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**Short Notes**

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**Rapid assessment on the abundance of bird species utilising the Kota Kinabalu Wetland Centre mangroves**

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**ABSTRACT**

Kota Kinabalu Wetland Centre (KKWC) mangroves have an essential role as a green ecosystem in Kota Kinabalu. The aim of this study was to assess the usefulness of mangrove areas as a site for birdlife by estimating the number of bird species and family, and the population density of bird species. The most frequent bird groups found in KK Wetland Centre were waders (14.70%) followed by herons, storks and bitterns (12.59%), raptors (8.15%) and bulbuls (7.41%). The population density of bird found in KKWC was between 12 – 17 birds/km<sup>2</sup>. The result shows an estimated population of 3526 individuals from 83 species of birds covering an area of 24 ha. As a conclusion, this area is important as an urban bird habitat in Kota Kinabalu. Conservation of adequate and contiguous suitable mangrove habitat may provide a sanctuary for bird to live and feed between their territories. Ecological improvements of green mangrove ecosystem could be of immediate benefit to the bird population.

*Keywords:* Bird checklist, mangrove environment, birdlife area, conservation and population density

**INTRODUCTION**

Swamps, marshes and other wetlands that were once regarded as useless to agricultural and industrial development are now recognized for their great values in recycling chemical and biological materials, and especially for their rich biological diversity. Wetlands filter pollutants, act as reservoirs of nutrients in food chains, produce forage for domestic animals and fuel for humans, provide aesthetics, recreational and cultural benefits to society and are habitats for thousands of unique species of plants and animals (Eric *et al.*, 2000).

The mangrove area is one type of wetlands and in Sabah it consisted of 322,349 hectares which most of them have been constituted as Mangrove Forest Reserve (Sabah Forestry Department, 2003). The ecological importance of mangrove areas can hardly be overestimated as they form the feeding and nursery grounds for many species of birds and other invertebrate species. Mangrove vegetation protects the coastal areas from erosion and acts as a buffer zone against tidal currents, floods and storms.

In wetland areas, birds are expected to be an important resource as tourist attraction. Certain species of birds are fully dependent on the mangrove for their habitat and food. Birds play important roles in maintaining wetlands ecosystem which include being pollinators, seed dispersers, pollution regulators providing food for other animal predators, and also contribute in nutrient recycling processes. Birds are closely related to the habitat conditions. Each species rarely occurs in only one type of habitat. They are completely dependent on their habitat, for cover and rich food resources. Habitat type, size of the area, plant community structure and landscape pattern can have a great effect on bird community structure in a given habitat (Wijesekara, 1999).

The aim of this study was to conduct rapid assessment on the density and abundance of bird species utilising the Kota Kinabalu Wetland Centre (KKWC) mangrove area.

#### MATERIALS AND METHODS

Secondary data were obtained from literature, books and scientific reports available from World Wildlife Fund (WWF-Kota Kinabalu) and Sabah Wildlife Department. Secondly are from field survey and observation as a complement and confirmation to the mechanisms. For this study, the chosen location is the mangrove areas in KKWC which is located two kilometres north-east of Kota Kinabalu City centre. This location was chosen due to the large diversity of birds and in addition, it is a suitable location for tourist attraction. KKWC, which covers an area of 24 hectares, is the only remaining patch of once an extensive mangrove forest existed in much of the area in the coastal town of Kota Kinabalu (Fig. 1).

Seven days were spent in the field from 14th to 20th November 2005. Point count method had been carried out and species of birds was identified through their vocalization from 6 a.m. to 11 a.m. and 4.30 p.m. to 6.30 p.m. The

