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Citation: *AIP Conference Proceedings* **1744**, 020056 (2016); doi: 10.1063/1.4953530

View online: <https://doi.org/10.1063/1.4953530>

View Table of Contents: <http://aip.scitation.org/toc/apc/1744/1>

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The Diversity of Bird Species that are Traded in the Bird Market in the City of Bogor, Indonesia

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Abstract. Local community in Bogor is currently practicing bird-keeping as a hobby. Birds itself has a special attraction until now. There are many endangered and protected birds that are still sold and traded. Research on the types of birds which are sold and traded in Bogor should be conducted to determine the number and bird species, including protected and endangered species. Research using random sampling method were administered on two markets. Market research area consists of Bogor Market, Empang St. Market, Anyar Market and the Merdeka Market. It was recorded that 54 species of the 24 tribes of were found in Bogor bird markets. Bogor bird markets' diversity index is relatively high with $H' = 4.158$. Dominant species is parakeets/*Burung Parkit (Melopsittacus undulatus)* with ID = 9.053. Protected bird species *Burung Madu Hitam (Nectarinia aspasia)* and *Burung Madu Belukar (Anthreptes rhodolaema)* of the tribe Nectariniidae, *Burung Raja Udang Meninting (Alcedo meninting)* of the tribe Alcedinidae and *Burung Tiong Emas (Gracula religiosa)* were recorded. Conservation status of the traded birds is: CR (Critically Endangered) for *Ekek Geling (Cissa thalassina)* and VU (Vulnerable) for *Gelatik Jawa (Padda oryzivora)* and *Cucak rawa (Pycnonotus zeylanicus)*.

Keywords: Bogor bird market, conservation, diversity, endangered, protected.

INTRODUCTION

Biodiversity loss has become one of the biggest environmental issues in the late 20th century. Biodiversity is the entire diversity of life found on earth, including genes, species, ecosystems and ecological processes. Biodiversity loss has reached a dangerous level [1]. Increasing world population growth has led to pressure on natural resources, including biodiversity, with the advancement of technology development for present exploitation of natural resources. One of the biodiversity that is affected is the bird population because of the exploitation of its economic value; it is inevitable that nature in the status of damage [2].

Conservation of the biodiversity is very important in relation to economics and ethics. There are many plants and wildlife which is utilized for economics and human advantages [1]. One of the components of biodiversity which should be preserved is birds. The presence and diversity of birds contribute to human life, especially to the people in Bogor who practices bird-keeping as hobby. Birds have its own charm for bird-keepers communities and collectors because their voice is melodious, their feathers are colorful and their behavior is interesting. These enticing characteristics drive people to search and buy bird at the bird market. In the Bogor birds markets, birds are sold because they have their own appeal. There are many threatened and protected birds are traded; thereby encouraging authors to do some research on the types of birds marketed in Bogor city. Herewith, the number and the diversity of traded birds in Bogor can be determined, including endangered and protected species and become an input to the government, in particular, Conservation and Animal Rescue Organization.

MATERIALS AND METHODS

The study was conducted in the markets of birds in Bogor, Indonesia (Merdeka Market, Anyar Market, Bogor Market and Empang St. Market). The research was carried out for four months from February to April 2013. The material used was bird species in the bird market in the city of Bogor. The tool used is a digital camera, stationery, booklets and bird identification guidebooks.

Direct observation conducted in Bird Market in Merdeka Market, Anyar Market, Bogor Market and Empang St. Market. The sampling was conducted randomly from each store in each location were taken two stores to the survey, interviews with traders, species of birds in the portrait, in the image and the calculated amount. Interview was conducted in four villages with 39 respondents to identify market linkages birds with the bird-keeping community. Identification of birds was conducted using bird identification books written by MacKinnon [2], van Balen [3] and Coates [4].

Diversity of birds is determined using Shannon-Wiener formula [5]:

$$H' = - \sum P_i \ln P_i \quad (1)$$

H' = The value of diversity

P_i = n_i / N

\ln = Natural logarithm

TABLE 1. The magnitude of the diversity index types according to Shannon-Wiener defined

H' Value	The Amount of Species Diversity
< 1	Low
1–3	Medium
> 3	High

Dominant bird species is determined based on Helvoort [6]:

$$ID = n_i / N \times 100 \% \quad (2)$$

ID = dominant index of a kind

n_i = Number of individuals of a species

N = The number of individuals of all types

TABLE 2. Criteria for determining dominant species based on Helvoort [6]

ID	Determination of Dominance
(0 to 2) %	Not Dominant
(2 to 5) %	Subdominant
> 5 %	Dominant

RESULTS AND DISCUSSIONS

Type Birds Found

Table 3 showed that there were 54 species of 24 tribes of birds traded in sampling location.

