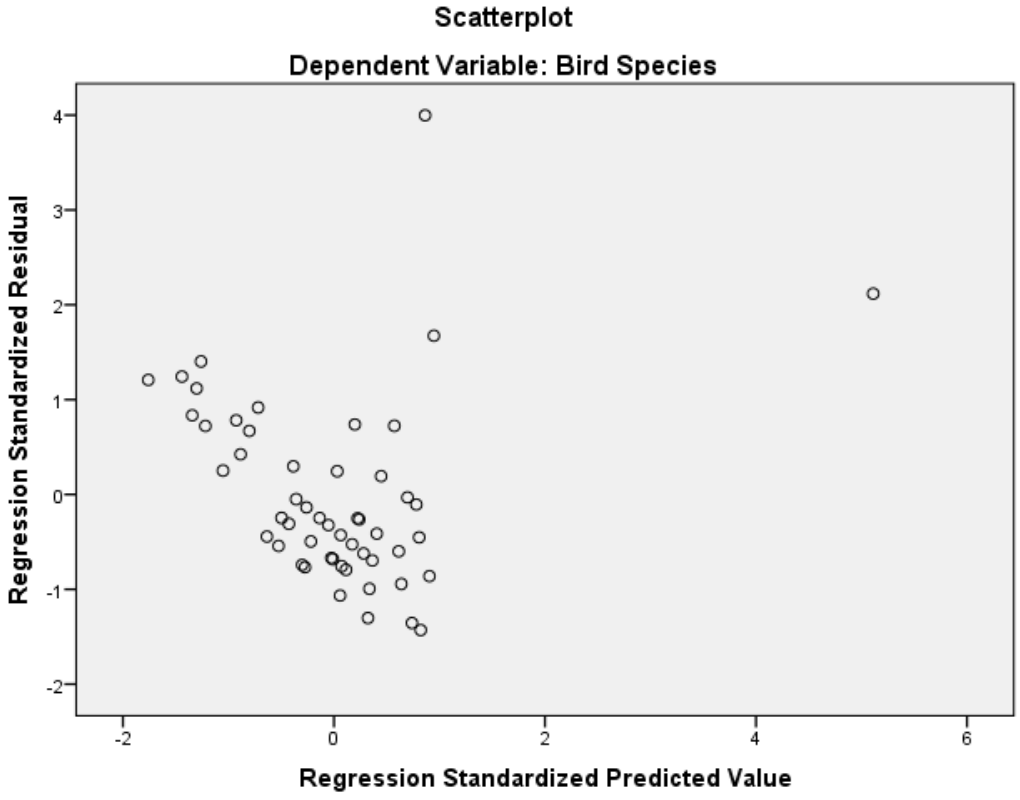

Figure 2. Linear Regression between Birds Species and Traffic Noise

Meanwhile, Table 4 shows the Pearson Correlation analysis of bird's abundance and traffic noise. The results showed negative relationship between traffic noise and bird's individual and was very significant ($r = -0.753$, $p<0.000$). The strength of the relationship was moderately high (Cohen, 1988). The scatter plot shown in Figure 3 shows the bird's abundance decrease when the traffic noise increase.

Table 4: Correlation between number of bird's abundance and traffic noise

		Bird's abundance	Traffic Noise
Pearson Correlation	Bird's abundance	1	-0.753**
	Traffic Noise	-0.753**	1
Sig. (2-tailed)	Bird's abundance	.000	0
	Traffic Noise	0	0.000
N	Bird's abundance	52	52
	Traffic Noise	52	52

