

MIDDLE MAHAKAM CONSERVATION PROGRAM

Bird diversity surveys and conservation status assessment of the lesser adjutant in the Middle Mahakam Lakes and Wetlands Area in East Kalimantan, Indonesia, 2005-2007



YAYASAN KONSERVASI RASI

**Sponsored by the Nederlandse Stichting voor Internationale Vogelbescherming,
Global Nature Fund & the Oriental Bird Club**

PREFACE AND ACKNOWLEDGEMENTS

This technical report presents results of four monitoring surveys, which were conducted between 2005 and 2007 in the Middle Mahakam River area (including lakes and wetlands) in East Kalimantan, Indonesia to assess total bird diversity. Additionally, an interview survey was conducted in 2007 of the total numbers and species of (protected) birds captured, held in captivity, traded or consumed. This research is part of the larger “Middle Mahakam Conservation Program”, which is an ongoing research and conservation program executed by Yayasan Konservasi RASI since 1999 in cooperation with the East Kalimantan Nature Conservation Agency (BKSDA Kaltim) and local Governments (West and Central Kutai Districts). The data within this report are still under revision and should not be cited without prior permission of the first author.

Surveys were conducted by Budiono, Rafidha Agustina, Syachraini, Agus Soeyitno, Lusiana Patandung, Firman Abadi, Nur Leli Yusliati, Caroline Wilcock and Pete Tighe. Analyses were performed by Budiono, Rafidha Agustina, Agus Soeyitno and Daniëlle Kreb. We would like to thank everyone and our boatmen, Masman and Pak Acoh very much for their hard work. We also would like to thank Christian Gönner and Vincent Nijman for their help in bird species identification.

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Budiono, Ir.

Executive Director/ Principal Investigator
Yayasan Konservasi RASI
P.O. Box 1105
Jl. Pandan Harum Indah
(Erlisa), Blok D, No. 87
Samarinda, Kalimantan Timur
Indonesia
Tel/ fax: + 62.541.206406/081347433450
E-mail: yk-rasi@samarinda.org
http://www.geocities.com/yayasan_konservasi_rasi

CONTENTS

	page
PREFACE & ACKNOWLEDGEMENTS	i
SUMMARY	1
INTRODUCTION	2
- <i>Background</i>	2
- <i>Historical Background of Project</i>	3
- <i>Project objectives</i>	3
METHODS	4
- <i>Bird diversity observation survey.</i>	4
- <i>Interview survey</i>	5
RESULTS	5
PART I. BIRD DIVERSITY ASSESSMENT SURVEYS	5
- <i>Species, numbers and habitat</i>	5
- <i>Species account and numbers per water condition.</i>	8
- <i>Breeding bird species</i>	9
PART II. INTERVIEW SURVEYS	10
DISCUSSION	11
- <i>Current species conservation status</i>	11
- <i>Threats</i>	11
- <i>Recommendations</i>	12
REFERENCES	12
APPENDICES	13
- <i>Appendix 1</i>	13
- <i>Appendix 2</i>	17
- <i>Appendix 3</i>	18
- <i>Appendix 4</i>	21

Bird diversity surveys and conservation status assessment of the lesser adjutant in the Middle Mahakam Lakes and Wetlands Area in East Kalimantan, Indonesia, 2005-2007

By Budiono, Rafidha Agustina, Daniëlle Kreb & Agus Soeyitno (Yayasan Konservasi RASI)

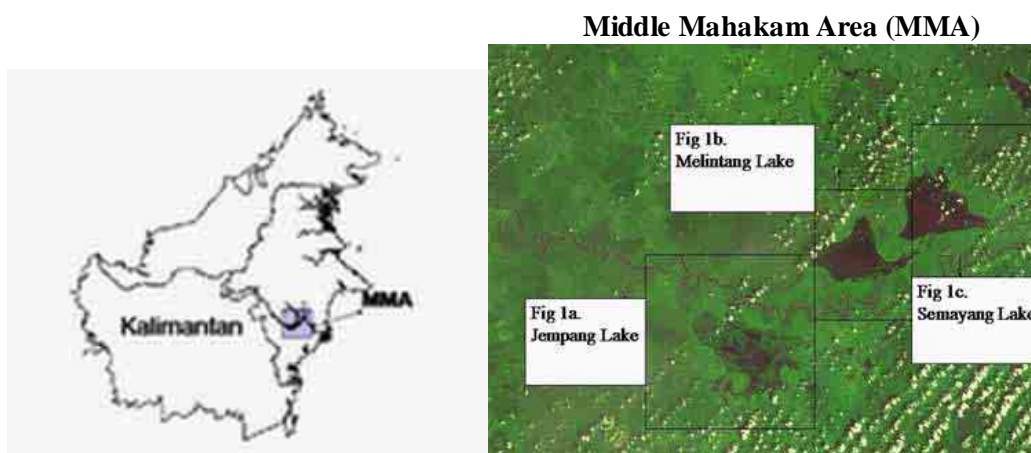
SUMMARY

A combination of observation and interview surveys were conducted in the Middle Mahakam River area (MMA) in East Kalimantan, Indonesia between 2005 and 2007 to assess total bio-diversity with a focus on avifauna, compare species and relative abundance composition during different water level conditions and assess the extent of bird captures from the wild with a focus on lesser adjutants. The survey area involved the river between Muara Kaman (180km from the mouth) and Melak (380km from the mouth) including the larger lakes of Semayang, Melintang and Jempang, several minor swamp (lake) areas and tributaries. Four diversity surveys were conducted between 2005 and 2007 at high, medium and low water levels during a total of 39 days covering a total distance of 3097 km and one interview survey on captivated birds. A total number of 91 bird species were positively identified during these four surveys of which 98% have been digitally portrayed. Most species and in the largest numbers were found in the lakes area (firstly in Jempang Lake), but when split to „micro“ habitat type, riparian forest (especially of tributaries) appeared to account for the largest total diversity of species followed by lake forest and open swamps. On the other hand, densities and total numbers of birds observed were significantly higher in (open swamp) lake habitat at all water levels (high, medium, low) compared to other habitats. Large numbers of cattle-, intermediate-, great-, and little egrets, Javan pond-herons, wandering whistling ducks, white-winged, black-naped and whiskered terns were found in the open swamps during all or particular seasons. Total bird abundance was highest during the dry season. Several bird species such as common sandpiper, black-winged and white-headed stilts, black-tailed godwit, brahminty kites, black-naped and whiskered terns like to feed on the mudflats that become exposed during the dry season (August-October). At least 17 species are known to breed in the MMA of which 13 species were observed with clear breeding plumage. Important nest sites for lesser adjutants and purple herons were identified in Metau Forest (west of Jempang Lake) and Tubuhan Lake (north of Semayang Lake), where juvenile birds are regularly caught from their nests whereas lesser adjutants are also often deliberately caught with fish hooks and fish bait. Based on interviews, we found that between 2000 and 2007 at least 527 lesser adjutants were caught from the wild and 281 purple herons. At least 207 captivated birds of 16 species were observed in the MMA during June 2006 of which eight species involve protected species. When combining our own surveys with field data of bird observations from other sources (C. Gonner; T. Boorsma, BEBSIC), between 1990 and 2007 a total of 298 bird species have been identified in the Middle Mahakam Area of which 70 species represent protected species. According to the IUCN Red List, 55 species are categorized as EN, CR, Vu or NT but only 22 of these threatened species are nationally protected, excluding protection for two endangered species, seven vulnerable species and 24 near-threatened species. Five endemic bird species for Kalimantan were recorded, i.e. dusky munia, and Bornean whistler, Bornean peacock-pheasant, Bornean blue-flycatcher and Bornean Bristlehead. Major threats to the bird communities in the Middle Mahakam Area at present are captures of wild birds at large scale such as wandering whistling ducks, lesser adjutants, purple herons and to a smaller extent several species of hens, eagles, egrets and others. Other important threats involve habitat loss due to forest fires, illegal logging and forest conversion of lowland, freshwater and peat swamp forest for agriculture, mining and oilpalm plantations. There is a need to raise local awareness about protected species, increase law-enforcement and effective habitat protection, especially of nesting areas.

INTRODUCTION

Background

The Middle Mahakam Area (MMA), which is located in the area between 180 km and 375 km upstream of the mouth of the Mahakam River (between 116° and 117° East and 0° to 0°30' South), is one of Kalimantan's largest wetland areas. It includes three major lakes (Jempang, Melintang and Semayang) and several minor lakes, peat and freshwater swamps, and major tributaries. The area is located in East Kalimantan in the Sundaland ecoregion and is part of the Mahakam River watershed, which is one of the major river systems of Kalimantan and runs from 118° east to 113° west and between 1° north and south.



The area of the Middle Mahakam Lakes (Danau Jempang: 116°12' E, 0°25' S) covers about 400,000 ha. The three largest lakes are Danau Jempang (15,000 ha in average), Danau Melintang (11,000 ha) and Danau Semayang (13,000). Due to alternating water levels the size of the lakes's water surface ranges from zero in extremely dry years (1982/83, 1991, 1994, 1997/98) to more than 60,000 ha. Their maximum depth is about 6-7m. Annual fluctuations can reach more than 6m. The Middle Mahakam Area (MMA) receives an average annual rainfall of 2,100-2,400 mm. Maximum temperatures range between 30-34°C, minimum temperatures between 22-24°C. The yearly average relative humidity is about 85%. The vegetation of the lakes (more than 86 aquatic plant species and genera) is dominated by floating weeds (mainly *Salvinia spec.* and *Eichhornia crassipes*, *Mimosa pigra* and *Polygonum barbatum*) (Gönnner, 2000).

The lakes and swamps in the MMA are very important fish-spawning grounds and replenish the main river seasonally. Therefore, the MMA is an area of intensive fishing activity with an annual average catch of 25,000 to 35,000 metric tons since 1970 (MacKinnon et al., 1997). To date the area has been the largest single supplier of dried freshwater fish for the island of Java, with between 6,000 and 9,000 tons being exported annually (MacKinnon et al. 1997). On a landscape level, the area plays an important buffer role for the natural regulation of the Mahakam River and also downstream human settlements. The swamp area of the lakes is surrounded by freshwater (periodic) swamp forests, peat swamp forests (mainly in the northern part) and lowland dipterocarp rain forests. There are several smaller freshwater swamp lakes and black-water tributaries that directly drain from the swamps. To the north of Melintang and Semayang Lakes, peat swamp forests were severely

affected by forest fires in 1998. Despite the enormous damage caused by recent forest fires, the MMA is still one of Kalimantan's most important wetland areas. A comparison of water birds between the MMA and Negara River in South-Kalimantan (van Balen & Prentice 1997) or Tanjung Puting National Park (Nash & Nash 1988) highlights the MMA's importance as a crucial breeding and migration site for 90 waterbird species, including important breeding populations of various herons and the Lesser Adjutant (*Leptoptilos javanicus*). Breeding was also noted for the Little Tern (*Sterna albifrons*), and the White-headed Stilt (*Himantopus leucocephalus*), which appear to be the first breeding record for Borneo (Gönner, 2000, Gönner 2005 pers. comm.). Several thousand wandering whistling-ducks, waders and terns, both from the Oriental as well as from the Austral region, visit the MMA on their annual migration. The preservation of these wetlands and lakes is of not only national but also international biodiversity importance in terms of migrating and breeding bird species in these areas. The MMA, besides representing an area of high fish and bird diversity (at least 98 freshwater fish species identified by WIIP in 2000), is also home to a significant number of endangered mammals (including 10 primate species), such as the endemic Proboscis Monkeys (*Nasalis larvatus*) and the wild Banteng (*Bos javanicus*). Two species of crocodiles (*Crocodylus siamensis* and *Tomistoma schlegeli*) are found in the marshes (Cox, 1993). The MMA is also the area which is most frequented by Indonesia's single freshwater dolphin species, the Critically Endangered Irrawaddy dolphin (*Orcaella brevirostris*) of which the population is estimated to consist of only 70 individuals (Kreb et al., 2007)

Historical Background of Project

This current project builds on earlier biodiversity assessment surveys conducted by YK-RASI. In 2001, YK-RASI conducted a preliminary survey on the status of various bird species with particular reference to the Lesser Adjutant, but also on two crocodile species, Siamese Crocodile and False Gaviel in collaboration with Global Nature Funds (GNF) (Budiono, 2001). Between 1999 and 2002, as well as in 2005 intensive monitoring surveys were conducted to detect abundance and identify core dolphin areas by Kreb (2005) and YK-RASI. In 2005 YK-RASI also conducted an assessment of important fish spawning areas sponsored by GNF. The surveys are part of the Middle Mahakam Conservation Program that started in 2000 and initially focused mainly on monitoring of the critically endangered freshwater dolphin population and its threats, as well as raising environmental awareness of fishermen and schoolchildren with reference to the dolphins and sustainable use of fish- and natural resources in general. Protection of the lakes and wetlands may considerably contribute to the protection of fish resources of important dolphin areas that connect with these lakes. The current and planned activities of YK-RASI focus on the protection of the lakes and wetlands areas as well as important river areas through integrated/participatory spatial planning management. The program is being executed by the local NGO Yayasan Konservasi RASI (YK-RASI) in collaboration with Wetlands International Indonesia Program (WIIP).