TABLE 3. Birds found in bird market

Family/Tribes	Local Name	Scientific Name	Author	E.St	A	B	M
Aegithinidae	Cipoh jantung	<i>Aegithina viridissima</i>	Bonaparte, 1850	10		2	
Alaudidae	Branjangan langit kecil	<i>Alauda gulgula</i>	Franklin, 1831	5	1		4
Alcedinididae	Raja udang meninting	<i>Alcedo meninting</i>	Horsfield, 1821			1	

Continued on next page

Table 3 Continued

Family/Tribes	Local Name	Scientific Name	Author	E.St	A	B	M
Chloropsidae	Cica daun besar	<i>Chloropsis sonnerati</i>	Jardine & Selby, 1827	2	2		
	Cica daun sayap biru	<i>Chloropsis cochinchinensis</i>	J. F. Gmelin, 1789	1			
Cisticolidae	Prenjak padi	<i>Prinia inornata</i>	Bonaparte, 1850	7	1	8	8
Columbidae	Merpati kipas	<i>Columba sp</i>	Temminck, 1811			1	
	Perkutut jawa	<i>Geopelia striata</i>	Linnaeus, 1766	2	1	5	5
Corvidae	Ekek geling	<i>Cissa thalassina</i>	Temminck, 1826				1
	Gagak kampung	<i>Corvus macrorhynchos</i>	Wagler, 1827			1	
	Tangkar ongklet	<i>Platylophus galericulatus</i>	Cuvier, 1816	1		1	
Dicruridae	Srigunting batu	<i>Dicrurus paradiseus</i>	Cabanis, 1851		1		
	Srigunting kelabu	<i>Dicrurus leucophaeus</i>	Vieillot, 1817				1
Estrilidae	Bondol peking	<i>Lonchura malacca</i>	Linnaeus, 1766			18	
	Gelatik jawa	<i>Padda oryzivora</i>	Linnaeus, 1758			3	
Fringilidae	Kenari	<i>Serinus canaria</i>	Linnaeus, 1758	6	5	13	4
	Kenari blackthroat	<i>Serius atrogularis</i>	A. Smith, 1836	1			
Irenidae	Kacembang gadung	<i>Irena puella turcosa</i>	Walden, 1870				2
Laniidae	Bentet kelabu	<i>Lanius schach</i>	Horsfield, 1821	2		2	1
Muscipidae	Kucica hutan	<i>Copsychus malabaricus</i>	Vieillot, 1818	6	10	5	2
	Kucica kampung	<i>Copsychus saularis</i>	Horsfield, 1821		3	2	
	sikatan kepala abu	<i>Culicicapa ceylonensis</i>	Oberholser, 1923			1	
Nectariniidae	burung madu belukar	<i>Anthreptes rhodolaema</i>	Shelley, 1878	2			
	Burung madu hitam	<i>Nectarinia aspasia</i>	Lesson, 1827			8	
Oriolidae	Kepudang kuduk hitam	<i>Oriolus chinensis</i>	Vieillot, 1817	1		1	
Paridae	Gelatik batu kelabu	<i>Parus major cinereus</i>	Vieillot, 1818	11		7	10
Ploceida	Manyar tempua	<i>Ploceus philippinus infortunatus</i>	E. J. O. Hartert, 1902			26	
Psiitacidae	Katsuri kepala hitam	<i>Lorius lory</i>	Linnaeus, 1758			1	
	Love bird	<i>Agapornis fischeri</i>	Reichenow, 1887	13	1	2	
	Nuri coklat	<i>Chalcopsitta duivenbodei</i>	A. J. C. Dubois, 1884		1		
	Nuri kalung ungu	<i>Eos squamata</i>	Boddaert, 1783			1	
	Parkit	<i>Melopsittacus undulatus</i>	Shaw, 1805	4		35	5
Pycnonotidae	Brinji gunung	<i>Iole virescens</i>	Blyth, 1845	4			
	Cucak kuning	<i>Pycnonotus melanicterus</i>	J. F. Gmelin, 1789	4			2
	Cucak kutilang	<i>Pycnonotus aurigaster</i>	Vieillot, 1818	8	1	3	
	Cucak rawa	<i>Pycnonotus Zeylanicus</i>	J. F. Gmelin, 1789				1
	Empuloh janggut	<i>Alophoixus bres</i>	Lesson, 1831	3			6
	Merbah cerukcuk	<i>Pycnonotus goiavier analis</i>	Horsfield, 1821	4			
	Merbah gunung	<i>Pycnonotus flavescens</i>	Blyth, 1845			2	