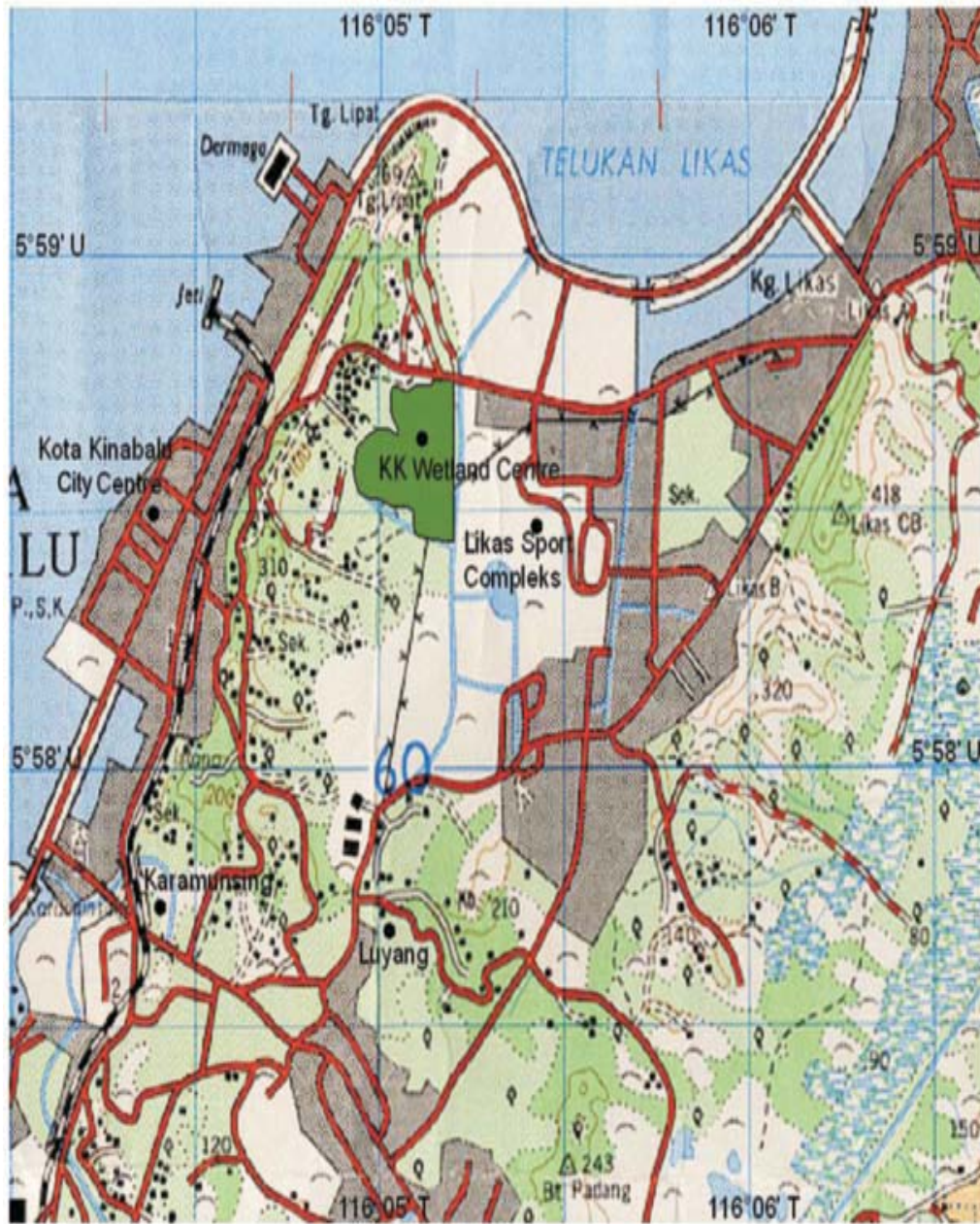
observation was made using a pair of binocular ( $10 \times 50$ ). Each individual bird or groups of birds seen or heard would be identified on the spot using bird checklist book of Borneo (Mackinnon & Phillipps, 1993). This point count method used to record a variety of birds that provides a uniform way of counting birds over time or across locations. Point counts are a standardized method (Ralph *et al.*, 1993) of assessing the diversity and abundance of birds by counting (detected by hearing and by sight) at points (Knapp & Keeley, 2001). In large areas, allocated point counts can be used as representative samples for the area. Point counts are visited over a period of several days or longer to assess how many and what types of birds are found in an area.

A total of 32 sampling points were established for bird survey in KKWC. Each point was selected by considering/ marking every 100 metres walk from the provided transect (boardwalk). At each point, the count was last exactly five minutes. Then, waiting around 2–4 minutes at each point before counting.