Project objectives

This project is part of the larger „Middle Mahakam Conservation Program“, which has been conducted by YK-RASI since 2000 and is an ongoing program to protect the unique middle Mahakam lakes and wetlands area, which is one of Kalimantan's largest wetland areas. The general goal is to establish a well-supported (scientifically, politically and socially) and legally-enforceable spatial plan for critical wetland, lake and river habitat with regards to extractive, restricted and prohibitive use of natural resources, and protected areas for birds, spawning fish and freshwater dolphins.

The detailed objectives of the biodiversity surveys, which primarily focus on avifauna are to: 1) Assess and compare species diversity during different seasons, 2) Locate biodiversity hotspots with a specific focus on avifauna, 3) Locate important bird breeding and feeding sites, 4) Disseminate results and propose (seasonal) non-disturbance zones based on the results of the first 3 objectives to local government and communities, 5) Assess the extent of protected wildlife captures and trade, 6) Increasing the awareness of local community on the protected status of several bird species that occur in the Middle Mahakam Lakes and Wetlands

METHODS

Bird diversity observation survey

Four observation surveys were conducted in the Middle Mahakam Lakes area in April/ May and September 2005, September 2006 and June 2007 at high, low, very low and medium waterlevels, respectively and lasting each 7, 8, 14 and 10 days respectively. at high and low water level conditions, which lasted 7 and 8 days, respectively. The medium to high-water level surveys (MHWL) covered the main river between Muara Kaman (c. 180 km from the mouth) and Melak (c. 350 km from the mouth), tributaries Kedang Rantau, Kedang Kepala, Belayan, Kedang Pahu, Sebintulung, Berangan, Enggelam, Rebaq Rinding, Minta, Baroh, Bolowan, Bongan, Jelau, Nayan, Liang, Ohong and the lakes Semayang, Melintang, Jempang, Siran, Wis, Tubuhan, Tempatung, Perian, Kedang Murung, Liang and Abit (Figure 1). Total distance searched by two survey teams during the MHWL survey was 1795 km. The low-water level (LWL) surveys covered the main river area between Muara Kaman and Muara Bunyut (c. 330 km from the mouth), including tributaries Kedang Rantau, Belayan, Kedang Pahu, Enggelam, Rebaq Rinding, Baroh, Keliran, Aloh, Bolowan, and the lakes of Semayang, Melintang, Jempang dan Tempatung. Some tributaries and lakes that were surveyed at during the MHWL surveys could not be accesses or partially such as the tributaries of Baroh and Bongan, and the lakes of Danau Siran, Perian, Keliran, Abid, Wis dan Tubuhan. Total distance searched during the LWL surveys is 1302 km. anak sungai Kedang Rantau, Belayan, Kedang Pahu, Enggelam, Rebaq Rinding, Baroh, Keliran, Aloh, Bolowan, serta Danau Semayang, Melintang, Jempang dan Tempatung

The first MHWL survey used 2 survey teams of 2 observers each, that surveyed different areas and the second MHWL survey used 2 survey teams of 3 observers each of which one team focused on birds held in captivity in villages and conducted interviews with the owners (see methods below for interview surveys). The LWL survey only used one survey team of 3 observers. The vegetation/ forest strips and mudflats along rivers, lakes, and wetlands were scanned from small motorized boats (12 -20 hp) traveling at an average speed of 16 km h⁻¹ following a pre-designed route between 7.30-17.30 hours. The observers searched the vegetation and trees both with the naked eye and by binoculars. During search effort, every 15 minutes, area (river, tributary, lake), time, GPS position, mean speed, cloud coverage (1-9), wind conditions (beaufort), sun reflection (%) was recorded. Every change of survey location was also recorded.

During the MHWL survey, lakes' forest edges were submersed and search effort was conducted by boat both within the forest and at the edges of the forest. During the LWL survey, the forest edges of the lakes were too far to observe from the boat due to aquatic vegetation blocking any boat passage (c. 500 m from the shore). Therefore, a total distance of 10 km in different representative areas of the lakes was surveyed by walking quietly towards and along the edges ususally in opposite wind direction. Also, when the distance of the boats to the mudfluts or swamp vegetation where birds gathered, was too large for positive species identification, one observer would walk until a good position for identification was obtained.

When a sighting of a bird or group of birds was made, we recorded its position, time, species names, estimated total numbers (using best, low and high estimate ranges), numbers of juveniles and

adults (only during the second survey), their behaviour (feeding, flight, roosting, rest, etc), breeding or non-breeding plumage, name of location, global habitat type (lake, tributary, main river) and detailed habitat type (open water, mudflat, open swamp area (immersed sedge, grassland and aquatic vegetation), freshwater and peat-swamp forests). At every sighting, digital photographs were taken of each species using a digital Canon Eos 20D camera and 300mm/f4.0 lens for later identification. A direct, preliminary field identification was also made using a fieldguide for birds (MacKinnon *et al.* 2000) and mammals (Payne *et al.* 1985), including a description of plumage and other body characteristics. All field identifications were cross-checked by bird specialists (all by C. Goenner and some raptor species by V. Nijman) and only positive species identifications were included. 98% of all positive species identifications were digitally portrayed.

Interview survey

In June 2007, observation surveys were conducted in villages in the lakes and Middle Mahakam Area to assess the numbers and species of protected birds and lesser adjutant in particular that are caught from the wild every year. Since most captured birds were exposed on floating rafts along the river, the species and numbers could be directly identified. Fifty owners of lesser adjutants and purple herons were interviewed in a semi-structured interview and asked where, when, how and why the bird was captured.

RESULTS

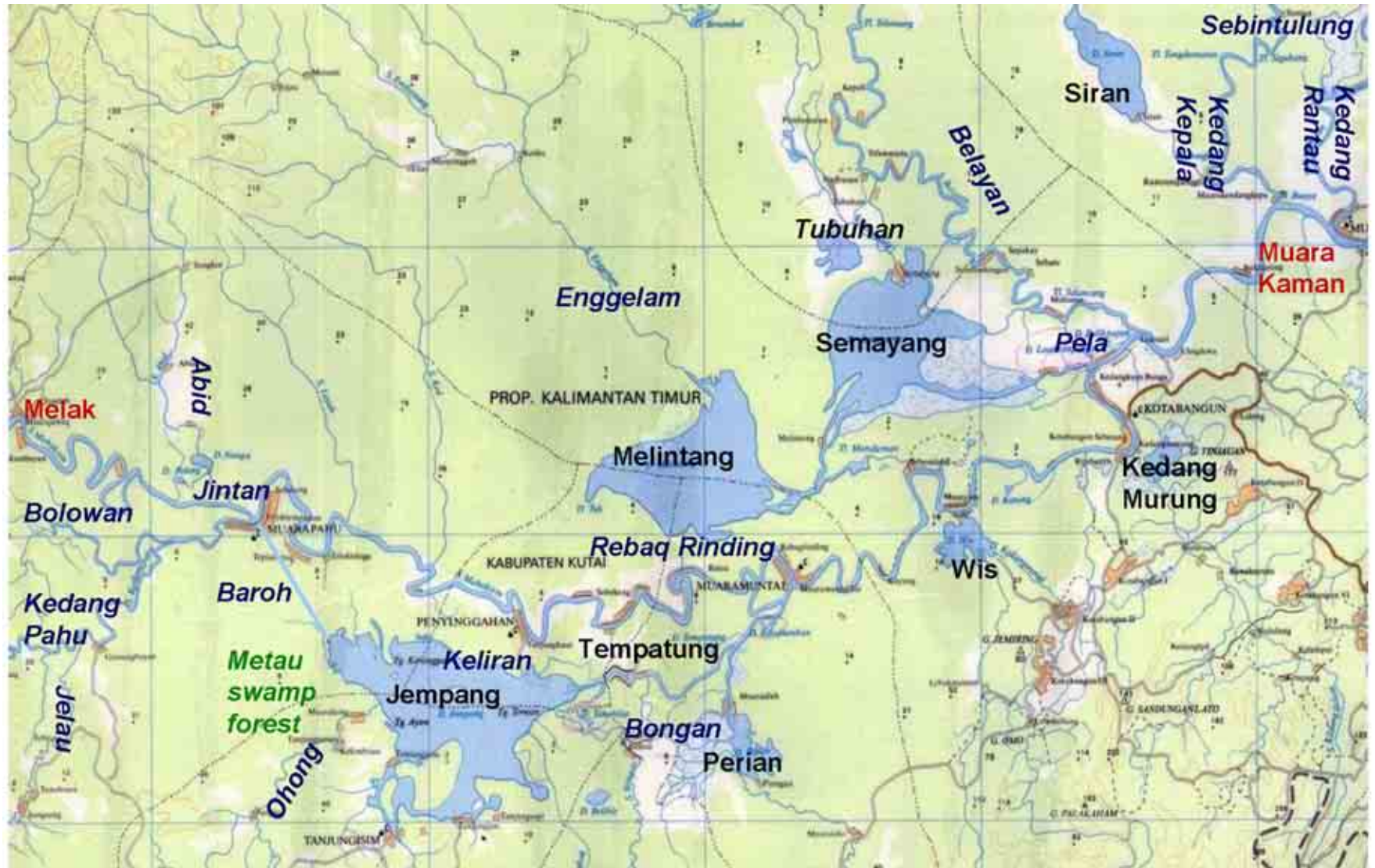
PART 1. BIRD DIVERSITY ASSESSMENT SURVEYS

Species, numbers and habitat

During the four bird monitoring surveys conducted between April 2005 and June 2007 at high, medium and low waterlevels, a combined total of 91 bird species were directly observed in the Middle Mahakam Area (Appendix 1). Highest diversity was observed in the lakes area including surrounding freshwater swamp forest where 64 bird species have been observed of which 47 species in Jempang Lake, 34 species in Melintang Lake and 22 species in Semayang Lake (Appendix 2). Other lakes with significant bird presence are Tempatung Lake (20 species), Siran Lake (16 species), Tubuhan Lake (13 species), Wis Lake (15 species). The lakes' bird communities included eight species of herons, bittern, and egrets; three duck species, five eagle/falcon species, four crakes and rail species, three tern species, kingfisher, darter, swiftlet, lesser adjutant, dove, swallow, woodpecker, sparrow, starling, jacana and one group of the rare white-shouldered ibis in flight. Species commonly encountered (≥ 6 times) in and around the lakes are black-nest swiftlet, purple heron, intermediate egret, cattle egret, great egret, little egret, javan pond-heron, common sandpiper, lesser adjutant and oriental darter. Species which have been observed in largest numbers in the lakes are javan pond-heron, wandering whistling-duck, common sandpiper, great egret, cattle egret, intermediate egret, purple heron, whiskered tern, black-naped tern and brahminy kite. When looking at the species diversity, most species in the lakes habitat were encountered in the surrounding lake forest (32), then open swamp (29), open water (14) and mudflat (5) (Table 1).

The bird community of the riparian forest along the Mahakam River and its tributaries consisted of 80 species in total, whereas the highest numbers of species were observed in the tributaries (62 species in total) as follows: Kedang Rantau (31 species), Belayan (24 species), Baroh (24 species), Liang (20 species), Ohong (18 species), Bolowan (18 species), Kedang Kepala (17 species), Kedang Pahu (13 species), Jintan (13 species), Enggelam (12 species), Rebaq Rinding (10 species), Abid (7 species), Jelau (4 species), Sebintulung (3 species). In the main Mahakam River 37 species were observed including three species of kingfishers, four species of hornbills, six species of eagles, black-thighed falconet,

Figure 1. Map of Middle Mahakam River with survey locations.



oriental darter, glossy swiftlet, Javan pond-heron, lesser adjutant, storm's stork, green imperial pigeon, spotted-dove, lesser coucal, Asian koel, three species of malkohas are chesnut-breasted malkoha, chesnut-bellied malkoha, and Raffles's malkoha, black-and-red broadbill, pacific swallow, four species of woodpeckers are grey-capped woodpecker, grey-and-buff woodpecker, Sunda woodpecker and white-bellied woodpecker, drongos, pied fantail, magpie robin, pied bushchat, old world flycatchers, Bornean whistler, and starling.

Birds that were most often sighted (n= >6 times per survey) along the rivers and tributaries are stork-billed kingfisher, cattle egret, brahminy kite, changeable hawk-eagle, oriental darter, chesnut-breasted malkoha, oriental pied hornbill, magpie robin, Pacific swallow, spotted-dove, and glossy swiftlet. During the LWL survey of September 2006 large numbers of oriental darters were observed in the riparian forest of tributaries.

