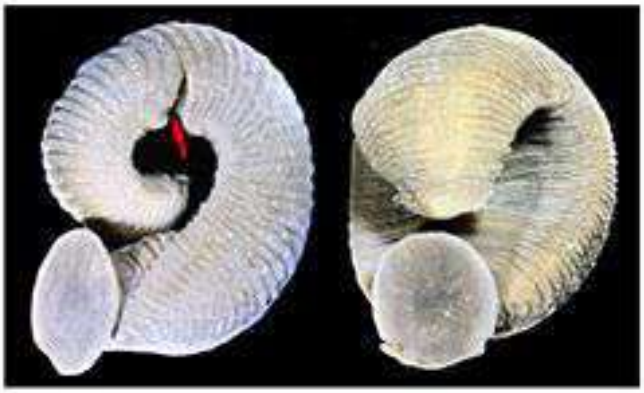
ISSN 2336-9744 (online)



ECOLOGICA MONTENEGRINA

Volume 61
2023

Vol. 61 (2023)

Published: 2023-03-19

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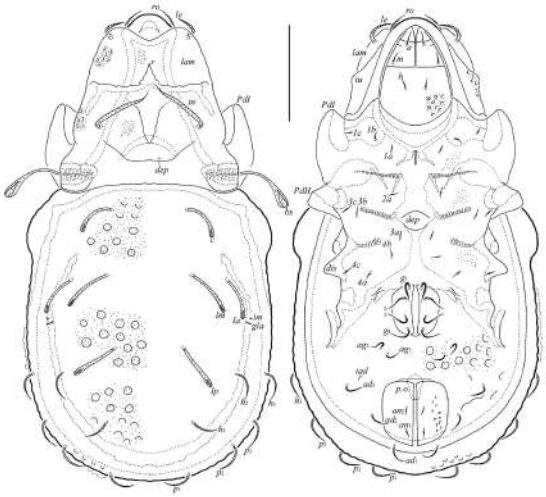

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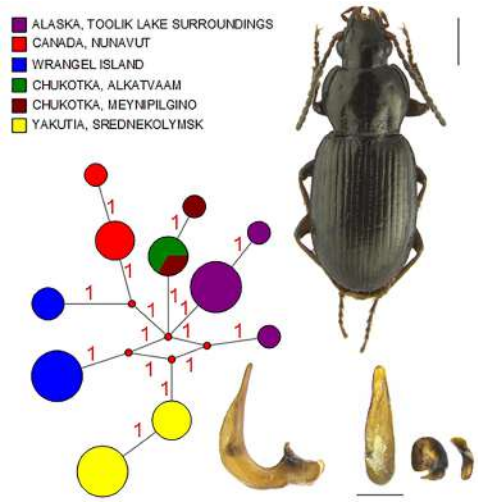

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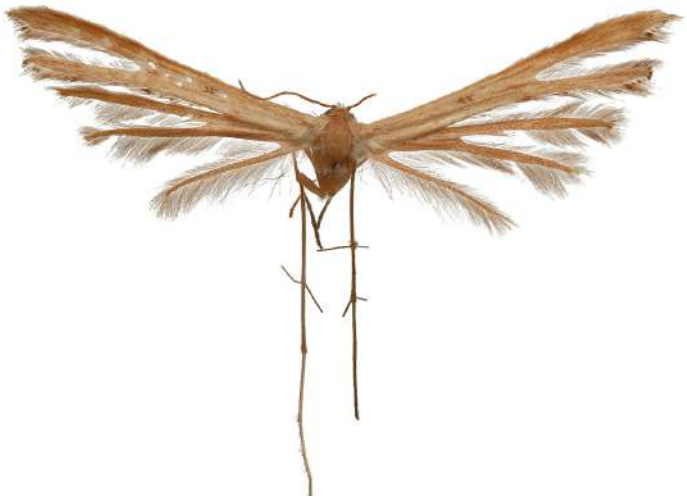

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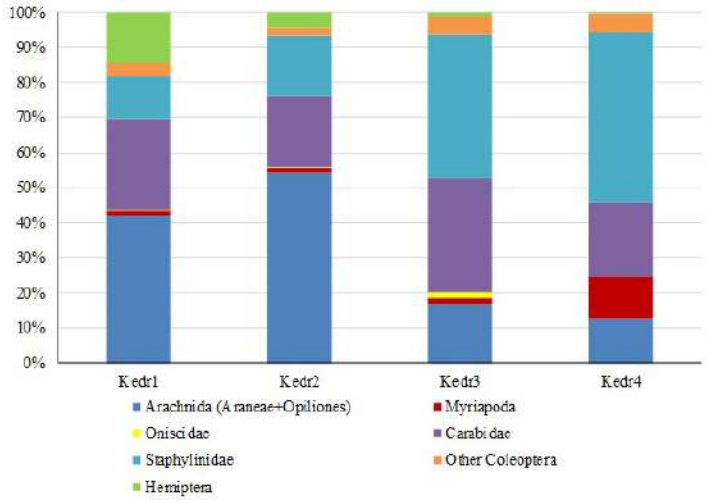

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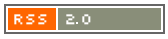

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Ecologica Montenegrina

A peer-reviewed open-access journal

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OJS / PKP

Ecologica Montenegrina
ISSN 2336-0744 (online) | ISSN 2337-0173 (print)

Ecologica Montenegrina 61: 16-30 (2023)
This journal is available online at: www.biotaxa.org/em
https://dx.doi.org/10.37828/em.2023.61.3

Article

New ecological information on the little-known Sumatran endemics Black-and-white langur *Presbytis bicolor* Aimi & Bakar, 1992 (Primates: Cercopithecidae)

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Received 10 December 2022 | Accepted by *V. Pešić*: 31 January 2023 | Published online 3 February 2023.

