

Population density and distribution of Javan gibbon (*Hylobates moloch*) in Central Java, Indonesia

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Manuscript received: 4 July 2011. Revision accepted: 27 September 2011.

ABSTRACT

Setiawan A, Nugroho TS, Wibisono Y, Ikawati V, Sugardjito J. 2012. Population density and distribution of Javan gibbon (*Hylobates moloch*) in Central Java, Indonesia. *Biodiversitas* 13: 23-27. A survey of Javan gibbon (*Hylobates moloch*) was conducted from July 2009 to November 2010 in the Dieng mountains and Mount Slamet, Central Java, Indonesia. The purpose of the survey was to assess current population status and its distribution, including factors threatening the species. Line transect method was used to estimate gibbon densities. We detected a total of 144 individuals in 56 groups on a 212.7 km length trail. Average group size was calculated as 2.57 (ranging between 2 and 7) individuals. We compared the population density between Mount Slamet and Dieng mountains. It was found that the density in Mount Slamet was lower than in the Dieng mountains with 1.7 ind./km² compare to 2.5-7.57 ind/km² respectively. In total, there were about 1,034 individuals of gibbon in Central Java which was divided in two sub populations. The one in Mount Slamet was about 175 individuals whereas in the range of Dieng mountains was 881 individuals. Establishing a protected area and enhancing conservation awareness were critically important for survival of this endangered ape. Conservation awareness should consider human needs of local people surrounding the forest habitat.

Key words: Javan gibbon, population, distribution, Dieng Mountains, Mount Slamet, Central Java.

INTRODUCTION

Indonesia holds six species of gibbons including Javan gibbon (*Hylobates moloch*) which is endemic to Java (Marshall and Sugardjito, 1987). This species is heading to extinction due to forest degradation and land conversion for agriculture. Previous survey on this species has been conducted by Kapeler (1984). He has assessed 32 forest patches that are inhabited by Javan gibbon in Java and the population has been estimated between 2400 and 7900 individuals. Sugardjito and Sinaga (1999) have studied the population specifically, in Halimun National Park, west Java and has been estimated the population about 1,000 individuals. Further survey, conservation activities and ecological study of Javan gibbon also continued intensively in this area (Iskandar 2007; Kim et al. 2011). Based on the published data available on gibbon population, Supriatna and Wahyono (2000) estimated that some 2000-4000 gibbons remaining in the wild. The latest survey of Javan gibbon was conducted by Nijman and van Balen (1998) in Dieng mountains with the results of remaining population between 519-577 individuals, recent survey of Javan gibbon conducted by Djanubudiman et al. (2005), visited 23 locations in West Java and 7 locations in Central Java, has provided population estimate of gibbons 492 individuals in Dieng Mountains and 96 individuals gibbons

in Mount Slamet and the total estimate for the whole of Java 4888 individuals. Nijman (2004) also stated that the total gibbon population in Java between 4000 and 4500 individuals.

In contrast to west Java, the forest habitat in central Java does not have any protected area which forms a network system and received little attention among conservationists and researchers. Consequently, forest habitat in this region is more threatened by encroachment. However, based on the field survey conducted by previous authors, there still remained a large forest block in Central Java where the Javan gibbon lived. In this paper we report the results of a survey for more than a decade of Javan gibbons in Central Java with focusing on the conservation status of the population and its distribution.

MATERIALS AND METHODS

The two main study sites include Dieng mountains and Mount Slamet (Figure 1). The locations two survey population distribution were selected to follow the previous surveys done in Central Java (Nijman and van Balen 1998; Djanubudiman 2004). We surveyed from July 2009 up to November 2010.