Table 1. Total numbers, species and relative abundance of birds per habitat and water level condition/ season

Bird species										
LWL	OS		LF		OW		M		RF	
	Sep-05	Sep-06	Sep-05	Sep-06*	Sep-05	Sep-06	Sep-05	Sep-06	Sep-05	Sep-06
Total numbers	2322 (1641-3017)	21712 (558-31500)	607 (538-654)	111	637 (471-802)	2735 (543-2162)	1186 (1100-1275)	85	249	1600
Relative abundance (%)	46%	83%	12%	0,50%	13%	10%	24%	0,50%	5%	6%
Total species	10	18	18	7	6	10	5	2	26	36
HWL/MWL	OS		LF		OW		M		RF	
	Apr-05	June-07	Apr-05	June-07	Apr-05	June-07	Apr-05	June-07	Apr-05	June-07
Total numbers	2286 (2001-2596)	2828 (600-2850)	67 (62-71)	35	14	43			228 (219-236)	392 (24-400)
Relative abundance (%)	88%	86%	3%	1%	1%	1%			8%	12%
Total species	19	24	12	11	7	2			36	50
Total species at 4 surveys combined	29		32		14		7		80	

N.B. : HWL = High water level; MWL = Medium water level; LWL = Low water level; OS = Open swamp (immersed sedge and grasslands; aquatic vegetation); LF = Lakes (freshwater/peat swamp) forest ; OW = open water including single trees, logs etc; RF = Riparian forest (rivers and tributaries); M = Mudflat, * During the extended dry season in 2006 large lake forest areas were inaccessible for observation and number of species and individuals in this habitat probably underestimated

The largest numbers of birds were observed during the extended dry season in 2006 in the lakes (Table 1). During this season but also during both high and medium water levels in April/May 2005 and June 2007, the greatest majority of birds were found in the open swamps, which had not been dried up and contained a lot of fish prey, in contrast to the mudflats which dried up during the 2006 survey but which was the second preferred habitat during the average dry season of 2005 as they still contained some water. Several bird species such as common sandpiper, black-winged and white-headed stilts, black-tailed godwit, brahminy kites, black-naped and whiskered terns were feeding on these mudflats.

Regarding species diversity, when combining all surveys and looking at "micro-habitat type", the largest diversity was observed in riparian forest (80 species), especially tributaries (where diversity was nearly twice as much, i.e. 62 species as in the main river, i.e. 37 species), then lake forest (32 species), open swamps (29 species), open water (14 species) and mudflats (7 species) (Table 1). The high diversity in riparian forest applied for all waterlevels. When looking at the lakes habitat during the LWL surveys, the total number of species were more or less equally distributed over the open swamps

and lakes forest (except for the extended dry season in 2006, when large lake forest areas were inaccessible for observation and species in this habitat probably underestimated), whereas during the high and especially medium water levels highest diversity in the lakes was found in the open swamps.

When looking at bird species density in terms of numbers of bird species per km transect surveyed, during high and medium water, most species per km transect were found in the lakes, although for medium water a nearly equal number of birds per km were encountered in the lakes and tributaries (Table 2). At low water levels a higher species density was found for rivers or tributaries, which may be an underestimation due to the fact that not all representative areas could be reached. Densities of individual birds encountered per km transect correspond with the earlier statement of total numbers encountered, which is significantly largest in the lakes.

Table 2. Species and individual sighting rates (mean numbers/ km transect surveyed) per habitat and water level condition.

HABITAT	HWL		MWL		LWL		LWL	
	Apr-05		Jun-07		Sep-05		Sep-06*	
	Bird density of species and individuals							
	Species density	Individual density	Species density	Individual density	Species density	Individual density	Species density	Individual density
	mean N/km	mean N/km	mean N/km	mean N/km	mean N/km	mean N/km	mean N/km	mean N/km
Main River	0,8	9	0,2	5	2,6	10	0,2	2,4
Lakes	6,1	118	3,6	161	1,9	166	3,6	837
Tributaries	1,3	37	3,5	39	2	70	5,2	290
n species	53		62		41		54	
n sightings	139		381		177		204	
Total estimates best	2.572 (2278-2996)		3.344 (18-3514)		6.798 (5191-8580)		26.182 (1131-34662)	
Relative species occurrence (%)	46%		54%		43%		57%	
Relative abundance (%)	43%		57%		21%		79%	

* During the extended dry season in 2006 large lake-forest areas were inaccessible for observation and number of species and individuals in the lakes probably underestimated

Species account and numbers per water condition

During the HWL and MWL surveys, the highest numbers of bird species were identified, i.e. 53 and 62 bird species, whereas during the LWL surveys 41 and 54 bird species were identified (Table 2). During medium and high-water levels access was greatly facilitated for observing birds in freshwater forest strips surrounding the lakes, whereas at low water levels several forest strips could not be accessed by boat and some representative areas were accessed by foot, although others remained inaccessible if the muddy soil was too deep and observers got stuck. Therefore, the actual total number of species is suspected to be higher during the dry season due to easier food access in the shallow lakes, grasslands and extensive mudflats. Especially, during the extensive dry season in 2006, which lasted from June until December, waterlevels dropped drastically and most parts of the lakes fell dry or were between 0.1-1m deep. This condition greatly facilitated the access to food for some species, in particular birds. However, also the number of individuals during the dry water surveys may be underestimated due to the earlier mentioned inaccessibility of some areas.

Species that were encountered during the HWL survey in relatively large numbers and absent or observed in very small numbers during the MWL and LWL surveys are the little egret (except MWL: 25% of HWL still present), savannah nightjar and white-winged tern, which is a northern migrant on its passage to Australia during northern winter (Appendix 3). During the MWL survey in June 2007, largest numbers of wandering whistling ducks, black-headed munias and changeable hawk eagles were encountered of which the latter were mostly in the dark phase. Migratory and partially resident species that were encountered during the LWL surveys (in particular the extremely dry season in 2006) in significantly, relatively larger numbers than during the MWL and HWL survey in the shallow lakes or narrow tributaries to feed on fish, are the great egret, intermediate egret, the Javan pond heron, oriental darter, purple heron and cattle egret although this latter species was also observed in similar large numbers during the HWL survey and first LWL survey in 2005. Common sandpipers, which are northern migrants during the autumn, were only observed during the LWL survey in 2006. Possibly, during the LWL survey in 2005 waterlevels were not low enough yet. Black-naped terns and whiskered terns were encountered in largest numbers during the first LWL survey in 2005, but they were also significantly present during the HWL survey in April, May 2005, with a lowest presence during the MWL survey in June 2007. Whiskered terns in the MMA are migrants from both northern and austral origin.

Breeding bird species

At least 13 species were observed with breeding plumages or observed while nesting in the MMA during particular seasons (see Appendix 3). Species with easily observable breeding plumages are presented in Table 3. Other species known to breed without clear breeding plumages, include the purple heron, grey-headed fish-eagle, Wallace’s hawk eagle, wandering whistling duck and brahmny kite, of which the latter was observed mating during the first HWL survey, March-April 2005. According to interviews, the largest numbers of nesting sites of purple herons are in Tubuhan Lake and in other parts of the three large Lakes, Semayang, Melintang and Jempang. Juvenile herons were caught from nests at several locations (see Part II, this report) during March, April and May. The grey-headed fish eagle was observed nesting during the MWL survey June 2007. Also, Wallace’s hawk eagle was observed with changed plumage (new feathers replacing old feathers) during MWL and LWL surveys, June-September. Wandering whistling ducks did not show any change of plumage but many pairs were observed during high water (Soeyitno, pers.comm.). Lesser adjutants were observed nesting in June-July (own observations and interviews). Based on interview surveys we found that the largest nesting site is situated in the area of Metau Forest, which is situated some 11 km inwards from the western shore of Jempang Lake. According to reliable information from local informants, in June 2006, c. 60 nest of lesser adjutants occurred in this area, mostly in the kahoi tree (*Shorea balangeran*). In addition, our own observation team observed from a large distance around 18 individual birds positioned in trees in this area.

Table 3. Percentage of bird populations observed in breeding plumage during different seasons.

	HWL- May 2005	MWL-June 2007	LWL-Sept 2005	LWL-Sept 2006
Species	% breeding	% breeding	% breeding	% breeding
Javan pond-heron	10-20%	40-55%	30%	0-20%
Intermediate egret	20-25%	80%	30%	60-70%
Cattle egret	20-25%	40%	40%	30%
Great egret	30-40%	60-70%	20%	50%
Whiskered tern	30-40%	30-40%	20%	20%
White-winged tern	30-40%	30-40%	20%	20%
Lesser adjutant	0	80%	25-35%	25-35%

Juveniles were observed for twenty-seven species including: five eagle/ kite species, four egret species, two heron species, four tern species, three rail species, wrinkled hornbill, spotted dove, little green pigeon, lesser adjutant, oriental darter, pintail snipe, black-tailed godwit, glossy swiftlet, and wandering whistling ducks (Appendix 3).

PART II: INTERVIEW SURVEYS

Interviews were held and observations made of captivated birds between 8 and 17 June in 29 villages in eight sub-districts within Central Kutai and West Kutai District by motorized vessel. We observed a total number of 207 individual birds of 16 species, which were caught from the wild (Table 4). The most numerous were purple herons (57), wandering whistling ducks (one location only – 43), lesser adjutants (39), black-crowned night herons (16) and white-breasted water hen (14) and others. Most birds were unprotected (73%) including eight species, and 57 birds involved protected species, including lesser adjutants, brahminy kites, great egrets, black eagles and the following CITES Appendix 2 listed species: little egrets, changeable hawk eagles, white-bellied fish eagles and oriental darters.

Table 4. Captivated birds observed during the interview survey in June 2007.

Observed Captivated Birds (June 2007)			Numbers	Protected Status		IUCN Red List Category			CITES
Common Name	Latin Name	Indonesian Name		Yes	No	VU	NT	LC	
Purple heron	<i>Ardea purpurea</i>	Cangak merah	57		v			v	
Lesser adjutant	<i>Leptoptilos javanicus</i>	Bangau tongtong	39	v		v			
Brahminy kite	<i>Haliastur indus</i>	Elang bondol	6	v				v	App.2
Little egret	<i>Egretta garzetta</i>	Kuntul kecil	2	v				v	
Great egret	<i>Egretta alba</i>	Kuntul besar	3	v				v	
Changeable hawk eagle	<i>Spizaetus cirrhatus</i>	Elang brontok	4	v				v	App.2
Common moorhen	<i>Gallinula chloropus</i>	Mandar batu	10		v			v	
White-breasted waterhen	<i>Amaurornis phoenicurus</i>	Kareo padi	14		v			v	
Wandering whistling duck	<i>Dendrocygna arcuata</i>	Belibis kembang	43		v			v	
Purple swampphen	<i>Porphyrio porphyrio</i>	Mandar besar	8		v			v	
Black-crowned night heron	<i>Nycticorax nycticorax</i>	Kowak-malam kelabu	16		v			v	
Buffy fish-owl	<i>Ketupa ketupu</i>	Beluk ketupa	1		v			v	App.2
White-bellied fish-eagle	<i>Haliaeetus leucogaster</i>	Elang Laut perut putih	1	v				v	App.2
Black eagle	<i>Ictinaetus malayensis</i>	Elang hitam	1	v		v			App.2
Oriental darter	<i>Anhinga melanogaster</i>	Pecuk-ular Asia	1	v			v		
Spotted dove	<i>Streptopelia chinensis</i>	Tekukur biasa	1		v			v	
			207						

NB. VU= Vulnerable; NT = Near Threatened; LC = Least Concern

All birds were listed with location and name of owner, whereas 32 owners of lesser adjutants and 18 owners of purple herons were interviewed more in detail. Based on this information, we found that between 2000 and 2007 at least 527 lesser adjutants were caught from the wild (2% involved purchases) and 281 purple herons (5% purchases). Only 7% lesser adjutants and 20% purple herons were alive until present and most birds had been captivated for one year now with exceptions of birds that have been held captive for 15 and 20 years now. Eighty percent were deliberately caught or purchased. Most lesser adjutants were caught as adults by means of fishing hooks (90% of total adjutants caught) or as juveniles from their nests (10%). The main location of capture is Metau Forest (93% of all adjutants), which at high water is temporarily flooded, where they are caught with underwater fishing hooks and usually killed if the bird is wounded or nearly dead and directly sold for meat or as pet if they are not badly wounded for c. Rp. 50.000 per individual. Here, they are also caught from their nest in the kahoi tree (*Shorea balangeran*) and raised as pet until they become adult. The reason of the respondents that

currently own a lesser adjutant is to keep them as pet (50%), hold them as pet until someone wants to buy it (41%), whereas 9% of respondents keeps the birds for own consumption at some stage. All owners claimed they did not know that the species is protected by law. Purple herons were for 100% caught as juveniles from their nets in the surrounding forest of the three large lakes and most of them in the small swamp lake Tubuhan in the northern section of Semayang Lake.