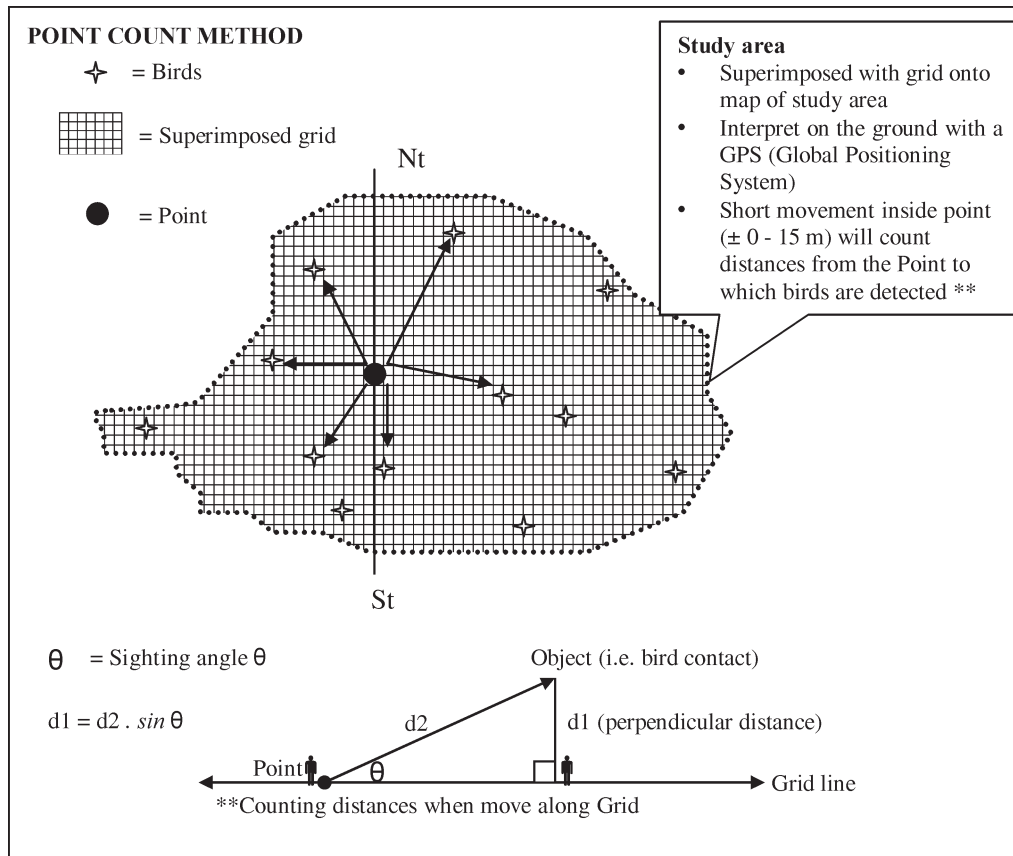
Every bird species observed was recorded between distances from the 10 – metre intervals out to 100 metres. All individuals of all species detected were counted, and a bird seen first was distinguished from birds heard first. Horizontal distance of the bird relative to the survey point and the distance from above the ground were recorded (Fig. 2). The abundance of bird was analyzed using distance sampling following Buckland *et al.* (2001).

#### RESULTS AND DISCUSSIONS

The total of bird species recorded in KKWC during the survey were 83 species from 31 families and 60 genera (Appendix 1). The group category was based from Clements (1991). The highest abundance of bird group/class observed was heron, storks and bitterns (10.4%), followed by waders (8.9%), pigeons, doves and parrots (5.2%) and kingfishers (3.7%). This group of



**Figure 1:** Location of Kota Kinabalu Wetland Centre  
Source: Mapping Department Malaysia, 1998



**Figure 2:** Detailed point count plot for bird survey

birds, as exemplified by Purple Heron (*Ardea purpurea*), Little Egret (*Egretta garzetta*), Common Greenshank (*Tringa nebularia*), Sandpiper (*Actitis hypoleucos*) and Cinnamon Bittern (*Ixobrychus cinnamomeus*) that fed on small fishes and crustaceans. The pigeon, doves and parrots are usually seen above the mangrove canopy that feed the mangrove flower of *Sonneratia alba*, *Avicennia alba* and *Lumnitzera racemosa*. While the kingfishers such as the Common Kingfisher (*Alcedo atthis*), Blue-eared Kingfisher (*Alcedo meninting*) and Collared Kingfisher (*Halcyon chloris*) are usually associated within seashores or river mouths and become predator for small fishes and mudskippers (*Periophthalmodon schlosseri*). The largest bird family recorded from the study

was Ardeidae (13 species) followed by Scolopacidae (9 species), Columbidae (7 species), Alcedinidae (5 species), and Nectariniidae (5 species). The most common bird family found in KKWC is Ardeidae which consists of herons, storks and bitterns which usually easy to be spotted flying in the mangrove mud and coastal areas. Sometimes this bird is known as 'Bangau Air' by the local.