**Correlation is significant at the 0.01 level (2-tailed)

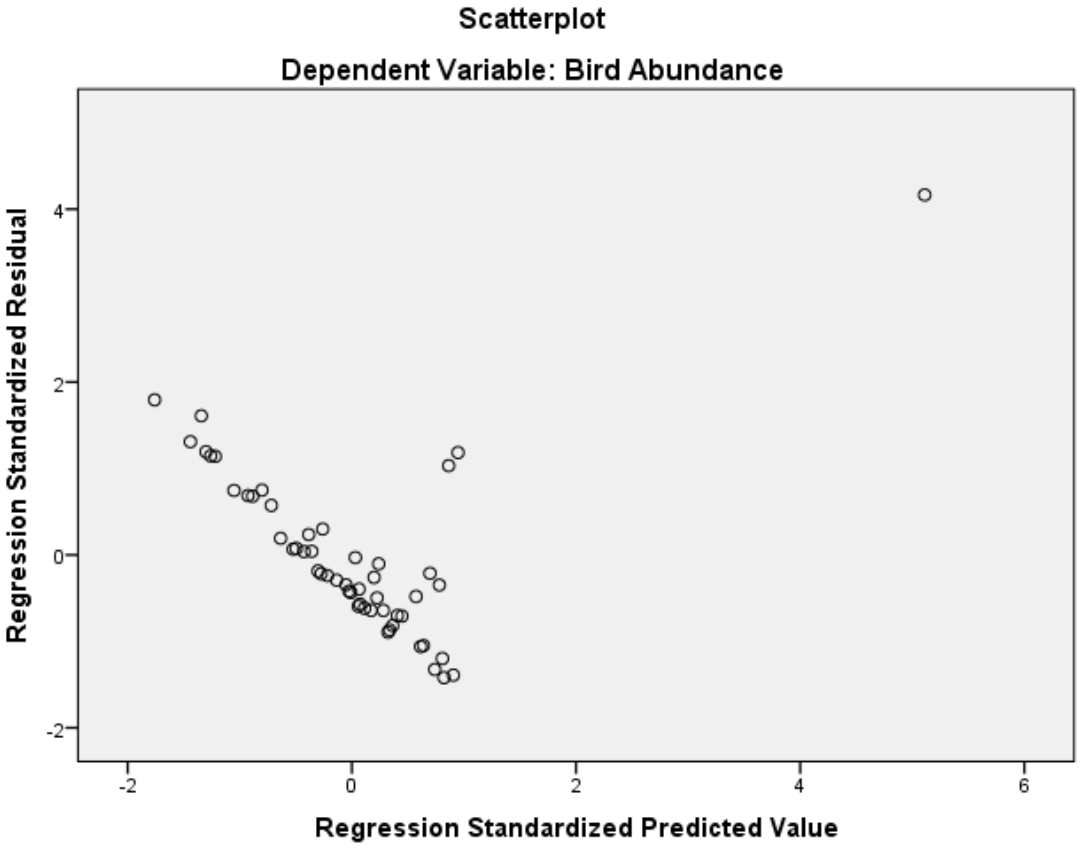

Figure 3. Linear Regression between Birds Abundance and Traffic Noise

Based on Table 5a and Table 5b shows the Linear Regression analysis. The value of adjusted R square for bird's abundance is higher (0.559) compared to bird's species richness (0.440). The results showed that the response of birds' population on traffic noise is more prominent in terms of bird's abundance as compared to species richness.

Table 5a. Model summary of Bird's Abundance

Model Summary[b]

Model	R	R Square	Adjusted R Square
1	0.753[a]	0.567	0.559

a. Predictors: (Constant), Traffic Noise

b. Dependent Variable: Bird's Abundance

Table 5b. Model summary of Bird's Species

Model Summary[b]

Model	R	R Square	Adjusted R Square
1	0.671[a]	0.451	0.440

a. Predictors: (Constant), Traffic Noise

b. Dependent Variable: Bird's Species

DISCUSSION

Road traffic or traffic noise is one of the concepts anthropogenic disturbance. An experiment that have been done in Idaho, found that animal give negative response to the traffic noise (McClure *et al.*, 2013). Based on Parris and Schneider (2008), diversity of bird population may be different in each habitat because some birds may move away from traffic noise. However, Summer *et al.* (2011) mentions that their study did find any relationship between bird's species richness and traffic noise.

Based on my findings, the response of bird's species richness and bird's abundance was very significantly correlated with traffic noise. Based on the results, bird's abundance and bird's species richness was significantly decreased at High Traffic Noise Zone. Herrera-montes and Aide (2011) reported that bird species richness and abundance were comparatively higher in low noise areas. Their findings were similar to the results of this study, where bird's species and bird's abundance were higher at the Low Traffic Noise Zone compare to the High Traffic Noise Zone.

The study in Carara National Park, Costa Rica by Arevalo and Newhard (2011) shows that the abundance of birds was higher in low traffic noise areas as compare to high traffic noise area. According to Dooling and Popper (2007), there are three classes of potential effects of traffic noise on birds, such as behavior effect, damage hearing and masking communication that may cause reduce in reproduction.

Goodwin and Shriver (2010) stated that birds avoid the area that has high traffic noise because the vocalization frequencies were overlapped with the frequencies of traffic noise. This causes male birds to have difficulties of finding their mate. Goodwin and Shriver (2010)

has proposed that this could be the reason why birds avoid the area that has high traffic noise zone and cause the bird's abundance to be lower as compare to low traffic noise zone.

CONCLUSION AND RECOMMENDATION

The results in this study show that the response of bird's population on traffic noise in Kinabalu Park was negatively significant both in species richness as well as abundance. We recommend that there should be a mechanism by the Park Management to control the number of vehicles that enter the Park. Alternative mode of transportation inside the Park such as electric powered buggy is recommended to address the issue of traffic noise around Kinabalu Park.

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