DISCUSSION

Current species conservation status

Total species account observed in the Middle Mahakam Area between 1988 and 2007 by different observers and their global and local status, are presented in Appendix 4. In total, 298 bird species have been observed in the MMA of which 95% are rarely observed. Fifty-one species enter in one of the IUCN (International Union for Conservation of Nature and Natural Resources) RedList categories, of which one Critically Endangered species, i.e. white-shouldered ibis, two Endangered species, i.e. Storm's stork, Bornean peacock-pheasant, 13 Vulnerable and 36 Near Threatened species. Only 22 species of these 55 species are nationally protected, excluding protection for two endangered species, seven vulnerable species and 24 near-threatened species.

Five endemic species were observed, i.e. dusky munia, Bornean blue-flycatcher, Bornean bristlehead, Bornean peacock-pheasant and Bornean whistler. Nevertheless, none of these endemic species are nationally protected but four species are listed on the CITES appendix.

Thirty-six bird species are listed on the most recent CITES (*Convention on International Trade in Endangered Species*) Appendix updated in June 2006 for Indonesia. Of 298 identified species in the Mahakam, four species are listed on Appendix 1, including peregrine falcon, Bornean bristlehead, helmeted hornbill and the white-bellied woodpecker. Thirty species of eleven families including: Accipitridae (all eagle species), Pandionidae (osprey), Falconidae (black-thighed falconet), Bucerotidae (all hornbill species, except for those in App.1), Strigidae (buffy fish-owl) and Ploceidae (Java sparrow), Pachycephalidae (Bornean whistler), Phasianidae (great argus dan and Bornean peacock-pheasant), Ploceidae (dusky munia), Psittacidae (blue-rumped parrot and long-tailed parakeet), Sturnidae (Asian glossy starling), whereas two species are listed on Appendix 3, i.e. crested fireback and mangrove whistler.

Threats

The following practices have impacted on birdlife in the Middle Mahakam area:

1. Deliberate catch of protected species (notably of lesser adjutants in large numbers) and an unsustainable catch of wandering whistling-ducks and purple herons that lack a protected status until present. Lesser adjutants and purple herons are both caught as juveniles from their nest sites but lesser adjutants are also purportedly fished with underwater hooks (pancing) with bait fish. Wandering whistling ducks are caught mainly by use of large mistnets but also with poison (pesticides, cyanide).
2. Accidental catch of birds in fishermen's gear (pancing, langit-langit)
Habitat and species diversity loss through forest conversion of lowland, freshwater and peat swamp forest for agriculture, mining and oilpalm plantations, forest fires and (illegal) logging.
3. Competition for fish resources for those bird species preying on fish during the dry season in the lakes, where fishing gear occupies most part of the lakes' remaining waters and also fish trawling takes place.

Recommendations

The preliminary results indicate that the Middle Mahakam rivers, lakes and wetlands area host a large variety of bird species of which a large proportion only occur in low numbers and some are threatened in their survival. Follow-up activities and recommendations will involve:

1. Increasing local awareness regarding protected species status by a.o. handing posters with protected bird (& mammal & reptile) species to the owners; post them at gather places and at schools;
2. Increase law-enforcement to prevent further catches by asking for cooperation of heads of villages to report new captures of protected species. Also, organize regular patrols and fine owners of newly captivated animals.
3. Organize a release action in cooperation with the local Nature Conservancy Agency (BKSDA) of protected birds, which are able to fly and possible chipping of those birds that have flight difficulties;
4. Conduct ground surveys in the important nesting areas of Metau and Tubuhan Forest, map coordinates and propose these areas as protected areas to prevent nest site captures.

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APPENDICES

Appendix 1. Bird species, observed numbers and location

No	Local Name	International Name	Family	Mean observed N per survey	Location
1	Cekakak Hutan Melayu	Rufous-Collared Kingfisher	Alcedinidae	2	Sungai Baroh
2	Elang Hitam	Black Eagle	Accipitridae	1	Sungai Kedang Rantau dan Danau Melintang
3	Elang Bondol	Brahminy Kite	Accipitridae	32	Mahakam, Danau Jempang, Sungai Rebak Rinding, Danau Semayang, Sungai Belayan, Sungai Sebintulung, Sungai Kedang Pahu, Sungai Jelau, Sungai Beloan, Sungai Baroh, Danau Melintang, Danau Wis, Sungai Enggelam, Sungai Kedang Kepala dan Danau Siran, Bukit Jering, Mahakam Hilir
4	Elang Brontok	Changeable Hawk-Eagle	Accipitridae	5 (1-14)	Mahakam, Sungai Kedang Rantau, Danau Jempang, Danau Tempatung, Danau Melintang, Danau Semayang
5	Elang Laut Perut Putih	Crested Serpent-Eagle	Accipitridae	1	Mahakam, Danau Jempang, Sungai Baroh, Danau Tempatung, Jantur, Sungai Aloh, Danau Melintang
6	Elang Ikan Kepala Kelabu	Grey-Headed Eagle	Accipitridae	4 (2-5)	Danau Melintang, Sungai Beloan, Danau Jempang, Sungai Enggelam, Sungai Kedang Rantau, Sungai Ohong, Danau Wis
7	Elang Ikan Kecil	Lesser Fish-Eagle	Accipitridae	1	Danau Melintang
8	Elang Ular Bido	Wallace's Hawk-Eagle	Accipitridae	3 (2-4)	Sungai Mancong
9	Elang Wallace	White-Bellied Fish-Eagle	Accipitridae	4 (1-6)	Sungai Kedang Rantau, Mahakam, Sungai Kedang Kepala, Sungai Belayan, Sungai Ohong
10	Raja Udang-meninting	Blue-eared Kingfisher	Alcedinidae	2 (2-3)	Sungai Jintan, Beloan, Sungai Baroh
11	Pekaka Emas	Stork-Billed Kingfisher	Alcedinidae	49 (3-89)	Mahakam, Sungai Baroh, Sungai Belayan, Sungai Rebak Rinding, Sungai Kedang Pahu, Sungai Beloan, Sungai Abid, Danau Tempatung, Danau Melintang, Sungai Enggelam, Danau Tubuhan, Sungai Sebintulung, Danau Jempang, Sungai Liang, Sungai Jintan, Sungai Ohong, Danau Kedang Murung, Sungai Kedang Rantau, Mahakam Hilir
12	Itik Gunung	Grey Duck	Anatidae	2	Danau Jempang
13	Itik Rumbai	Tufted Duck	Anatidae	2	Danau Jempang
14	Belibis Kembang	Wandering Whistling-Duck	Anatidae	893 (1-2116)	Mahakam, Danau Jempang, Danau Melintang, Danau Semayang, Danau Tubuhan, Danau Tempatung, Danau Siran, Danau Liang, Mahakam Hilir, Danau Wis
15	Pecuk Ular Asia	Oriental Darter	Anhingidae	28 (2-62)	Danau Semayang, Sungai Belayan, Danau Perian, Danau Tubuhan, Danau Jempang, Danau Melintang, Sungai Aloh, Sungai Beloan, Sungai Kedang Rantau, Danau Wis, Danau Tempatung, Sungai Jintan, Sungai Enggelam, Danau Siran, Danau Liang.
16	Walet Sapi	Glossy Swiftlet	Apodidae	132 (3-434)	Mahakam, Danau Jempang, Sungai Rebak Rinding, Danau Melintang, Sungai Beloan, Danau Tempatung, Sungai Enggelam, Sungai Kedang Kepala, Sungai Kedang Pahu, Sungai Liang, Sungai Kedang Rantau
17	Walet Sarang Hitam	Black-Nest Swiftlet	Apodidae	95	Danau Jempang, Tempatung, Melintang, Semayang, Sungai Pela, Liang
18	Bambangan Hitam	Black Bittern	Ardeidae	8 (2-13)	Mahakam Hulu, Danau Jempang, Danau Tempatung, Danau Wis, Mahakam Hilir
19	Kowak Malam Kelabu	Black-crowned Night-heron	Ardeidae	3 (1-6)	Mahakam, Danau Melintang, Sungai Rebak Rinding

20	Kuntul Kerbau	Cattle Egret	Ardeidae	288 (22-667)	Danau Jempang, Danau Tempatung, Danau Melintang, Danau Semayang, Sungai Kedang Kepala, Singai Kedang Rantau dan Danau Siran, Danau Wis, Sungai Belayan
21	Kuntul Besar	Great Egret	Ardeidae	1350 (42-5000)	Danau Melintang, Danau Jempang, Danau Tempatung, Danau Semayang, Sungai Kedang Kepala, Danau Tubuhan, Mahakam, Danau Siran dan Sungai Belayan, Danau Melintang, Sungai Pela, Danau Wis, Mahakam Hilir, Sungai Liang
22	Kuntul Perak	Intermediate Egret	Ardeidae	1036 (1-5500)	Danau Jempang, Danau Melintang, Danau Semayang, Danau Tempatung, Danau Siran dan Sungai Kedang Kepala, Sungai Kedang Rantau, Danau Kedang Murung, Danau Wis, Mahakam Hilir, Sungai Belayan
23	Blekok Sawah	Javan Pond-Heron	Ardeidae	4066 (140-15000)	Danau Jempang, Danau Tempatung, Danau Melintang, Sungai Belayan, Danau Wis, Danau Semayang, Danau Tubuhan, Sungai Sebintulung dan Danau Siran, Sungai Pela, Singai Liang, Sungai Kedang Rantau, Muara Kedang Kepala
24	Kuntul Kecil	Little Egret	Ardeidae	66 (10-205)	Mahakam, Danau Jempang, Danau Semayang, Sungai Belayan, Sungai Kedang Kepala, Danau Siran dan Daanau Wis, Danau Melintang, Mahakam Hilir, Sungai Belayan, Sungai Kedang Rantau
25	Cagak Merah	Purple Heron	Ardeidae	41 (10-89)	Danau Jempang, Danau Melintang, Danau Semayang, Danau Tempatung, Jantur, Danau Perian dan Danau Siran, Sungai Enggelam, Muara Kedang Kepala, Sungai Kedang Rantau, Sungai Ohong
26	Bambangan Coklat	Schrenk's Bittern	Ardeidae	3 (1-4)	Jantur, Danau Jempang, Danau Kedang Murung, Danau Wis,
27	Kokokan Laut	Striated Heron	Ardeidae	1	Mahakam Hulu dan Hilir (Muara Muntai)
28	Kekeb Babi	White-breasted Wood-swallow	Artamidae	4	Danau Jempang, Mahakam Hulu (Muara Pahu)
29	Kangkareng Hitam	Asian Black Hornbill	Bucerotidae	1	Sungai Baroh
30	Kangkareng Perut Putih	Oriental Pied Hornbill	Bucerotidae	19 (2-20)	Mahakam, Sungai Baroh, Sungai Kedang Rantau, Sungai Jelau, Sungai Beloan, Sungai Abid, Sungai Belayan, Sungai Jintan, Sungai Liang, Sungai Kedang Kepala
31	Rangkong Badak	Rhinoceros Hornbill	Bucerotidae	1	Sungai Baroh
32	Julang-Jambul Hitam	Wrinkled Hornbill	Bucerotidae	3	Sungai Baroh
33	Kepudang Sumatra	Bar-bellied Cuckoo-shrike	Campephagidae	4	Sungai Kedang Rantau
34	Kepudang Gunung	Sunda Cuckoo-shrike	Campephagidae	1	Mahakam Hulu
35	Cabak Kota	Savannah Nightjar	Caprimulgidae	15 (2-38)	Danau Melintang, Sungai Pela, Danau Tempatung, Danau Kedang murung, Sungai Kedang Rantau
36	Bangau Tong-tong	Lesser Adjutant	Ciconidae	40 (6-68)	Mahakam, Danau Jempang, Danau Tempatung, Sungai Rebaq Rinding, Danau Melintang, Danau Wis, Danau Semayang, Sungai Belayan, Danau Tubuhan, Danau Siran, Sungai Kedang Kepala, Sungai Kedang Pahu, Sungai Beloan, Sungai Abid, Bukit Jering, Sungai Jintan, Sungai Ohong, Danau Kedang Murung, Sungai Liang, Sungai Kedang Rantau
37	Bangau Storm	Storm's Stork	Ciconidae	1	Sungai Beloan
38	Pergam Hijau	Green Imperial Pigeon	Columbidae	1 (1-2)	Mahakam, Sungai Rebaq Rinding
39	Punai Kecil	Little Green-Pigeon	Columbidae	3 (1-5)	Sungai Kedang Pahu dan Sungai Kedang Rantau
40	Tekukur Biasa	Spotted-Dove	Columbidae	8 (3-15)	Mahakam, Danau Jempang, Danau Tubuhan, Sungai Keliran, Sungai Rebaq Rinding, Sungai Belayan, Sungai Liang, Sungai Beloan, Danau Semayang, Mahakam Hilir, Sungai Kedang Kepala
41	Gagak Hutan	Slender-billed Crow	Corvidae	2	Sungai Beloan
42	Tuwur Asia	Asian Koel	Cuculidae	1	Sungai Baroh, Sungai Enggelam, Mahakam Hilir
43	Kadalan Saweh	Chesnut-bellied Malkoha	Cuculidae	1	Mahakam Hulu (Muara Pahu)