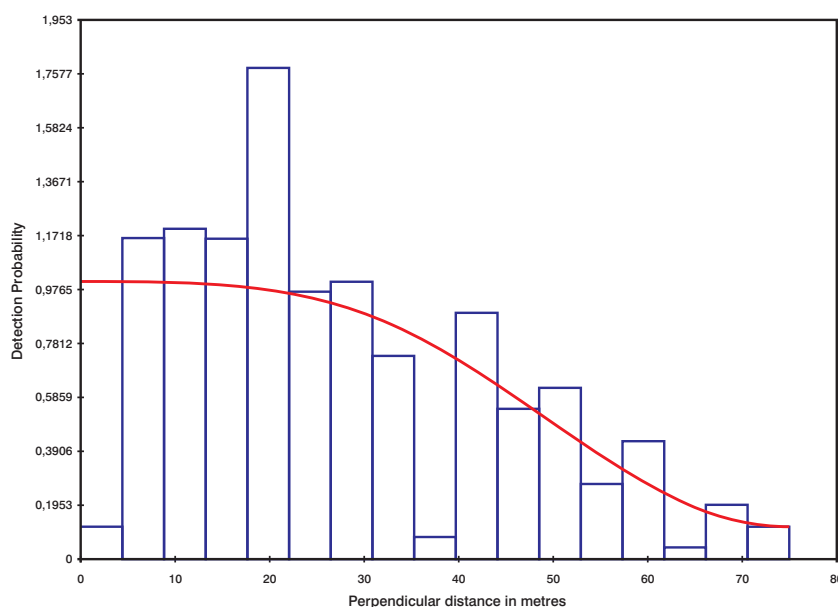
Most of the birds observed in KKWC are resident bird with 66% from the total of overall birds surveyed, whereas migratory bird consists of 32% and 2% includes for both resident and migratory bird. Resident bird means, the bird is breeding and stay in the same area or location throughout the year and does not migrate. From

the distance sampling analysis, the estimated population density of birds in KKWC was 14.11 individuals/km<sup>2</sup>. Its density lies in between a range of 11.53 – 17.25 birds/km<sup>2</sup>, within 95% confidence interval. The total population of birds was 3526 individuals in an area of about 24 hectares (Table 1). Two assumptions are essential for reliable estimation of density from point transect sampling are; (1) bird directly on the point are always detected at their initial location, prior to any movement in responsive to the observer. (2) Distances are measured accurately or objects are correctly counted in the proper distance interval.

In this survey, rare species that were difficult to be spotted belong to woodpeckers, wablers (Tailorbird and Snipe), and sunbird and spiderhunter, while the remotes detected birds are raptors. Sometimes they were spotted flying a distance of 75 m in the sky and only could be identified using binoculars. Generally, the detection function decreases with increasing distance (Buckland *et al.*, 1993). This was correct in this survey when using point count method, where the detection of bird decrease at the distance of 75 m (Fig. 3).

**Table 1:** Population density and abundance of birds in KKWC

	Estimate	%CV	df	95%	Confidence Interval
D (Density)	14.105	10.26	461	11.534	17.248
N (Abundance)	3526.0	10.26	461	2884.0	4312.0



**Figure 3:** Detection probability of all birds recorded perpendicular to distance using point count method in KKWC

Sampling error also influence the detection probability, that not all individuals bird species could be detected in the investigated areas, due to numerous variables such as the observer's visual acuity, hearing ability, and experience, the length of time spent at a station, the season of the year, the time of the day, wind, temperature, and other weather conditions, the habitat features and the bird's reproductive status and behaviour. These variables affected the detection function and the occurrence of birds in each survey

#### CONCLUSION AND RECOMMENDATIONS

Kota Kinabalu Wetland Centre mangroves can be considered as one of the most important habitats for birds. Most of the recorded bird species belong to the family of Ardeidae (13 species), Scolopacidae (9 species), Columbidae (7 species), Alcedinidae (5 species) and Nectariniidae (5 species) respectively. This area is also an important habitat for kingfishers which eat small fishes (Mudskipper; *Periophthalmodon schlosseri*), crustaceans (Mud Lobster; *Thalassina anomala*) and small aquatic invertebrates, like the Common Kingfisher (*Alcedo atthis*), Blue-eared Kingfisher (*Alcedo meninting*) and Collared Kingfisher (*Halcyon chloris*) they can usually be observed near the mangrove fringe and river mouths. Herons, Bitterns and Storks belong to the Ardeidae family and which usually easy to be spotted flying in the mangrove mud. Most of the birds observed in KKWC are resident birds with 66% of the total overall bird's survey; whereas migratory bird consists of 32%. An estimated population of 3,526 individuals in 24 hectares is considered very high. As recommendations, the presence of birdlife in KKWC environment is a testimony to the quality of the environment. It is an indicator that some balance between the natural and the built environment could be achieved. To enhance the birdlife, it would be necessary to consider a few particular types of bird areas, namely:

- (a) Natural areas which are currently rich in birdlife and may act as population reservoirs for birds. Adequate protection of these reservoirs may provide a sanctuary for residence and migratory birds.
- (b) Improvement of vegetated corridors along mangrove areas, swamp areas and green spaces would be of immediate benefit to the bird habitat. These corridors may provide cover, shelter, water, food and space for those birds to move between habitats.

#### ACKNOWLEDGEMENT

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**Appendix 1:** Taxonomic list of bird species recorded at Kota Kinabalu Wetland Centre

Family	Species	Observed No.	Estimated No.	Protection Status*
Ardeidae	<i>Ardea purpurea</i>	2	1 – 5	P, I
Ardeidae	<i>Ardea cinerea</i>	1	1 – 5	P, I
Ardeidae	<i>Nycticorax caledonicus</i>	3	1 – 5	P
Ardeidae	<i>Nycticorax nycticorax</i>	2	1 – 5	P
Ardeidae	<i>Egretta intermedia</i>	6	10 – 20	P, I
Ardeidae	<i>Egretta eulophotes</i>	8	10 – 20	P, VU, I
Ardeidae	<i>Egretta sacra</i>	2	1 – 5	P, I
Ardeidae	<i>Egretta alba</i>	4	5 – 10	P, I
Ardeidae	<i>Egretta garzetta</i>	5	5 – 10	P, I
Ardeidae	<i>Butorides striatus</i>	1	1 – 5	P, I
Ardeidae	<i>Ixobrychus sinensis</i>	1	1 – 5	P
Ardeidae	<i>Ixobrychus cinnamomeus</i>	1	1 – 5	P
Ardeidae	<i>Gorsachius melanolophus</i>	2	1 – 5	P
Ciconiidae	<i>Leptoptilos javanicus</i>	1	1 – 5	P, VU
Charadriidae	<i>Pluvialis fulva</i>	1	1 – 5	-
Charadriidae	<i>Charadrius dubius</i>	1	1 – 5	-
Scolopacidae	<i>Tringa tetanus</i>	12	10 – 20	-
Scolopacidae	<i>Tringa glareola</i>	15	10 – 20	-
Scolopacidae	<i>Tringa nebularia</i>	4	5 – 10	I
Scolopacidae	<i>Tringa stagnatilis</i>	4	5 – 10	-
Scolopacidae	<i>Actitis hypoleucos</i>	2	1 – 5	-
Scolopacidae	<i>Xenus cinereus</i>	1	1 – 5	-
Scolopacidae	<i>Tringa brevipes</i>	1	1 – 5	-
Scolopacidae	<i>Gallinago megala</i>	1	1 – 5	-
Scolopacidae	<i>Gallinago</i> sp.	1	1 – 5	-
Recurvirostridae	<i>Himantopus himantopus</i>	2	1 – 5	-
Alcedinidae	<i>Alcedo atthis</i>	1	1 – 5	-
Alcedinidae	<i>Alcedo meninting</i>	1	1 – 5	-
Alcedinidae	<i>Halcyon chloris</i>	1	1 – 5	-
Alcedinidae	<i>Halcyon pileata</i>	1	1 – 5	-
Alcedinidae	<i>Pelargopsis capensis</i>	1	1 – 5	-
Meropidae	<i>Merops viridis</i>	1	1 – 5	-
Pandionidae	<i>Pandion haliaetus</i>	1	1 – 5	P, I
Accipitridae	<i>Haliaeetus leucogaster</i>	1	1 – 5	I
Accipitridae	<i>Haliastur indus</i>	1	1 – 5	P, I
Accipitridae	<i>Spilornis cheela</i>	1	1 – 5	P, I
Rallidae	<i>Rallus striatus</i>	2	1 – 5	I
Rallidae	<i>Amaurornis phoenicurus</i>	1	1 – 5	I
Rallidae	<i>Gallinula chloropus</i>	1	1 – 5	I
Columbidae	<i>Chalcophaps indica</i>	1	1 – 5	P, I
Columbidae	<i>Columba livia</i>	1	1 – 5	III
Columbidae	<i>Ducula aenea</i>	1	1 – 5	I
Columbidae	<i>Geopelia striata</i>	3	1 – 5	I
Columbidae	<i>Streptopelia chinensis</i>	3	1 – 5	I
Columbidae	<i>Treron olax</i>	2	1 – 5	I
Columbidae	<i>Treron vernans</i>	1	1 – 5	I
Cuculidae	<i>Cacomantis merulinus</i>	1	1 – 5	-
Cuculidae	<i>Centropus bengalensis</i>	2	1 – 5	-
Cuculidae	<i>Centropus sinensis</i>	2	1 – 5	-
Caprimulgidae	<i>Caprimulgus macrurus</i>	1	1 – 5	-
Apodidae	<i>Apus affinis</i>	5	1 – 5	-
Apodidae	<i>Collocalia esculenta</i>	2	1 – 5	-