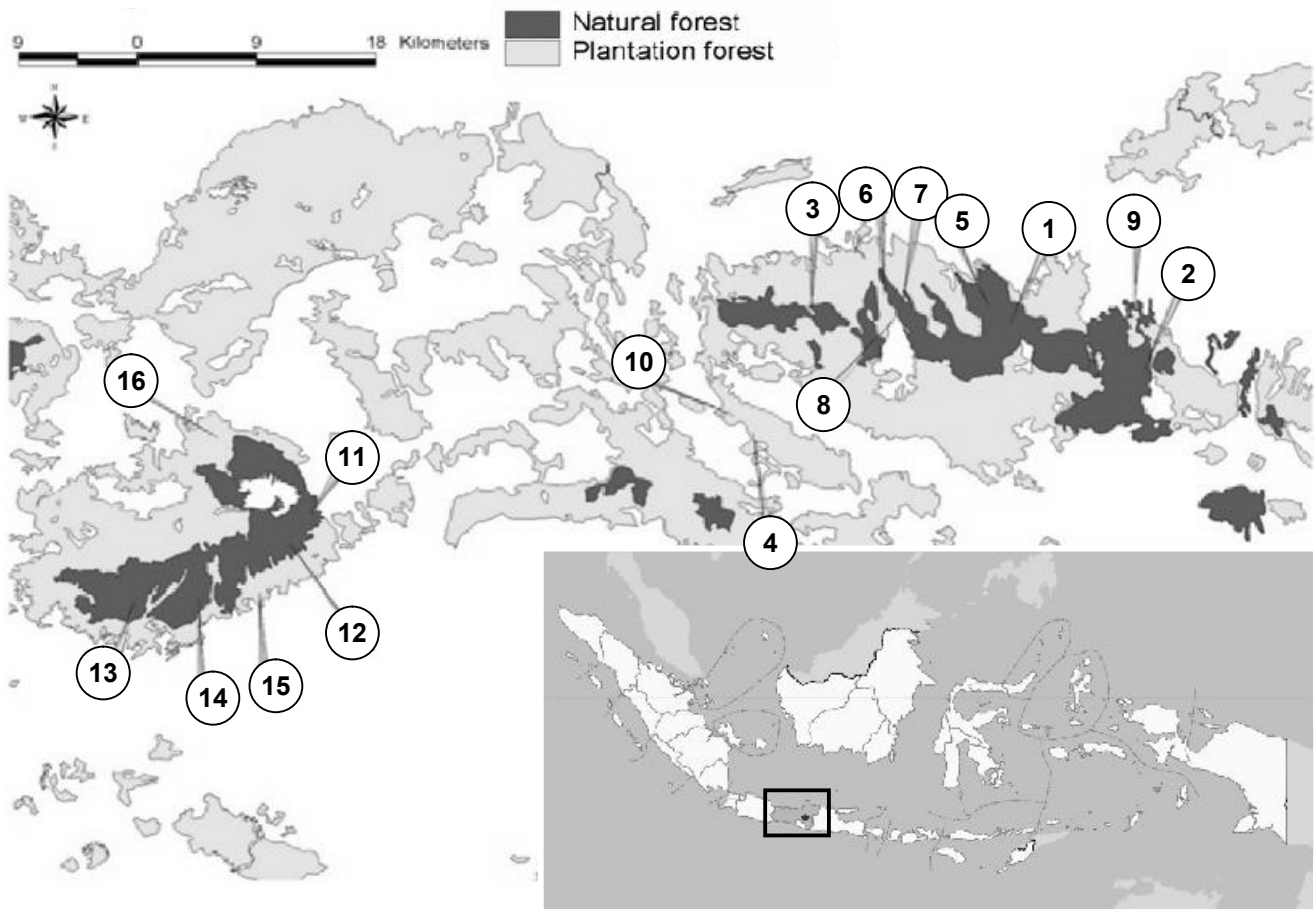


Figure 1. Map of the study sites and the distribution of Javan gibbons in central Java

We used Landsat satellite imagery to identify forest blocks for the survey sites. The first forest block was located in Mount Slamet, with the total size of forest block as potential habitat 103.41 km² (see Figure 1, sites: 11, 12, 13, 14, 15, 16). In this block we have established six sites as field camp i.e. Curug Cipendog in the south-west slope (07°20'09.5"S, 109°08'02.6"E; 850 m asl.), Curug Gomblang (07°19'38.1"S, 109°12'17.8"E, 952 m asl.) and Pancuran Pitue (07°18'35.0"S, 109°13' 04.7"E, 780 m asl.) in the Southern slope, Gunung Tukung (07°16'12.6"S, 109°15'16.0"E, 1472 m asl.) and Gunung Malang (07°16'12.5"S, 109°15'20.4"E, 1336m asl.) in the north-east slope, and Gunung Suci (07°11'40.13"S, 109°11'26.8"E; 1531 m asl.) in the north-west slope of Mount Slamet. We utilized existed forest trails in Mount Slamet to survey and avoid trails for mountain climber, we records all of direct sight with the gibbon, the distance from observer, number of individuals and GPS coordinate.