44	Kadalan Birah	Chesnut-Breasted Malkoha	Cuculidae	1	Sungai Rebak Rinding, Sungai Beloan
45	Bubut Alang-alang	Lesser Coucal	Cuculidae	5 (1-9)	Sungai Rebak Rinding, Sungai Mancong, Mahakam, Sungai Liang, Bukit jering, Sungai Baroh, Sungai Ohong, mahakam Hilir, Sungai Belayan, Sungai Kedang Rantau
46	Kadalan Selaya	Raffles's Malkoha	Cuculidae	1	Sungai Baroh
47	Srigunting Keladi	Bronzed Drongo	Dicruridae	2	Sungai Baroh
48	Srigunting Batu	Greater Racket-Tailed Drongo	Dicruridae	4 (1-8)	Sungai Belayan, Mahakam, Sungai Jintan
49	Sempur Hujan Sungai	Black-and-Red Broadbill	Eurylaimidae	3 (1-6)	Sungai Baroh, Sungai Liang, Sungai Jintan, Sungai Ohong, Sungai Enggelam
50	Alap-alap Capung	Black-Thighed Falconet	Falconidae	11 (7-15)	Mahakam Hulu, Sungai Belayan, Danau Melintang, Sungai Baroh, Danau Siran, Sungai Liang, Sungai Kedang Rantau, Muara Kedang Kepala, Mahakam Hilir
51	Alap-alap Kawah	Peregrine Falcon	Falconidae	3 (1-4)	Sungai Baroh , Sungai Keliran, Danau Tubuhan, Mahakam
52	Layang-layang Batu	Pacific Swallow	Hirundinidae	15 (2-31)	Danau Melintang, Sungai Beloan, Mahakam, Danau Jempang, Sungai Liang, Belayan, Sungai Kedang Rantau, Sungai Kedang Kepala, Sungai Kedang Pahu, Danau Jempang, Sungai Ohong
53	Sikatan Rimba Gunung	Eye-browed Jungle-flycatcher	Muscicapidae	1	Mahakam
54	Sikatan Melayu	Malaysian Blue-flycatcher	Muscicapidae	2	Sungai Ohong
55	Kipasan Belang	Pied Fantail	Muscicapidae	6 (4-8)	Mahakam Hilir, Sungai Jintan, Sungai Baroh, Sungai Ohong, Danau Tubuhan
56	Sikatan bodoh	Snowy-browed flycatcher	Muscicapidae	2	Sungai Beloan.
57	Kancilan Kalimantan	Bornean Whistler	Pachycephalidae	2	Mahakam Hulu (Muara Pahu)
58	Sempidan Biru	Crested Fireback	Phasianidae	1	Mahakam
59	Pelatuk Merah	Banded Woodpecker	Picidae	1	Danau Jempang
60	Caladi Tikotok	Grey-and-buff Woodpecker	Picidae	1	Sungai Mancong dan Sungai Ohong
61	Caladi Belacan	Grey-Capped Woodpecker	Picidae	2 (1-3)	Danau Jempang, Danau Melintang, Sungai Kedang Rantau, Sungai Ohong
62	Caladi Tilik	Sunda woodpecker	Picidae	1	Sungai Kedang Rantau
63	Pelatuk Ayam	White-bellied Woodpecker	Picidae	1	Sungai kedang Rantau, Mahakam Hulu, Sungai Ohong
64	Bondol Rawa	Black-headed Munia	Ploceidae	186 (61-350)	Mahakam, Sungai Liang, Bukit Jering
65	Burung Gereja Erasia	Eurasian Tree Sparrow	Ploceidae	6	Mahakam Hulu (Muara Pahu)
66	Gelatik	Java Sparrow	Ploceidae	20	Danau Jempang
67	Cucak Kelabu	Grey-bellied Bulbul	Pycnonotidae	1	Sungai Kedang Kepala
68	Mandar Batu	Coomon Moorhen	Rallidae	65 (56-83)	Danau Jempang, Danau Semayang, Danau Tempating, Danau Wis, Danau Siran, Sungai Belayan, Danau Tubuhan, Danau Melintang, Danau Liang.
69	Mandar Besar	Purple Swampphen	Rallidae	13 (1-18)	Danau Semayang, Danau Tempating, Danau Wis, Danau Jempang, Danau Liang
70	Tikusan Merah	Ruddy-Breasted Crake	Rallidae	1	Danau Jempang
71	Mandar-padi Erasia	Tri-Coloured Munia	Rallidae	2	Danau Melintang
72	Kareo Padi	White-Breasted Waterhen	Rallidae	5 (1-9)	Sungai Rebak Rinding, Danau Wis, Sungai Beloan, Danau Tubuhan, Mahakam, Sungai Belayan, Sungai Kedang Rantau, Danau Siran
73	Tikusan Alis Putih	White-Browed Crake	Rallidae	3 (1-5)	Danau Jempang
74	Gagang-bayam Belang	Black-winged Stilt	Recurvirostridae	2	Danau Jempang.
75	Gagang-bayam Timur	White-headed Stilt	Recurvirostridae	4	Danau Jempang.

76	Biru-laut Ekor-hitam	Black-tailed Godwit	Scolopacidae	11	Danau Jempang.
77	Trinil Kaki Merah	Common Redshank	Scolopacidae	1	Danau Jempang.
78	Trinil Pantai	Common Sandpiper	Scolopacidae	53 (1-156)	Sungai Rebaq Rinding, Mahakam, Sungai Kedang Pahu, Danau Jempang, Danau Semayang
79	Berkik Ekor Lidi	Pintail Snipe	Scolopacidae	2	Sungai Kedang Rantau
80	Trinil Rumbai	Ruff	Scolopacidae	1 (1-2)	Sungai Baroh, Danau Jempang, Danau Melintang
81	Cinenen Merah	Rufous-tailed Tailorbird	Silviidae	3 (2-4)	Sungai Rebaq Rinding, Sungai Jintan dan sungai Kedang Rantau
82	Dara Laut Tengkuluk Hitam	Black-Naped Tern	Sternidae	407 (6-977)	Danau Jempang, Danau Tempatung, Danau Melintang, Danau Semayang
83	Dara-laut Kecil	Little Tern	Sternidae	15	Danau Jempang
84	Dara Laut Kumis	Whiskered Tern	Sternidae	806 (135-1594)	Danau Jempang, Danau Tempatung, Mahakam, Danau Melintang, Danau Semayang, Sungai Rebaq Rinding, Sungai Kedang Rantau, Sungai Ohong, sungai Kedang kepala, danau Siran
85	Dara Laut Sayap Putih	White-Winged Tern	Sternidae	362	Danau Jempang, Danau Tempatung, Danau Melintang
86	Beluk Ketupa	Buffy Fish-owl	Strigidae	1	Danau Melintang
87	Jalak Suren	Asian Pied Starling	Sturnidae	3	Danau Melintang dan Sungai Abid
88	Burung Sepatu Jengger	Comb-crested Jacana	Tacanidae	4 (2-5)	Danau Tubuhan, Danau Jempang, Danau Liang
89	Ibis Karau	White-Shouldered Ibis	Threskiornithidae	6	Danau Jempang
90	Kucica Kampung	Magpie Robin	Turdidae	7 (2-13)	Sungai Rebaq Rinding, Mahakam Hulu (Muara Pahu), Sungai Baroh, Sungai Ohong, Sungai Bongan, Danau Melintang, Sungai Belayan, Sungai Liang, danau Siran
91	Decu Belang	Pied Bushchat	Turdidae	6 (3-8)	Mahakam, Sungai Kedang Pahu, Beloa dan Kedang Rantau, Sungai Jintan

Appendix 2. Number of bird species per location and survey

Central Kutai sub-district

Location	Number of species				
	HWL 05	MWL 07	LWL 05	LWL 07	Total
Mahakam	6	1	12	14	15
S. Jintan	-	-	5	-	13
S. Bongan	-	-	-	1	1
S. Rebaq rinding	5	9	8	2	10
S. Aloh	-	2	-	-	2
S. Enggelam	1	3	5	4	12
S. Belayan	9	5	9	11	24
S. Pela	-	-	5	-	5
S. Liang	-	-	14	7	20
S. Bukit jering	-	-	3	-	3
S. Kedang kepala	6	4	7	5	17
S. Subintulung	-	3	-	-	3
S. Kedang rantau	-	7	22	18	31
Desa Jantur	-	2	3	-	5
D. Melintang	7	15	15	13	34
D. Semayang	18	5	11	8	22
D. Tempatung	9	12	5	14	20
D. Perian	-	2	-	-	2
D. Kedang Murung	-	-	-	10	5
D. Wis	2	7	-	14	15
D. Tubuhan	-	11	-	2	13
D. Siran	10	2	-	13	16
D. Liang	-	-	-	6	5

West Kutai sub-district

Location	Number of species				
	HWL 05	MWL 07	LWL 05	LWL 07	Total
Kedang Pahu	2	3	5	2	18
Muara Jelau	2	-	-	-	5
Mahakam	14	15	9	17	28
S. Bolowan	-	9	7	8	16
S. Jintan	-	-	-	6	10
S. Abit	-	4	-	-	6
S. Baroh	7	-	-	12	12
S. Mancong	3	-	-	-	5
S. Ohong	-	-	-	18	24
S. Keliran	-	2	-	-	2
D. Jempang	21	19	26	19	47

S = Sungai (River); D = Danau (Lake)

Appendix 3. Identified species, number of sightings, best estimates, mean group size, presence of juveniles per survey/ waterlevel condition

(B= breeding (column-international); G = group size, A= Adult, K = Juvenile, n = no. of sightings)

No	INTERNATIONAL	FAMILY	n	N best estimate (min-max)	Mean G of best estimate	Age	n	N best estimate (min-max)	Mean G of best estimate	Age	n	N best estimate (min-max)	Mean G of best estimate	Age	n	N best estimate (min-max)	Mean G of best estimate	Age
AVES			(HWL) APRIL-MEI 2005				(MWL) JUNI 2007				(LWL) SEPTEMBER 2005				(LWL) SEPTEMBER 2006			
1	Black Eagle	Accipitridae	1	1	1	A	1	1	1	A	1	1	1	A	-	-	-	-
2	Brahminy Kite-B	Accipitridae	17	31	2 (1-4)	A/J	16	35 (1-35)	2 (1-4)	A/J	15	39	9 (1-15)	A/J	4	21	5 (1-12)	A/J
3	Changeable Hawk-eagle	Accipitridae	1	1	1	A	12	14	1 (1-2)	A/J	1	1	1	A	4	4	1	A/J
4	Crested Serpent-Eagle	Accipitridae	1	1	1	A	-	-	-	-	-	-	-	-	-	-	-	-
5	Grey-headed Fish-eagle-B	Accipitridae	2	2	1	A	5	5	1	A	2	2	1 (1-2)	A/J	4	5	1 (1-2)	A
6	Lesser Fish-Eagle	Accipitridae	1	1	1	A	-	-	-	-	-	-	-	-	-	-	-	-
7	Wallace's Hawk-eagle-B	Accipitridae	-	-	-	-	4	4	1	J	3	3	1 (1-2)	A/J	2	2	1	J
8	White-Bellied Fish-Eagle	Accipitridae	1	1	1	A	3	6	2 (1-3)	A	6	6	2 (1-3)	A/J	1	1	1	A
9	Blue-eared Kingfisher	Alcedinidae	-	-	-	-	2	2	1	A	-	-	-	-	2	3	2 (1-2)	A
10	Rufous-Collared Kingfisher	Alcedinidae	1	2	2	A	-	-	-	-	-	-	-	-	-	-	-	-
11	Stork-billed Kingfisher	Alcedinidae	3	3	1	A	25	65 (1-65)	3 (1-5)	A	12	38	2 (1-3)	A	13	89	7 (1-27)	A
12	Grey Duck	Anatidae	1	2	2	A	-	-	-	-	-	-	-	-	-	-	-	-
13	Tufted Duck	Anatidae	1	2	2	A	-	-	-	-	-	-	-	-	-	-	-	-
14	Wandering Whistling-Duck-B	Anatidae	1	1	1	A/J	16	2116 (1-2500)	132 (125-500)	A/J	4	1424 (1050-1799)	28 (7-150)	A/J	2	29	15 (4-25)	A/J
15	Oriental Darter	Anhingidae	2	2	1	A/J	12	21 (1-21)	2 (1-5)	A	10	27	3 (2-9)	A/J	10	62	6 (1-31)	A
16	Glossy Swiftlet	Apodidae	3	66 (61-70)	22 (5-50)	A	2	3	1 (1-2)	A/J	4	53	9 (1-20)	A	4	23	6 (2-15)	A
17	Black-nest Swiftlet	Apodidae	-	-	-	-	-	-	-	-	-	-	-	-	7	95	2	A
18	Black Bittern	Ardeidae	2	2	1	A	11	13	1 (1-2)	A	4	8	1 (1-2)	A	-	-	-	-
19	Black-crowned Night-heron	Ardeidae	1	1	1	A	1	1	1	A	4	6	1 (1-2)	A	-	-	-	-
20	Cattle Egret-B	Ardeidae	7	218 (205-231)	31 (1-55)	A/J	4	22	6 (2-10)	A/J	4	247 (200-368)	63 (50-75)	A/J	9	667 (250-1000)	74 (5-500)	A/J
21	Great Egret-B	Ardeidae	2	48 (46-51)	24 (1-47)	A/J	9	42 (1-45)	5 (1-15)	A/J	8	313 (270-338)	75 (8-212)	A/J	12	5000 (50-6000)	417 (50-650)	A/J
22	Intermediate Egret-B	Ardeidae	3	180 (174-189)	60 (55-61)	A/J	14	42 (1-45)	3 (1-110)	A/J	5	373 (310-384)	87 (6-156)	A/J	7	3550 (138-5500)	490 (287-760)	A/J
23	Javan Pond-Heron-B	Ardeidae	7	143 (159-176)	20 (1-112)	A/J	24	140 (1-250)	6 (1-47)	A/J	16	983 (620-1346)	50 (4-175)	A/J	18	15000 (150-18400)	200 (3-750)	A/J
24	Little Egret-B	Ardeidae	12	205 (194-216)	17 (1-55)	A/J	8	49 (1-50)	6 (1-20)	A/J	-	-	-	-	3	10	3 (1-7)	A/J
25	Purple Heron-B	Ardeidae	3	10	3 (1-7)	A/J	23	33 (1-35)	1 (1-3)	A/J	7	37	9 (2-15)	A/J	11	89	8 (1-30)	A/J
26	Schrenk's Bittern	Ardeidae	-	-	-	-	4	4	1	A	-	-	-	-	1	1	1	A