Family	Species	Observed No.	Estimated No.	Protection Status*
Picidae	<i>Picoides moluccensis</i>	1	1 – 5	I
Hirundinidae	<i>Hirundo rustica</i>	6	5 – 10	-
Hirundinidae	<i>Hirundo tahitica</i>	5	5 – 10	-
Artamidae	<i>Artamus leucorhynchus</i>	2	1 – 5	-
Campephagidae	<i>Lalage nigra</i>	1	1 – 5	-
Aegithinidae	<i>Aegithina tiphia</i>	1	1 – 5	-
Aegithinidae	<i>Aegithina viridissima</i>	1	1 – 5	-
Irenidae	<i>Chloropsis sonnerati</i>	1	1 – 5	-
Pycnonotidae	<i>Pycnonotus goiavier</i>	3	1 – 5	I
Pycnonotidae	<i>Pycnonotus plumosus</i>	2	1 – 5	I
Pycnonotidae	<i>Pycnonotus brunneus</i>	2	1 – 5	I
Pycnonotidae	<i>Pycnonotus zeylanicus</i>	3	1 – 5	II
Muscicapidae	<i>Copsychus saularis</i>	1	1 – 5	I
Timaliidae	<i>Trichastoma bicolor</i>	1	1 – 5	-
Sylviidae	<i>Megalurus palustris</i>	1	1 – 5	-
Sylviidae	<i>Orthotomus sericeus</i>	1	1 – 5	-
Sylviidae	<i>Orthotomus ruficeps</i>	1	1 – 5	-
Cisticolidae	<i>Prinia flaviventris</i>	1	1 – 5	-
Corvidae	<i>Rhipidura javanica</i>	1	1 – 5	-
Laniidae	<i>Lanius cristatus</i>	1	1 – 5	-
Sturnidae	<i>Aplonis panayensis</i>	1	1 – 5	I
Motacillidae	<i>Anthus rufulus</i>	1	1 – 5	-
Sturnidae	<i>Sturnus sinensis</i>	1	1 – 5	I
Nectariniidae	<i>Anthreptes malacensis</i>	1	1 – 5	-
Nectariniidae	<i>Hypogramma hypogrammicum</i>	2	1 – 5	-
Nectariniidae	<i>Nectarinia jugularis</i>	3	1 – 5	-
Nectariniidae	<i>Arachnothera longirostra</i>	1	1 – 5	-
Nectariniidae	<i>Prionochilus percussus</i>	1	1 – 5	-
Estrildidae	<i>Lonchura fuscans</i>	2	1 – 5	-
Estrildidae	<i>Lonchura malacca</i>	2	1 – 5	-
Passeridae	<i>Passer montanus</i>	2	1 – 5	-

\*Notes: (P) – Protected under Schedule 2, Part 1, Section 25(2) protected animals under Wildlife Conservation Enactment 1997, Sabah:

(NT) – Near Threatened; (VU) – Vulnerable; Species are classified under IUCN Red Data List, 2006:

Appendix I (CITES) – species threatened with extinction. Trade in specimens of these species is permitted only in exceptional circumstances

Appendix II (CITES) – species not necessarily threatened with extinction, but in which trade must be controlled in order to avoid utilization incompatible with their survival

Appendix III (CITES) – contains species that are protected in at least one country, which asked other CITES Parties for assistance in controlling the trade.

(CITES = Convention on International Trade in Endangered Species of Wild Flora and Fauna)