Continued on next page

Table 3 Continued

Family/Tribes	Local Name	Scientific Name	Author	E.St	A	B	M
Sturnidae	Jalak bahu putih	<i>Sturnus sinensis</i>	J. F. Gmelin, 1788			2	10
	Jalak suren	<i>Sturnus contra jalla</i>	Horsfield, 1821	15	7	12	1
	Kerak jambul	<i>Acridotheres cristatellus</i>	Linnaeus, 1766	1			
	Kerak kerbau	<i>Acridotheres javanicus</i>	Cabanis, 1851	4		5	
	Kerak ungu	<i>Acridotheres tristis</i>	Linnaeus, 1766	9	1	9	5
	Perling kumbang	<i>Aplonis panayensis strigata</i>	Horsfield, 1821	4		6	
Sylviidae	Tiong emas	<i>Gracula religiosa</i>	Linnaeus, 1758		2		
	Cinenen kelabu	<i>Orthotomus atrogularis</i>	Temminck, 1836	3			
Timaliidae	Cica kopi melayu	<i>Pomatorhinus montanus</i>	Horsfield, 1821		1		
	Poksai genting	<i>Garrulax mitrata</i>	S. Müller, 1836	1			
Turdidae	Poksai jambul	<i>Garrulax leucolophus</i>	Hardwicke, 1815	2			
	Tepus gelagah	<i>Timalia pileata</i>	Horsfield, 1821			5	
	Anis kembang	<i>Zoothera interpers</i>	Temminck, 1828	7	1		
	Anis merah	<i>Zoothera citrina rubecula</i>	Gould, 1836		1		1
Zosteropidae	Berkecet biru	<i>Erichacus cyane</i>	Pallas, 1776	6			
	Kacamata gunung	<i>Zosterops montanus</i>	Bonaparte, 1850	17		6	17

Notes : E. St = Empang St. Market

B = Bogor Market

A = Anyar Market

M = Merdeka Market

There were 34 species of birds found at Empang St. Market. Common species found was *Burung Kacamata (Zosterops Montanus)* with a total of 17 times encounter, followed by *Burung Jalak Suren (Sturnus contra)* with 15 times the encounter. There were 31 species of 19 tribes found in Bogor Market. Parakeet (*Melopsittacus undulatus*) was the most common species encountered in the Bogor Market with 35 individuals, followed by *Burung Manyar tempua (Ploceus philippinus)* with 26 individuals. There were 19 species of birds from 16 tribes found in Merdeka Market. Glasses mountain (*Zosterops Montanus*) was the most common species in Merdeka Market with 17 times encounter, followed *Burung Gelatik Batu Kelabu (Parus major)* and *Burung Jalak Bahu Putih (Sturnus sinensis)* with 10 times encounter. There were 17 species of 13 tribes found in Anyar Market. The most common species in Anyar Market was *Burung Kucica Hutan (Copsychus malabaricus)* with 10 times encounter and *Burung Jalak suren (Sturnus contra)* with 7 times encounter.