27	Striated Heron	Ardeidae	1	1	1	A	-	-	-	-	-	-	-	-	1	1	1	A
28	White-breasted Wood-swallow	Artamidae	-	-	-	-	-	-	-	-	-	-	-	-	1	4	4	A
29	Asian Black Hornbill	Bucerotidae	1	1	1	A	-	-	-	-	-	-	-	-	-	-	-	-
30	Oriental Pied Hornbill	Bucerotidae	6	11	2 (1-3)	A	10	20 (1-20)	2 (1-5)	A	6	14	3 (2-9)	A	10	31	3 (1-15)	A
31	Rhinoceros Hornbill	Bucerotidae	1	1	1	A	-	-	-	-	-	-	-	-	-	-	-	-
32	Wrinkled Hornbill	Bucerotidae	-	-	-	-	1	3	3	A/J	-	-	-	-	-	-	-	-
33	Bar-bellied Cuckoo-shrike	Campephagidae	-	-	-	-	1	1	1	J	-	-	-	-	1	4	4	A
34	Sunda Cuckoo-shrike	Campephagidae	1	1	1	A	-	-	-	-	-	-	-	-	-	-	-	-
35	Savannah Nightjar	Caprimulgidae	2	38 (36-40)	19 (1-35)	A	3	6	2	A	-	-	-	-	1	2	2	A
36	Lesser Adjutant-B	Ciconiidae	14	57	4 (1-15)	A/J	22	28	3 (1-5)	A/J	10	68	3 (1-10)	A/J	4	6	2 (1-2)	A/J
37	Storm's Stork	Ciconiidae	-	-	-	-	1	1	1	A	-	-	-	-	-	-	-	-
38	Green Imperial Pigeon	Columbidae	1	1	1	A	-	-	-	-	1	2	2	A	-	-	-	-
39	Little Green-Pigeon	Columbidae	1	1	1	A/J	-	-	-	-	1	5	5	A/J	1	4	4	A/J
40	Spotted-dove	Columbidae	3	3	1 (1-2)	A/J	7	10	1 (1-20)	A	6	15	2 (1-4)	A/J	2	5	3 (1-4)	A/J
41	Slender-billed Crow	Corvidae	-	-	-	-	1	2	2	A	-	-	-	-	-	-	-	-
42	Asian Koel	Cuculidae	1	1	1	A	2	2	1	A	-	-	-	-	-	-	-	-
43	Chesnut-bellied Malkoha	Cuculidae	-	-	-	-	1	1	1	A	-	-	-	-	-	-	-	-
44	Chesnut-breasted Malkoha	Cuculidae	-	-	-	-	1	1	1	A	1	4	4	A	1	1	1	A
45	Lesser Coucal	Cuculidae	1	1	1	A	7	9	1 (1-2)	A	1	2	1 (1-2)	A	4	6	2 (1-3)	A
46	Raffles's Malkoha	Cuculidae	-	-	-	-	1	1	1	A	-	-	-	-	-	-	-	-
47	Bronzed Drongo	Dicruridae	-	-	-	-	2	2	1	A	-	-	-	-	-	-	-	-
48	Greater Racket-tailed Drongo	Dicruridae	1	2	2	A	5	8	1 (1-3)	A	1	1	1	A	3	4	1 (1-2)	A
49	Black-and-red Broadbill	Eurylaimidae	1	1	1	A	5	6	1 (1-2)	A	-	-	-	-	1	1	1	A
50	Black-thighed Falconet	Falconidae	3	15 (10-19)	5 (1-15)	A	5	7	1 (1-2)	A	3	15	1 (1-2)	A	4	8	2 (1-5)	A
51	Peregrine Falcon	Falconidae	1	1	1	A	-	-	-	-	2	4	1 (1-2)	A	-	-	-	-
52	Pacific Swallow	Hirundinidae	-	-	-	A	10	31 (1-31)	3 (1-10)	A	1	2	2	A	4	27	7 (1-20)	A
53	Eye-Browed Jungle-Flycatcher	Muscicapidae	1	1	1	A	1	1	1	A	-	-	-	-	-	-	-	-
54	Malaysian Blue-flycatcher	Muscicapidae	-	-	-	-	2	2	1	A	-	-	-	-	-	-	-	-
55	Pied Fantail	Muscicapidae	-	-	-	-	6	8	1 (1-2)	A	-	-	-	-	1	4	4	A
56	Snowy-browed flycatcher	Muscicapidae	-	-	-	-	-	-	-	-	-	-	-	-	1	2	2	A
57	Bornean Whistler	Pachycephalidae	-	-	-	-	1	2	2	A	-	-	-	-	-	-	-	-
58	Crested Fireback	Phasianidae	1	1	1	A	-	-	-	-	-	-	-	-	-	-	-	-
59	Banded Woodpecker	Picidae	-	-	-	-	1	1	1	A	-	-	-	-	-	-	-	-
60	Grey-and-buff Woodpecker	Picidae	1	1	1	A	1	1	1	A	-	-	-	-	-	-	-	-

61	Grey-capped Woodpecker	Picidae	2	3	1 (1-2)	A	1	1	1	A	1	1	1	A	1	1	1	A
62	Sunda woodpecker	Picidae	-	-	-	-	-	-	-	-	1	1	1	A	-	-	-	-
63	White-bellied Woodpecker	Picidae	-	-	-	-	2	2	1	A	-	-	-		1	1	1	A
64	Black-headed Munia	Ploceidae	-	-	-	-	3	310 (4-350)	103 (4-300)	A	1	20	20	A	4	61	15 (5-40)	A
65	Eurasian Tree Sparrow	Ploceidae	-	-	-	-	4	6	1 (1-2)	A	-	-	-	-	-	-	-	-
66	Java Sparrow	Ploceidae	-	-	-	-	-	-	-	-	5	20	3 (1-5)	A	-	-	-	-
67	Grey-bellied Bulbul	Pycnonotidae	-	-	-	-	1	1	1	A	-	-	-	-	-	-	-	-
68	Coomon Moorhen	Rallidae	2	56	25 (20-29)	A/J	21	58 (1-58)	3 (1-11)	A/J	4	83	13 (10-15)	A/J	4	61	15 (2-24)	A/J
69	Purple Swampphen	Rallidae	3	18 (17-19)	6 (1-8)	A/J	7	17	2 (1-10)	A/J	5	17	13 (10-15)	A/J	1	1	1	A/J
70	Ruddy-Breasted Crake	Rallidae	1	1	1	A	-	-	-	-	-	-	-	-	-	-	-	-
71	Water Rail	Rallidae	-	-	-	-	-	-	-	-	1	1	1	J	-	-	-	-
72	White-breasted Waterhen	Rallidae	1	1	1	A	4	6	2 (1-3)	A	5	9	1 (1-2)	A	4	5	1 (1-2)	A
73	White-browed Crake	Rallidae	1	1	1	A	3	3	1	J	-	-	-	-	1	5	5	A
74	Black-winged Stilt	Recurvirostridae	-	-	-	-	-	-	-	-	-	-	-	-	1	2	2	A
75	White-headed Stilt	Recurvirostridae	-	-	-	-	-	-	-	-	-	-	-	-	1	4	4	A
76	Black-tailed Godwit	Scolopacidae	-	-	-	-	-	-	-	-	-	-	-	-	1	11	11	A/J
77	Common Redshank	Scolopacidae	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1	A
78	Common Sandpiper	Scolopacidae	-	-	-	-	1	1	1	A	1	2	2	A	10	156	16 (1-77)	A
79	Pintail Snipe	Scolopacidae	-	-	-	-	-	-	-	-	1	2	2	A/J	-	-	-	-
80	Ruff	Scolopacidae	1	1	1	A	1	1	1	A	-	-	-	-	1	2	2	-
81	Rufous-tailed Tailorbird	Silviidae	-	-	-	-	2	4	2	A	-	-	-	-	1	2	2	-
82	Black-naped Tern-B	Sternidae	3	397 (328-543)	132 (25-375)	A/J	2	6	3 (2-4)	A/J	5	977 (648-1464)	125 (75-175)	A/J	4	246 (124-492)	62 (25-125)	A/J
83	Little Tern-B	Sternidae	-	-	-	-	-	-	-	-	-	-	-	-	3	15	5 (2-11)	A/J
84	Whiskered Tern-B	Sternidae	4	659 (532-788)	165 (25-560)	A/J	19	135 (1-40)	7 (1-30)	A/J	6	1594 (1265-1956)	210 (50-500)	A/J	4	835 (419-1670)	209 (75-375)	A/J
85	White-Winged Tern-B	Sternidae	2	362 (293-431)	181 (6-312)	A/J	-	-	-	-	-	-	-	-	-	-	-	-
86	Buffy Fish-owl	Strigidae	-	-	-	-	1	1	1	J	-	-	-	-	-	-	-	-
87	Asian Pied Starling	Sturnidae	2	3	1 (1-2)	A	-	-	-	-	2	3	3	A	-	-	-	-
88	Comb-crested Jacana	Tacanidae	-	-	-	-	4	5	1 (1-2)	A	1	2	2	A	-	-	-	-
89	White-Shouldered Ibis	Threskiornithidae	1	6	6	A	-	-	-	-	-	-	-	-	-	-	-	-
90	Magpie Robin	Turdidae	-	-	-	-	11	13	1 (1-2)	A	-	-	-	-	1	2	2	A
91	Pied Bushchat	Turdidae	-	-	-	-	2	3	1 (1-2)	A	-	-	-	-	5	8	2 (1-3)	A
Total no. of sightings/ birds			140	2.573 (2055-2773)			381	3.344 (18-3514)			177	6.774 (4783-8127)			204	26.182 (1131-33062)		
Total Number of Bird Species			53				62				41				54			

Appendix 4. Bird species identified in the Middle Mahakam Area (MMA), their status (nationally protected, IUCN, CITES) and the observer source.