In Dieng mountains (see Figure.1 sites 1, 2, 3, 4, 5, 6, 7, 8, 9, 10) we surveyed the population in the Western part of Dieng mountain mainly at Sokokembang forest (07 05'51.0"S, 109 43'29.9"E, 685 m asl.). We define forest area as potential habitat of Javan gibbon in to four forest block based on satellite imagery and field survey, i.e Sokokembang (65.69 km²), Sikesod (48.38 km²), Linggo

Asri, Sawangan Ronggo, Bantar Kulon, Alas Daon, Lebak Barang, Kembang Langit as one forest block sized (18.95 km²), and Semangkug Mlaya (33.88 km²). We established seven transects lines in Sokokembang forest (± 3000 ha). Each transect was 1 km in length. These transects started from Wela River, heading to 40° and 240°. We walked slowly 1km/hr, and stopped for several minutes to locate branch shaking and sounds of gibbons. Most field work started at 06.00 and lasted up to 17.00, with a break at mid day (12.00 until 14.00). We recorded number of individuals, age class, and the distance of animals detected to observer. GPS (Garmin 60 CSX) was used to record points where we found the animals, and we recorded their behaviors *ad-libitum* (Martin and Bateson 2007) as well as food items consumed in vernacular name. Due to steep topography, time constraint and man power availability, we used existed trails in Mount Slamet and other locations except Sokokembang forest to survey of the gibbon Data was collected throughout broad surveys across forest patches from non replicate forest walks. Walks were conducted mostly cross-country, but where not possible, on established bush trails. This method involves slow, quiet walking, with stops every 100 m to visually scan the forest and look for sounds. All recorded data were written down on prepared worksheets.

We followed the technical survey procedure mentioned in the National Research Council (NRC, 1981) to calculate density of each site. The basic formula for calculate density is $D = n/A$, where D = density, n = number animals seen, A = sample area (determined by $2wl$, w = strip width and l = length of the transect). Perpendicular distance determined based on trigonometric calculation, $p = s \sin \alpha$, p is perpendicular distance, s = sighting distance from the observer to the animal at the moment detection (we used laser range finder-Bushnell yard age pro-, to measure distance), and α = is the sighting angle, or the angle between transect line and the animal to observer line at the moment of detection, the angle (α) is determined using a field compass. At the end of observation and density calculation was done for maximum perpendicular distance, which was found as 150 meter in Mount Slamet and 49.4 meters in Dieng Mountains area.

General description of forested habitat and threats for gibbon population determined based on qualitative assessment, we asked villagers, forestry officers or village leaders whether Javan gibbon still exist, forest threats and forest resource utility.

RESULTS AND DISCUSSION

There were 144 individuals belongs to 56 groups of gibbon have been seen recorded on the 212.7 km forest

transect lines. Average group size 2.57 individuals (range from 2 up to 7). The estimate average densities in Mount Slamet and Dieng mountains are 1.7 ind/km² and 5.15 ind/km² respectively. The detailed results are presented in Table 1, whereas the map of location can be seen in Figure 1. The vertical distribution of gibbon was starting from the lowest habitat (270 meters above sea level; m a.s.l.) up to the highest at 1900 m a.s.l. (Figure 3).

Mount Slamet and Dieng Mountain complex were located far apart and does not form continuous habitat. Unfortunately, we did not collected data on floristic composition in these areas. We separated the results of total population, and estimated based on available potential habitat using Landsat satellite imagery 2001 analysis. Although the gibbons do not evenly distribute in the forest, we extrapolated the density with remaining potential habitat. Thus, there were approximately 1,056 individuals of gibbon in Central Java include the population in Mount Slamet about 175 individuals and Dieng mountain within four forest block are 497 individuals (site no. 1), 120 individuals (site no. 2), 115 individuals (site.3, 4, 5, 6, 7, 8, 9) and 149 individuals (site no. 10), and the total population was approximately estimated 881 individuals.

In Western part of Dieng Mountain, Sokokembang forest specifically, we were able identifying age-classes for each groups (Figure 2).

Table 1. The survey sites of Javan gibbon and its densities in Central Java.