Diversity Index

TABLE 4. Diversity index of each location in Bogor bird markets

Location	Number of species	Total number of individuals	$H' = - \sum P_i \ln P_i$
Bogor Market	31	194	1.259
Empang St. Market	34	166	1.397
Merdeka Market	19	86	1.122
Anyar Market	17	40	1.051

According to Melati [5], total diversity of bird species in Bogor bird markets is very high with $H' = 4.158$ (Table 4). According to the Avian Wealth of Indonesia recorded by Indonesian Bird, there are 1 594 species of birds identified in Indonesia. According to Iskandar [7], diversity of flora and fauna in Indonesia cannot be separated from the four major factors:

- Large areas. Indonesia is the 4th largest area in the world with a total area of approximately 8×10^6 square kilometers with a land area of 1.9×10^6 square kilometers.
- Geographical situation. Indonesia is an archipelago which is separated far apart; encouraging formation new species

- Location of Indonesia lies between the two biogeographic regions, namely Indo-Malaya in the west and Australia to the east, so that the composition of flora and fauna is a combination of flora and fauna of two areas.
- Diverse ecosystem, including the coast to the mountains, with total number of 47 ecosystems types

Dominance Index

There are six species dominating the bird market in Bogor:

- Parkit (*Melopsittacus undulatus*) ID = 9.053 %
- Kacamata gunung (*Zosterops montanus*) ID = 8.230 %
- Jalak suren (*Sturnus contra*) ID = 7.202 %
- Kenari (*Serinus canaria*) ID = 5.761 %
- Gelatik batu kelabu (*Parus major*) ID = 5.761 %
- Manyar tempua (*Ploceus philippinus*) ID = 5.350 %

According to Helvoort [6], $ID \geq 5\%$ indicates dominant species.

Estimated Origin of Bird

Survey results from the merchants reveal that most birds in the Bogor bird markets are wild-caught birds. Among 54 species found, 50 species were wild-caught birds and four species are captive bred birds. Thus, bird-keeping practice directly and indirectly affects bird population in the wild and leads to the extinction. Wild-caught birds are dominated by local Javanese birds with total number of 42 species. There are only two migratory birds, namely *Branjangan langit kecil* (*Alauda gulgula*) and *Burung Jalak bahu putih* (*Sturnus sinensis*), which come from eastern region where parrots dominate the land. Local residents mostly maintain wild-caught birds; thereby affecting the number of bird populations in the wild. If the capture of birds from the wild persists, the bird species will be extinct

Bird Selling Price

Bird selling price in four survey sites in Bogor reached IDR Rp52 330 (note: 1 USD = IDR 9 686) . Highest selling price was found in *Anis Merah* (*Zoothera citrina*) with IDR 2×10^6 and *Burung Kucica hutan* (*Copsychus malabaricus*) with IDR 1.7×10^6 . This high selling price happens because the birds are mature and adaptable to the new environment with high physical endurance. Birds selling price also depends on the supply of bird feeding, the maintenance of birdhouse and the manufacture of bird-keeping properties [8].

Bird Conservation

Birds Threatened Status in Nature

There are three endangered species found in four bird markets in Bogor: *Burung Gelatik Jawa* (*Padda oryzivora*) and *Burung Cucak Rawa* (*Pycnonotus zeylanicus*) which are included in the IUCN category as Vulnerable (VU) species; and *Burung Ekek Geling* (*Cissa thalassina*) which is categorized as Critically Endangered (CR) species. Vulnerable (VU) and Critically Endangered (CR) status indicate that these birds are at high risk of extinction in the wild. Bird hunting of *Burung Gelatik Jawa* is very rapid because the feathers is used to produce coat, while songbird *Burung Cucak Rawa* is captured from the wild because their distinctive voice worth high price in the market. In addition to these, deforestation also causes habitat loss to this species.

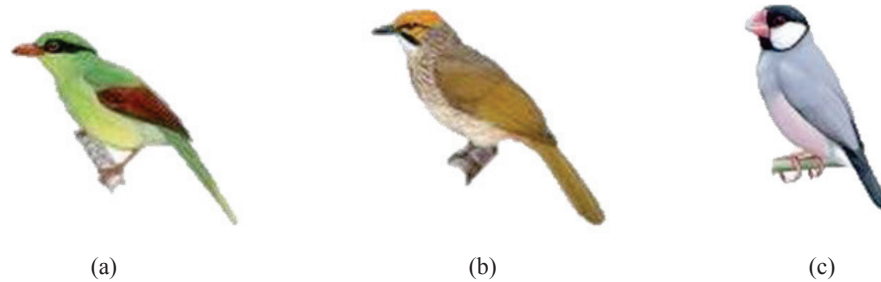


FIGURE 1. (a) *Ekek geling* (*Cissa thalassina* Temminck, 1826); (b) *Cucak rawa* (*Pycnonotus zeylanicus* J. F. Gmelin, 1789); (c) *Gelatik jawa* (*Padda oryzivora* Linnaeus, 1758).