No	Latin name	International Name	IUCN Red List					MMA		National protection	CITES App.	Source					
			E N	N T	V u	C R	L C	Co	Ra	P		C. Gonner	T. Boorsma	RASI	BEBSIC		
	Accipitridae	Eagles															
1	<i>Haliastur indus</i>	Brahminy Kite										App. 2					
2	<i>Spizaetus cirrhatus</i>	Changeable Hawk-Eagle										App. 2					
3	<i>Ictinaetus malayensis</i>	Black Eagle										App. 2					
4	<i>Ichthyophaga humilis</i>	Lesser Fish-Eagle										App. 2					
5	<i>Ichthyophaga ichthyæetus</i>	Grey-Headed Fish-Eagle										App. 2					
6	<i>Haliaeetus leucogaster</i>	White-Bellied Fish-Eagle										App. 2					
7	<i>Elanus caeruleus</i>	Black-winged Kite										App. 2					
8	<i>Spilornis cheela</i>	Crested Serpent-Eagle										App. 2					
9	<i>Spizaetus nanus</i>	Wallace's Hawk-Eagle										App. 2					
10	<i>Accipiter trivirgatus</i>	Crested Goshawk										App. 2					
11	<i>Accipiter gularis</i>	Japanese Sparrowhawk										App. 2					
12	<i>Pernis ptilorhynchus</i>	Oriental Honey-Buzzard										App. 2					
	Aegithinidae	Ioras															
13	<i>Chloropsis sonnerati</i>	Greater Green Leafbird															
14	<i>Chloropsis cyanopogon</i>	Lesser Green Leafbird															
15	<i>Chloropsis cochinchinensis</i>	Blue-winged Leafbird															
16	<i>Aegithina viridissima</i>	Green Iora															
17	<i>Aegithina tiphia</i>	Common Iora															
	Alcedinidae	Kingfisher															
18	<i>Lacedo pulchella</i>	Banded Kingfisher															
19	<i>Halcyon pileata</i>	Black-capped Kingfisher															
20	<i>Actenoides concretus</i>	Rufous-Collared Kingfisher															
21	<i>Todirhamphus sanctus</i>	Sacred Kingfisher															
22	<i>Pelargopsis capensis</i>	Stork-Billed Kingfisher															
23	<i>Alcedo meninting</i>	Blue-eared Kingfisher															
24	<i>Alcedo atthis</i>	Common Kingfisher															
25	<i>Alcedo euryzona</i>	Blue-banded Kingfisher															
26	<i>Ceyx erithacus</i>	Black-backed Kingfisher															
27	<i>Ceyx rufidorsa</i>	Rufous-backed Kingfisher															
	Anatidae	Ducks															
28	<i>Dendrocygna arcuata</i>	Wandering Whistling-Duck															
29	<i>Anas querquedula</i>	Garganey															
30	<i>Anas superciliosa</i>	Grey Duck															
31	<i>Aythya fuligula</i>	Tufted Duck															
	Anhingidae	Cormorants															
32	<i>Anhinga melanogaster</i>	Oriental Darter															
	Phalacrocoracidae	Cormorants															
33	<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant															
	Apodidae	Swiftlets															
34	<i>Apus affinis</i>	Little Swift															
35	<i>Hirundapus giganteus</i>	Brown-backed Needletail															
36	<i>Rhaphidura leucopygialis</i>	Silver-rumped Swift															
37	<i>Hydrochous gigas</i>	Giant Swiftlet															
38	<i>Collocalia esculenta</i>	Glossy swiftlet															

No	Latin name	International Name	IUCN Red List					MMA		National protection	CITES App.	Source					
			E N	N T	V u	C R	L C	Co	Ra	P		C. Gonner	T. Boorsma	RASI	BEBSIC		
39	<i>Collocalia maxima</i>	Black-Nest Swiftlet															
40	<i>Collocalia fuciphaga</i>	Edible-nest Swiftlet															
41	<i>Cypsiurus balasensis</i>	Asian Palm-Swift															
	Ardeidae	Bitterns, Herons, Egrets															
42	<i>Ixobrychus eurhythmus</i>	Schrenk's Bittern															
43	<i>Ixobrychus flavicollis</i>	Black Bittern															
44	<i>Ixobrychus sinensis</i>	Yellow Bittern															
45	<i>Ixobrychus cinnamomeus</i>	Cinnamon Bittern															
46	<i>Ardeola speciosa</i>	Javan Pond-Heron															
47	<i>Ardea purpurea</i>	Purple Heron															
48	<i>Butorides striatus</i>	Striated Heron															
49	<i>Nycticorax nycticorax</i>	Black-crowned Night-heron															
50	<i>Egretta alba</i>	Great Egret															
51	<i>Egretta eulophotes</i>	Chinese Egret															
52	<i>Egretta garzetta</i>	Little Egret															
53	<i>Bubulcus ibis</i>	Cattle Egret															
54	<i>Egretta intermedia</i>	Intermediate Egret															
	Artamidae	Wood-Swallow															
55	<i>Artamus leucorhynchus</i>	White-breasted Wood-swallow															
	Bucerotidae	Hornbills															
56	<i>Anorrhinus galeritus</i>	Bushy-crested Hornbill										App. 2					
57	<i>Aceros undulatus</i>	Wreathed Hornbill										App. 2					
58	<i>Aceros corrugatus</i>	Wrinkled Hornbill										App. 2					
59	<i>Anthracoceros malayanus</i>	Asian Black Hornbill										App. 2					
60	<i>Anthracoceros albirostris</i>	Oriental Pied Hornbill										App. 2					
61	<i>Buceros rhinoceros</i>	Rhinoceros Hornbill										App. 2					
62	<i>Buceros vigil</i>	Helmeted Hornbill										App. 1					
	Campephagidae	Shrikes															
63	<i>Hemipus hirundinaceus</i>	Black-winged Flycatcher-Shrike															
64	<i>Lalage nigra</i>	Pied Triller															
65	<i>Coracina larvatus</i>	Sunda Cuckoo-shrike															
66	<i>Coracina striata</i>	Bar-bellied Cuckoo-shrike															
67	<i>Coracina fimbriata</i>	Lesser Cuckoo-Shrike															
68	<i>Pericrocotus flammeus</i>	Scarlet Minivet															
69	<i>Pericrocotus igneus</i>	Fiery Minivet															
	Capitonidae	Barbets															
70	<i>Calorhamphus fuliginosus</i>	Brown Barbet															
71	<i>Megalaima chrysopogon</i>	Gold-whiskered Barbet															
72	<i>Megalaima australis</i>	Blue-eared Barbet															
73	<i>Megalaima henricii</i>	Yellow-crowned Barbet															
74	<i>Megalaima rafflesii</i>	Red-crowned Barbet															
75	<i>Megalaima mystacophanos</i>	Red-throated Barbet															
	Caprimulgidae	Nightjars															
76	<i>Caprimulgus affinis</i>	Savannah Nightjar															
77	<i>Eurostopodus temminckii</i>	Malaysian Eared-Nightjar															
	Charadriidae	Plovers															
78	<i>Charadrius veredus</i>	Oriental Plover															

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			E N	N T	V u	C R	L C	Co	Ra	P		C. Gonner	T. Boorsma	RASI	BEBSIC		
79	<i>Pluvialis squatarola</i>	Grey Plover															
80	<i>Pluvialis fulva</i>	Pacific Golden-plover															
81	<i>Charadrius dubius</i>	Little Ringed Plover															
82	<i>Charadrius mongolus</i>	Mongolian Plover															
	Ciconiidae	Storks															
83	<i>Ciconia stormi</i>	Storm's Stork															
84	<i>Leptoptilos javanicus</i>	Lesser Adjutant															
	Columbidae	Pigeons, Doves															
85	<i>Chalcophaps indica</i>	Emerald Dove															
86	<i>Ducula aenea</i>	Green Imperial Pigeon															
87	<i>Ducula bicolor</i>	Pied Imperial-Pigeon															
88	<i>Treron fulvicollis</i>	Cinnamon-headed Green-Pigeon															
89	<i>Treron capellei</i>	Large Green-Pigeon															
90	<i>Treron vernans</i>	Pink-necked Green-Pigeon															
91	<i>Treron olax</i>	Little Green-Pigeon															
92	<i>Streptopelia chinensis</i>	Spotted-Dove															
	Coraciidae																
93	<i>Eurystomus orientalis</i>	Dollarbird															
	Corvidae	Crows															
94	<i>Corvus enca</i>	Slender-billed Crow															
95	<i>Platysmurus leucopterus</i>	Black Magpie															
96	<i>Pityriasis gymnocephala- E</i>	Bornean Bristlehead										App.1					
	Cuculidae	Malkohas, Cuckoos															
97	<i>Centropus bengalensis</i>	Lesser Coucal															
98	<i>Centropus sinensis</i>	Greater Coucal															
99	<i>Clamator coromandus</i>	Chestnut-winged Cuckoo															
100	<i>Phaenicophaeus curvirostris</i>	Chesnut-Breasted Malkoha															
101	<i>Phaenicophaeus javanicus</i>	Red-billed Malkoha															
102	<i>Phaenicophaeus sumatranus</i>	Chesnut-bellied Malkoha															
103	<i>Phaenicophaeus chlorophaeus</i>	Raffles's Malkoha															
104	<i>Cuculus sparverioides</i>	Large Hawk-Cuckoo															
105	<i>Cuculus micropterus</i>	Indian Cuckoo															
106	<i>Cuculus saturatus</i>	Oriental Cuckoo															
107	<i>Surniculus lugubris</i>	Drongo Cuckoo															
108	<i>Chrysococcyx xanthorhynchus</i>	Violet Cuckoo															
109	<i>Eudynamis scolopacea</i>	Asian Koel															
110	<i>Cacomantis merulinus</i>	Plaintive Cuckoo															
111	<i>Cacomantis sonneratii</i>	Banded Bay Cuckoo															
112	<i>Cacomantis sepulcralis</i>	Rusty-breasted Cuckoo															
	Dicaeidae	Flowerpeckers															
113	<i>Prionochilus xanthopygius</i>	Yellow-rumped Flowerpecker															
114	<i>Prionochilus percussus</i>	Crimson-breasted Flowerpecker															
115	<i>Dicaeum trigonostigma</i>	Orange-bellied Flowerpecker															
116	<i>Dicaeum cruentatum</i>	Scarlet-backed Flowerpecker															
117	<i>Dicaeum trochileum</i>	Scarlet-headed Flowerpecker															
118	<i>Dicaeum chrysortheum</i>	Yellow-vented Flowerpecker															

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	Dicruridae	Drongos															
119	<i>Dicrurus paradiseus</i>	Greater Racket-Tailed Drongo															
120	<i>Dicrurus annectans</i>	Crow-billed Drongo															
121	<i>Didrurus leucophaeus</i>	Ashy Drongo															
122	<i>Dicrurus aeneus</i>	Bronzed Drongo															
	Eurylaimidae	Broadbill															
123	<i>Corydon sumatranus</i>	Dusky Broadbill															
124	<i>Calyptomena viridis</i>	Green Broadbill															
125	<i>Cymbirhynchus macrorhynchus</i>	Black-and-Red Broadbill															
126	<i>Eurylaimus ochromalus</i>	Black-and-yellow Broadbill															
127	<i>Eurylaimus javanicus</i>	Banded Broadbill															
	Falconidae	Falcon															
128	<i>Microhierax fringillarius</i>	Black-Thighed Falconet										App.2					
129	<i>Falco peregrinus</i>	Peregrine Falcon										App.1					
	Glareolidae	Pratincoles															
130	<i>Glareola maldivarum</i>	Oriental Pratincole															
	Hemiprocnidae	Treeswifts															
131	<i>Hemiproctus longipennis</i>	Grey-rumped Treeswift															
	Hirundinidae	Martins															
132	<i>Hirundo rustica</i>	Barn Swallow															
133	<i>Hirundo tahitica</i>	Pacific Swallow															
134	<i>Delichon dasypus</i>	Asian House-martin															
	Jacaniidae	Jacanas															
135	<i>Iredipara gallinacea</i>	Comb-crested Jacana															
	Laniidae	Shrikes															
136	<i>Lanius schach</i>	Long-tailed Shrike															
	Meropidae	Bee-eaters															
137	<i>Nyctornis amictus</i>	Red-bearded Bee-Eater															
138	<i>Merops viridis</i>	Blue-throated Bee-eater															
139	<i>Merops philippinus</i>	Blue-tailed Bee-eater															
	Motacillidae	Wagtails															
140	<i>Motacilla flava</i>	Yellow Wagtail															
	Muscicapidae	Old World Flycatchers															
141	<i>Hypothymis azurea</i>	Black-naped Monarch															
142	<i>Rhipidura javanica</i>	Pied Fantail															
143	<i>Rhipidura perlata</i>	Spotted Fantail															
144	<i>Philentoma velata</i>	Maroon-breasted Philentoma															
145	<i>Philentoma pyrhopterum</i>	Rufous-winged Philentoma															
146	<i>Terpsiphone paradisi</i>	Asian Paradise-Flycatcher															
147	<i>Ficedula hyperythra</i>	Snowy-browed flycatcher															
148	<i>Muscicapa dauurica</i>	Asian Brown Flycatcher															
149	<i>Ficedula dumetoria</i>	Rufous-chested Flycatcher															
150	<i>Cyornis superbus</i> - E	Bornean Blue-Flycatcher															
151	<i>Muscicapella hodgsoni</i>	Pygmy Blue-Flycatcher															
152	<i>Ficedula parva</i>	Red-breasted Flycatcher															
153	<i>Cyornis turcosus</i>	Malaysian Blue-flycatcher															
154	<i>Rhinomyias ruficauda</i>	Rufous-tailed Jungle-Flycatcher															
155	<i>Rhinomyias gularis</i>	Eye-browed Jungle-flycatcher															