Localities	N individu seen (group)	transect length (km)	potential habitat (km ²)	density (ind/km ²)	Vegetation	Elevation	Threats priority
1. Sokokembang	51 (20)	42.82	65.69	7.57	secondary forest, mix	250-950	1;2;4
2. Sikesod	2 (1)	4	48.38	2.5	primary forest	1450	3
3. Linggo asri	10 (3)	20	18.95	6.12	secondary forest	450-650	3;4
4. Sigugur	3 (1)	2			Plantation-mix	950	1;3;4
5. Sawangan Ronggo	4 (1)	2			secondary forest	550	1
6. Bantar Kulon					secondary forest	250	Na
7. Alas Daon	2 (1)	4			secondary forest	400	1;2;4
8. Lebak Barang	5 (2)	4			secondary forest	350	2;4
9. Kembang langit	2 (1)	6			secondary forest	650	2;3;4
10. Semangkung, Mlaya	2 (1)	2.5	33.88	4.4	plantation-mix	750	1;2;3;4
11. Gunung Malang (Mount Slamet eastern slope)	4 (2)	125.38	103.41	1.7	primary forest	1400	3;4
12. Gunung Tukung (Mount Slamet southeast slope)	17 (8)				primary forest	1500	3;4
13. Pancuran Pitoe (Mount Slamet southern slope)	11 (1)				secondary forest	750-1900	1;3;4
14. Curug Gomblang (Mt,Slamet, Southern Slope)	24 (9)				secondary forest	750-1500	1;3;4
15. CurugCipendog (Mount Slamet, South west slope)	5 (4)				secondary forest	750	1;3;4
16. Gunung Suci (Mount Slamet, North west slope)	2 (1)				secondary forest	850	1;3;4
Total	144	212.7	270.31				
Average density Dieng Mountain				5.15			
Average density in Mount Slamet				1.7			
Average group size in Dieng Mountain	2.61 ind						
Average group size in Mount Slamet	2.52ind						
Group range	2-7 ind						
Population estimate in Mount Slamet	175 ind						
Population estimate in DiengMountain	881 ind						

Notes: 1.Firewood collection; 2. Agriculture expansion; 3. Primates hunting; 4. Non timber extraction.

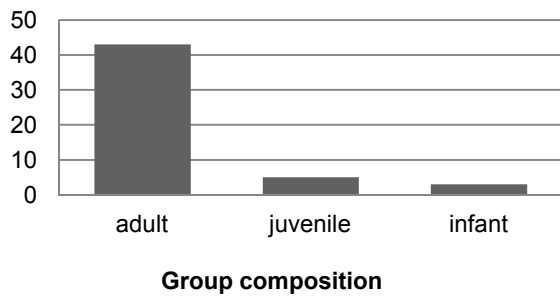


Figure 2. Group composition of Gibbon in Sokokembang forest, western part of Dieng mountain

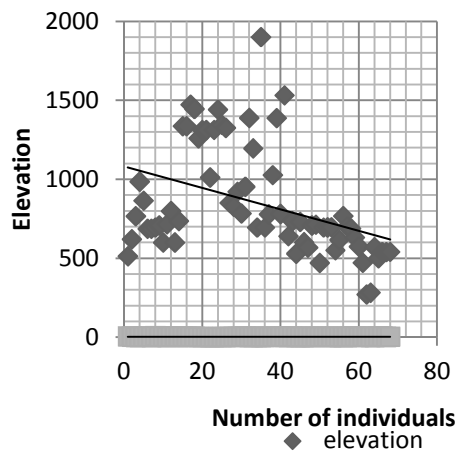


Figure 3. Altitudinal distribution of gibbon in Central Java

Discussion

The sites where we visited for this survey which have not been surveyed previously include, Sawanganronggo, Kembang langit, and Mlaya in Dieng Mountains, in Mount Slamet are Curug Cipendog, Curug Gomblang, Gunung Tukung, Gunung Malang, and Gunung Suci. The results of this survey in general, neither group or individual density do not show any significant differences with the previous reports in the same surveyed sites (Nijman and van Balen 1998; Djanubudiman, et al. 2004), but we were able to collect more detailed information on the number of gibbon seen directly. However, our extrapolation of potential habitat for the estimate total population is higher than previous survey in central java. This may be due to different method in determining forested area as potential habitat for Javan gibbon. In this area the Javan gibbons did not occupy secondary natural forests only but, it also lives in both degraded forest edge habitats and plantation forests (*Agathis dammara*, *Schima wallichii*). This was observed in Mount Slamet (Curug gomblang, Pancuran Pitue, Gunung Malang, in Sigugur and Semangkung Mlaya) whereas in the range of Dieng Mountain, we observed gibbon in the Pine plantation (*Pinus mercurii*). The average