Protected Birds According to Indonesia Regulatory Policies

Among 54 types of bird species found in this study, there are several species of protected birds listed in Government Regulation Number 7 Year 1999. Those protected birds are *Burung Madu Hitam* (*Nectarinia Aspasia*) and *Burung Madu Belukar* (*Anthreptes rhodolaema*) from tribe Nectariniidae in which all species of tribe/family Nectariniidae are protected by the government; *Burung Raja Udang Meninting* (*Alcedo Meninting*) from tribe Alcedinidae in which all species of tribe/family Alcedinidae are also protected by the Indonesia policies; and *Burung Tiong Emas* (*Gracula religiosa*).

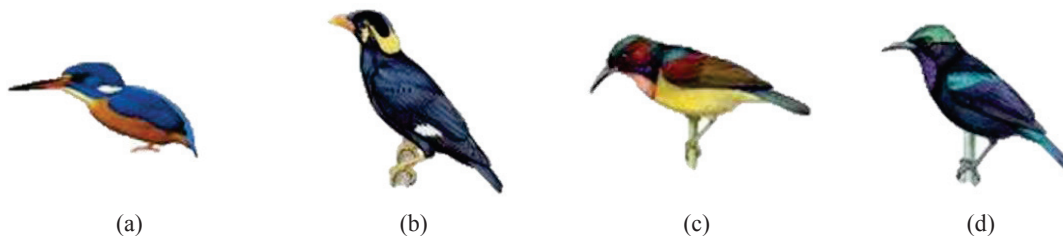


FIGURE 2. (a) *Burung Raja Udang Meninting* (*Alcedo meninting* Horsfield, 1821); (b) *Burung Tiong Emas* (*Gracula religiosa* Linnaeus, 1758); (c) *Burung Madu Belukar* (*Anthreptes rhodolaema* Shelley, 1878); (d) *Burung Madu Hitam* (*Nectarinia Aspasia* Lesson, 1827).

The present study shows that bird species which are considered as endangered species by the IUCN is not protected by local government, for instance *Burung Ekek Geling* (*Cissa thalasinna*) with Critically Endangered (CR) status; *Burung Gelatik Jawa* (*Padda oryzivora*) and *Burung Cucak Rawa* (*Pycnonotus zeylanicus*) with Vulnerable (VU) status [9].

Natural Bird Feeding

Eating is a consistent series of motion in searching and selecting feed [10]. In the present study, birds captured in the wild eat natural food in their habitat. Most bird traders had already replaced this natural food with artificial feed (pellets). Results of this research reveals that there is 19 species of frugivores (eating fruits and seeds), one type of carnivores (meat eaters), 31 species of Insectivora (insect eaters) and two species nectarivore (flower nectar eaters) in their natural habitat. Bird community is one component in maintaining the balance and preservation of nature. These roles can be reflected from the position tropic they occupy as an example. If insectivorous birds trading persist, ecological imbalance will happen as population of insects increases [11]. This also happened in Central Java when there was caterpillar outbreak due to the decreased number of caterpillar eating birds, such as *Burung Ciblek* (*Prinia familiaris*) or ‘prenjak’ and weaver ants. Weaver ants’ eggs was also hunted to feed the insectivorous birds which captured by the bird traders [12].

CONCLUSION

Based on the diversity of bird species traded in Bogor bird markets, it can be concluded that there were 54 types of birds have been found in four locations in Bogor, namely Merdeka Market, Anyar Market, Bogor Market and Empang St. Market. Bird diversity index in Bogor bird markets showed high diversity with $H' = 4.158$. The types of birds protected by Indonesian policies but still found in bird market were *Burung madu hitam* (*Nectarinia aspasia*), *Burung madu belukar* (*Anthreptes rhodolaema*), *Burung Raja udang meninting* (*Alcedo meninting*) and *Burung Tiong emas* (*Gracula religiosa*). Types of endangered birds in bird markets with the status Critically Endangered (CR) were *Ekek geling* (*Cissa thalassina*), while in the category Vulnerable (VU) were *Gelatik jawa* (*Padda oryzivora*) and *Cucak rawa* (*Pycnonotus zeylanicus*).

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