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156	<i>Rhinomyias umbratilis</i>	Grey-chested Jungle-Flycatcher															
	Nectariniidae	Sunbirds															
157	<i>Anthreptes malacensis</i>	Plain-throated Sunbird															
158	<i>Nectarinia jugularis</i>	Olive-backed Sunbird															
159	<i>Anthreptes singalensis</i>	Ruby-cheeked Sunbird															
160	<i>Anthreptes rhodolaemus</i>	Red-throated Sunbird															
161	<i>Nectarinia sperata</i>	Purple-throated Sunbird															
162	<i>Hypogramma hypogrammicum</i>	Purple-naped Sunbird															
163	<i>Aethopyga siparaja</i>	Crimson Sunbird															
164	<i>Arachnothera robusta</i>	Long-billed Spiderhunter															
165	<i>Arachnothera affinis</i>	Grey-breasted Spiderhunter															
166	<i>Arachnothera longirostra</i>	Little Spiderhunter															
167	<i>Arachnothera chrysogenys</i>	Yellow-eared Spiderhunter															
	Oriolidae	Bluebird															
168	<i>Irena puella</i>	Asian Fairy-Bluebird															
	Pachycephalidae	Whistlers															
169	<i>Pachycephala hypoxantha</i> -E	Bornean Whistler										App. 2					
170	<i>Pachycephala cinerea/grisola</i>	Mangrove Whistler										App. 3					
	Pandionidae	Osprey															
171	<i>Pandion haliaetus</i>	Osprey															
	Phalaropidae	Phalaropes															
172	<i>Phalaropus lobatus</i>	Red-necked Phalarope															
	Phasianidae	Partridges															
173	<i>Argusianus argus</i>	Great Argus										App. 2					
174	<i>Polyplectron schleiermacheri</i> -E	Bornean Peacock-Pheasant										App. 2					
175	<i>Coturnix chinensis</i>	Blue-breasted Quail															
176	<i>Rollulus rouloul</i>	Crested Partridge															
177	<i>Rhizothera longirostris</i>	Long-billed Partridge															
178	<i>Lophura ignita</i>	Crested Fireback										App.3					
	Picidae	Woodpeckers															
179	<i>Meiglyptes tukki</i>	Buff-necked Woodpecker															
180	<i>Meiglyptes tristis</i>	Buff-rumped Woodpecker															
181	<i>Dendrocopos canicapillus</i>	Grey-Capped Woodpecker															
182	<i>Hemicircus concretus</i>	Grey-and-buff Woodpecker															
183	<i>Dendrocopos moluccensis</i>	Sunda Woodpecker															
184	<i>Dryocopus javensis</i>	White-bellied Woodpecker										App. 1					
185	<i>Dinopium javanense</i>	Common Goldenback															
186	<i>Mulleripicus pulverulentus</i>	Great Slaty Woodpecker															
187	<i>Celeus brachyurus</i>	Rufous Woodpecker															
188	<i>Reinwardtipicus validus</i>	Orange-backed Woodpecker															
189	<i>Picus miniaceus</i>	Banded Woodpecker															
190	<i>Blythipicus rubiginosus</i>	Maroon Woodpecker															
191	<i>Dinopium rafflesi</i>	Olive-backed Woodpecker															
192	<i>Picus puniceus</i>	Crimson-winged Woodpecker															
193	<i>Picus mentalis</i>	Checker-throated Woodpecker															
194	<i>Sasia abnormis</i>	Rufous Pickulet															

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			E N	N T	V u	C R	L C	Co	Ra	P		C. Gonner	T. Boorsma	RASI	BEBSIC		
	Pittidae	Pittas															
195	<i>Pitta sordida</i>	Hooded Pitta															
196	<i>Pitta granatina</i>	Garnet Pitta															
197	<i>Pitta baudii</i>	Blue-headed Pitta															
	Ploceidae	Sparrows, Munia															
198	<i>Lonchura fuscans</i> -E	Dusky Munia										App. 2					
199	<i>Lonchura malacca</i>	Black-headed Munia															
200	<i>Passer montanus</i>	Eurasian Tree Sparrow															
201	<i>Padda oryzivora</i>	Java Sparrow															
	Podargidae	Frogmouths															
202	<i>Batrachostomus auritus</i>	Large Frogmouth															
203	<i>Batrachostomus stellatus</i>	Gould's Frogmouth															
204	<i>Batrachostomus javensis</i>	Javan Frogmouth															
	Psittacidae	Parrots															
205	<i>Psittacula longicauda</i>	Long-tailed Parakeet										App. 2					
206	<i>Psittinus cyanurus</i>	Blue-rumped Parrot										App. 2					
207	<i>Loriculus galgulus</i>	Blue-crowned Hanging-Parrot															
	Pycnonotidae	Bulbuls															
208	<i>Iole olivacea</i>	Buff-vented Bulbul															
209	<i>Tricholestes criniger</i>	Hairy-backed Bulbul															
210	<i>Pycnonotus cyaniventris</i>	Grey-bellied Bulbul															
211	<i>Pycnonotus atriceps</i>	Black-headed Bulbul															
212	<i>Pycnonotus aurigaster</i>	Sooty-headed Bulbul															
213	<i>Pycnonotus eutilotus</i>	Puff-backed Bulbul															
214	<i>Alophoixus phaeocephalus</i>	Yellow-bellied Bulbul															
215	<i>Alophoixus bres</i>	Grey-cheeked Bulbul															
216	<i>Pycnonotus plumosus</i>	Olive-winged Bulbul															
217	<i>Pycnonotus goiavier</i>	Yellow-vented Bulbul															
218	<i>Pycnonotus simplex</i>	Cream-vented Bulbul															
219	<i>Pycnonotus erythropthalmus</i>	Spectacled Bulbul															
220	<i>Pycnonotus brunneus</i>	Red-eyed Bulbul															
	Rallidae	Rails															
221	<i>Amauornis phoenicurus</i>	White-Breasted Waterhen															
222	<i>Gallinula chloropus</i>	Common Moorhen															
223	<i>Porphyrio porphyrio</i>	Purple Swamphen															
224	<i>Gallinula tenebrosa</i>	Dusky Moorhen															
225	<i>Rallus aquaticus</i>	Water Rail															
226	<i>Gallirallus striatus</i>	Slaty-breasted Rail															
227	<i>Porzana cinerea</i>	White-Browed Crane															
228	<i>Porzana fusca</i>	Ruddy-Breasted Crane															
	Recurvirostridae	Stilts															
229	<i>Himantopus himantopus</i>	Black-winged Stilt															
230	<i>Himantopus leucocephalus</i>	White-headed Stilt															
	Scolopacidae	Snipes, Godwits, Curlew, Stints, Sandpipers, Shanks															
231	<i>Gallinago stenura</i>	Pintail Snipe															
232	<i>Rostratula benghalensis</i>	Greater Painted Snipe															
233	<i>Gallinago megala</i>	Swinhoe's Snipe															
234	<i>Gallinago gallinago</i>	Common Snipe															

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235	<i>Limosa lapponica</i>	Bar-tailed Godwit														
236	<i>Limosa limosa</i>	Black-tailed Godwit														
237	<i>Numenius phaeopus</i>	Whimbrel														
238	<i>Numenius madagascariensis</i>	Far-eastern Curlew														
239	<i>Calidris tenuirostris</i>	Great Knot														
240	<i>Calidris ferruginea</i>	Curlew Sandpiper														
241	<i>Calidris subminuta</i>	Long-toed Stint														
242	<i>Calidris ruficollis</i>	Rufous-necked Stint														
243	<i>Calidris temminckii</i>	Temminck's Stint														
244	<i>Xenus cinereus</i>	Terek Sandpiper														
245	<i>Tringa ochropus</i>	Green Sandpiper														
246	<i>Tringa nebularia</i>	Common Greenshank														
247	<i>Tringa totanus</i>	Common Redshank														
248	<i>Tringa hypoleucos</i>	Common Sandpiper														
249	<i>Tringa stagnatilis</i>	Marsh Sandpiper														
250	<i>Philomachus pugnax</i>	Ruff														
251	<i>Tringa glareola</i>	Wood Sandpiper														
	Sylviidae	Warblers, Tailorbirds, Prinia														
252	<i>Phylloscopus borealis</i>	Arctic Warbler														
253	<i>Orthotomus atrogularis</i>	Dark-necked Tailorbird														
254	<i>Orthotomus ruficeps</i>	Ashy Tailorbird														
255	<i>Orthotomus sericeus</i>	Rufous-tailed Tailorbird														
256	<i>Locustella certhiola</i>	Palla's Warbler														
257	<i>Locustella ochotensis</i>	Middendorf 's Warbler														
258	<i>Acrocephalus orientalis</i>	Eastern Reed-warbler														
259	<i>Acrocephalus stentoreus</i>	Clamorous Reed-warbler														
260	<i>Prinia flaviventris</i>	Yellow-bellied Prinia														
261	<i>Gerygone sulphurea</i>	Golden-bellied Gerygone														
	Sittidae	Nuthatch														
262	<i>Sitta frontalis</i>	Velvet-fronted Nuthatch														
	Sternidae	Sterns														
263	<i>Sterna bergii</i>	Great Crested-Tern														
264	<i>Sterna albifrons</i>	Little Tern														
265	<i>Chlidonias hybrida</i>	Whiskered Tern														
266	<i>Chlidonias leucopterus</i>	White-Winged Tern														
267	<i>Sterna sumatrana</i>	Black-Naped Tern														
268	<i>Ketupa ketupu</i>	Buffy Fish-owl														
269	<i>Otus rufescens</i>	Reddish Scops-Owl										App. 2				
270	<i>Otus bakkamaena</i>	Collared Scops-Owl										App. 2				
271	<i>Strix leptogrammica</i>	Brown Wood-Owl										App. 2				
272	<i>Ninox scutulata</i>	Brown Hawk-Owl										App. 2				
	Sturnidae	Starlings														
273	<i>Sturnus philippensis</i>	Chesnut-cheeked Starling														
274	<i>Sturnus contra</i>	Asian Pied Starling														
275	<i>Aplonis panayensis</i>	Asian Glossy Starling														
276	<i>Gracula religiosa</i>	Hill Myna										App.2				
	Threskiornithidae	Ibises, Spoonbills														
277	<i>Pseudibis davisoni</i>	White-Shouldered Ibis														

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	Timaliidae	Babblers														
278	<i>Malacopteron magnum</i>	Rufous-crowned Babbler														
279	<i>Malacopteron magnirostre</i>	Moustached Babbler														
280	<i>Malacopteron affine</i>	Sooty-capped Babbler														
281	<i>Malacopteron cinereum</i>	Scaly-crowned Babbler														
282	<i>Macronous gularis</i>	Striped Tit-Babbler														
283	<i>Macronous pilosus</i>	Fluffy-backed Tit-Babbler														
284	<i>Trichastoma rostratum</i>	White-chested Babbler														
285	<i>Malacocincla malaccensis</i>	Short-tailed Babbler														
286	<i>Trichastoma bicolor</i>	Ferruginous Babbler														
287	<i>Pellorneum capistratum</i>	Black-capped Babbler														
288	<i>Stachyris nigricollis</i>	Black-throated Babbler														
289	<i>Stachyris erythroptera</i>	Chestnut-winged Babbler														
290	<i>Stachyris maculata</i>	Chestnut-rumped Babbler														
291	<i>Alcippe brunneicauda</i>	Brown Fulvetta														
	Trogonidae	Quetzals														
292	<i>Harpactes diardii</i>	Diard's Trogon														
293	<i>Harpactes kasumba</i>	Red-naped Trogon														
294	<i>Harpactes duvaucelii</i>	Scarlet-rumped Trogon														
	Turdidae	Bushchat, Shamas														
295	<i>Saxicola caprata</i>	Pied Bushchat														
296	<i>Trichixos pyrropygus</i>	Rufous-tailed Shama														
297	<i>Copsychus malabaricus</i>	White-rumped Shama														
298	<i>Copsychus saularis</i>	Magpie Robin														
	Total number of species											280	45	91	42	

N.B. National protected status based on the list of protected fauna according to national law UU. No.5 Tahun 1990 by Directorate General for Protection of Forest Resources and Nature Conservation (Dirjen PHKA), MMA = Middle Mahakam Area, R = Rare, EN = Endangered, CR = Critically Endangered, NT = Near Threatened, VU = Vulnerable, LC = Least Concern, C = (locally) common (> 6 sightings per survey or N>50 per survey), R = (locally) Rare (< 6 sightings per survey or N>50 per survey), P = Protected and E = Endemic for Kalimantan