group size of 2.61 individuals in Dieng Mountain and 2.5 individuals in Mount Slamet are much lower than any reported data in Java i.e 3 up to 5 individuals (Kappeler, 1981, 1984c; Gurmaya et al., 1995; Rinaldi, 1999; Supriatna et al., 1994, Nijman 2001; Sugardjito and Sinaga 2004). This indicates that the reproduction of gibbon in Dieng Mountain (Sokokembang forest) was low, there are only two groups which hold infants and 4 groups with juveniles (see. Figure.2).

Habitat of gibbons in central Java consists of fragmented forest as shown on the map of 2001 satellite imagery. Several locations such as Linggo asri, Sigugur and Mlaya have already been isolated from the main forest blocks of Dieng Mountain. We found groups of gibbons inhabiting forest habitat from the edge to the interior of forest which is consistent with the previous study (Nijman and van Balen 1998). We often see gibbons next to the main road (forest edge), for example in Sokokembang, and Lebak Barang. Gibbon mostly occupies forest between 400 to 1000 meter a.s.l, due to this forest provides more diverse food sources (see. Figure.3). The altitude of forest habitat has an impact on forest structure, distribution and abundance of food sources (Kim et al. 2011). However, Javan gibbon is also occur in habitat up to 1900 m a.s.l in Mount Slamet, and this might be due to increasing disturbed forest habitat particularly in the low-land. A land use conflict between human and wildlife were frequently happened in this area due to many forest habitats in low land are converted to agricultural land. The gibbons, therefore, are imposed to move higher and are occupying high land forest habitat.

Threats for gibbon population and habitat were different among locations and this could be used for determining priorities in conservation management for this species (Nijman 2006; Supriatna 2006; Supriatna et al. 2010). Fire wood collection and agricultural expansion threatened almost all areas in Dieng Mountain. Collecting fire wood by cutting down the trees and selling to the market are common phenomena in the Western part of Dieng Mountains. Expansion of coffee plantation was encroaching to the forest. Hunting gibbon for pets has been seen in Dieng Mountain and Mount Slamet. Information obtained from villagers who were interviewed said that gibbons are priced for Rp 300,000-Rp 500,000/ind. In general, the people living in surrounding the gibbon habitats have low income. This situation stimulates people to sell animals for their additional income. Therefore, conservation awareness and education efforts in this area should address these problems in order to improve livelihood or generate alternative income for villagers around the forest.

In order to secure the population of Javan gibbon, we recommend the establishment of protected area system in Central Java, specifically in Western part of Dieng Mountain and the natural forest of Mount Slamet, which is important not only for the Javan gibbon but also for all Javan endemic primates. The proposal to promote the Javan gibbon as provincial mascot could also be helpful for campaign the species conservation.

CONCLUSION

We have detected more gibbons individually in the field for new locations that were not visited previously by the earlier authors, including in plantation forest. We estimated 175 individuals of gibbon in Mt.Slamet forest block and 881 individuals in Dieng Mountains area although the forest covers are not continuously. It was found that the gibbon lives both in degraded forests and plantation. However, the current map of forest cover with the information on vegetation and altitudinal distribution is needed. Establishment of forest patrol units to monitor and protect the forest habitat with the gibbon population in Mt.Slamet and Westernpart of Dieng Mountain is critically important. Conservation awareness and education efforts in this area should address the the human needs for villagers around the forest.

ACKNOWLEDGEMENTS

We would like to thanks to Rufford Small Grant, Idea Wild, International Primatological Society, and the Indonesian Primatological Association for their assistance to provide grants for this work. We acknowledge people who contribute discussion to this paper including, Dr. Suci Utami, Dr. Noviar Andayani, and Chaerul Saleh. Special thanks is due to our scientific advisor the late Dr. Djuwantoko at Wildlife Laboratory, Faculty of Forestry, Gadjah Mada University, Yogyakarta.

REFERENCES

- Asquith NM, Maritanza, Sinaga RM. 1995. The Javan gibbon (*Hylobates moloch*): status and conservation recommendations. *Trop Biodiv* 3: 1-14.
- Djanubudiman G, Arisona J, Iqbal M, Wibisono F, Mulcahy G, Indrawan M, Hidayat RM. 2004. Current Distribution and Conservation Priorities for the Javan Gibbon (*Hylobates moloch*). Report to Great Ape Conservation Fund, US Fish and Wildlife Service, Washington, DC, Indonesian Foundation for Advance of Biological Sciences and Center for Biodiversity and Conservation Studies of University of Indonesia, Depok.
- Gurmaya KJ, Adiputra IMW, Saryatiman AB, Danardono SM, Sibuea TTH. 1995. Primate survey, population and ecology: Gunung Honje range Ujung Kulon National Park. Ujung Kulon National Park Project Phase II, 1993-1995. Departemen Kehutanan and New Zealand Ministry of Foreign Affairs and Trade, Jakarta.
- Iskandar E. 2007. Habitat dan populasi owajawa (*Hylobates moloch* Audebert 1797) di Taman Nasional Gunung Halimun Salak Jawa Barat. [Disertasi]. Bogor. Sekolah Pascasarjan, Institute Pertanian Bogor. [Indonesia]
- Kappeler M. 1981. The Javan silvery gibbon (*Hylobates lar moloch*). [Dissertation]. Universität Basel, Germany.
- Kappeler M. 1984. The gibbon in Java. In: Preuschoft H, Chivers DJ, Cheney DC, Seyfarth RM, Wrangham PW, Strushaker TT (eds) *The Lesser Apes: evolutionary and behavioral biology*. University of Chicago Press, Chicago.
- Kim S, Lappan S, Choe JC. 2011. Diet and ranging behavior of the endangered Javan gibbon (*Hylobates moloch*) in a submontane tropical rainforest. *Amer J Primatol* 73: 270-280.
- Marshall J, Sugardjito J. 1987. Gibbon systematics. In: Swindler D (ed) *Comparative Primate Biology, Vol. 1: Systematics, Evolution, and Anatomy*. Alan R. Liss, New York.
- Martin P, Bateson P. 2007. *Measuring Behavior an Introductory Guide*, 3rd ed. Cambridge University Press, London.
- National Research Council. 1981. *Techniques for the Study of Primate Population Ecology*. Subcommittee on Conservation of Natural Populations. National Research Council. National Academy Press, Washington, DC.
- Nijman V. 2001. Forest and primates. Conservation and ecology of the endemic primates of Java and Borneo. *Tropenbos-Kalimantan Series* 5. Wageningen.
- Nijman V. 2004. Conservation of the Javan Gibbon *Hylobates moloch*: population estimates, local extinctions, and conservation priorities. *Raffles Bull Zool* 52 (1): 271-280.
- Nijman V. 2006. *In-situ* and *ex-situ* status of the Javan gibbon and the role of zoos in conservation of the species. *Contrib Zool* 75 (3/4): 161-168.
- Nijman V, van Balen B. 1998. A faunal survey of the Dieng mountains, Central Java, Indonesia: Status and distribution of endemic primate taxa. *Oryx* 32: 145-146.
- Rinaldi D. 1999. Food preferences and habitat utilization of Java gibbon (*Hylobates moloch* Audebert) in Ujung Kulon National Park, West Java, Indonesia. [M.Sc. thesis]. Georg-August University, Göttingen, Germany.
- Sugardjito J, Sinaga MH. 1999. Conservation status and Population distribution of Primates in Gunung Halimun National Park, West Java, Indonesia. In: *Proceedings of the International Workshop Rescue and Rehabilitation*. Taman Safari and University of Indonesia, Cisarua, Bogor.
- Supriatna J. 2006. Conservation Programs for the Endangered Javan Gibbon (*Hylobates moloch*). *Primate Conserv* 21: 155-162.
- Supriatna J, Mootnick A, Andayani N. 2010. Javan Gibbon (*Hylobates moloch*): Population and conservation. In: Gursky-Doyen S, Supriatna J (eds.) *Indonesian Primates*. Springer, New York.
- Supriatna J, Wahyono EH. 2000. *Panduan lapangan primata Indonesia*. Yayasan Obor Indonesia, Jakarta. [Indonesia].