Abstract
Black-and-white langur *Presbytis bicolor* Aimi & Bakar, 1992 is a rare endemic leaf-eating monkey that occurs only in a limited distribution between the Indragiri River and Batanghari River, Sumatra, Indonesia. In this paper, we summarize historical records of *P. bicolor*, put the distribution records into the map (including new localities, but still in geographic range), and provide new additional pieces of information on its ecology. We collected all published and unpublished of our observations on *P. bicolor* from January 2016 to April 2022. Our findings suggest *P. bicolor* can tolerate and survive in the degraded forest habitat, particularly in areas where rubber plantations are present. It was confirmed that *P. bicolor* fed leaves of Para rubber tree *Hevea brasiliensis* (Euphorbiaceae) and Mango *Mangifera* sp (Anacardiaceae); and it was reported that they also fed various plants. No indications of hunting or illegal collecting for the pet trade, but the mortality due to electrocution from power lines and road accidents have been detected and confirmed for this species.

Key words: Black-and-white langur, *Presbytis bicolor*, Colobinae, Leaf-eating monkey, Sumatra.

Introduction

The leaf-eating monkeys or Colobinae are a large subfamily of the Old World monkeys in the family Cercopithecidae (Rowe 1996). The classification of the genera of Asian leaf-eating monkeys varies around 11 genera based on previous studies, including *Colobus*, *Kasi*, *Nasalis*, *Pliocolobus*, *Prebyticus*, *Presbytis*, *Pygathrix*, *Rhinopithecus*, *Semnopithecus*, *Simias* and *Trachypithecus* (Groves 2001; Roos *et al*. 2004; Burgin *et al*. 2020). Among them, the genus *Presbytis* or "Langur" is a group of Old World monkeys that live in Myanmar, the Thai-Malay Peninsula, Sumatra, Borneo, Java and smaller nearby islands (Groves 2005; Burgin *et al.* 2020; Zinner *et al*. 2013). This genus inhabits the tropical rainforests of Sundaland, and with more than 50 color variants grouped into up to 11 species, *Presbytis* is one of the most diverse Old World monkey genera (Meyer *et al*. 2011).

Sumatra is the westernmost and second largest island (473,606 square kilometres, including some "satellite" islands) in Indonesia (Sharp & Compost 1994). The island is one of the richest islands in Indonesia for faunas, particularly for primates (Whitten *et al*. 2000; Supriatna 2019). *Presbytis* is the largest genus of primate in Indonesia, and Sumatra is home to eight species, including Thomas's langur *Presbytis thomasi* Collett, 1892, Black-crested sumatran langur *P. melalophos* Raffless, 1821, Black sumatran langur *P. sumatrana* Muller & Schlegel, 1841, Black-and-white langur *P. bicolor* Aimi & Bakar 1992, Mitred langur *P. mitrata* Eschscholtz, 1821, Pagai langur *P. potenziani* Bonaparte, 1886, Siberut langur *P. siberu* Chasen & Kloss, 1928, Banded langur *P. femoralis* Martin, 1838 and Pale-thighed langur *P. siamensis* Muller & Schiegel, 1841 (Ruskhanidar *et al.* 2017).

Described and uplisted as a full species in 1992 by Aimi & Bakar (1992), the Black-and-white langur *Presbytis bicolor* is an endemic and poorly known leaf-eating monkey in Indonesia (Nijman 2021). This monotypic species is a Sumatran endemic that occurs only in limited distribution in Indragiri River (Batang Kuantan River) in the north, and Batanghari River in the south (Anandam *et al.* 2013; Beausejour *et al.* 2021). Recognition of the recent status of *P. bicolor* as a full species, split to Black-crested sumatran langur *Presbytis melalophos* has an impact on the data limitation (Supriatna 2019). The species is recently classified as Data Deficient (DD) on the IUCN Red List as its threat level will depend very much on its extent of occurrence which currently is unclear, if this primate was recorded in the eastern part of its proposed range then it would likely list as Endangered, as the area has been burned extensively and is severely degraded (Nijman 2021). In this paper, we provide new information to fill the gap in data on distribution range, habitat requirements and other significant findings from the field to help better understand for conservation of *P. bicolor* in the future.

Methods

Study Site. The site covered in this study was the area between Indragiri River and to Batanghari River, in the middle of mainland Sumatra, Indonesia (Fig. 1). This area is known as the geographic range for *P. bicolor* (Aimi & Bakar 1992; Nijman 2021).

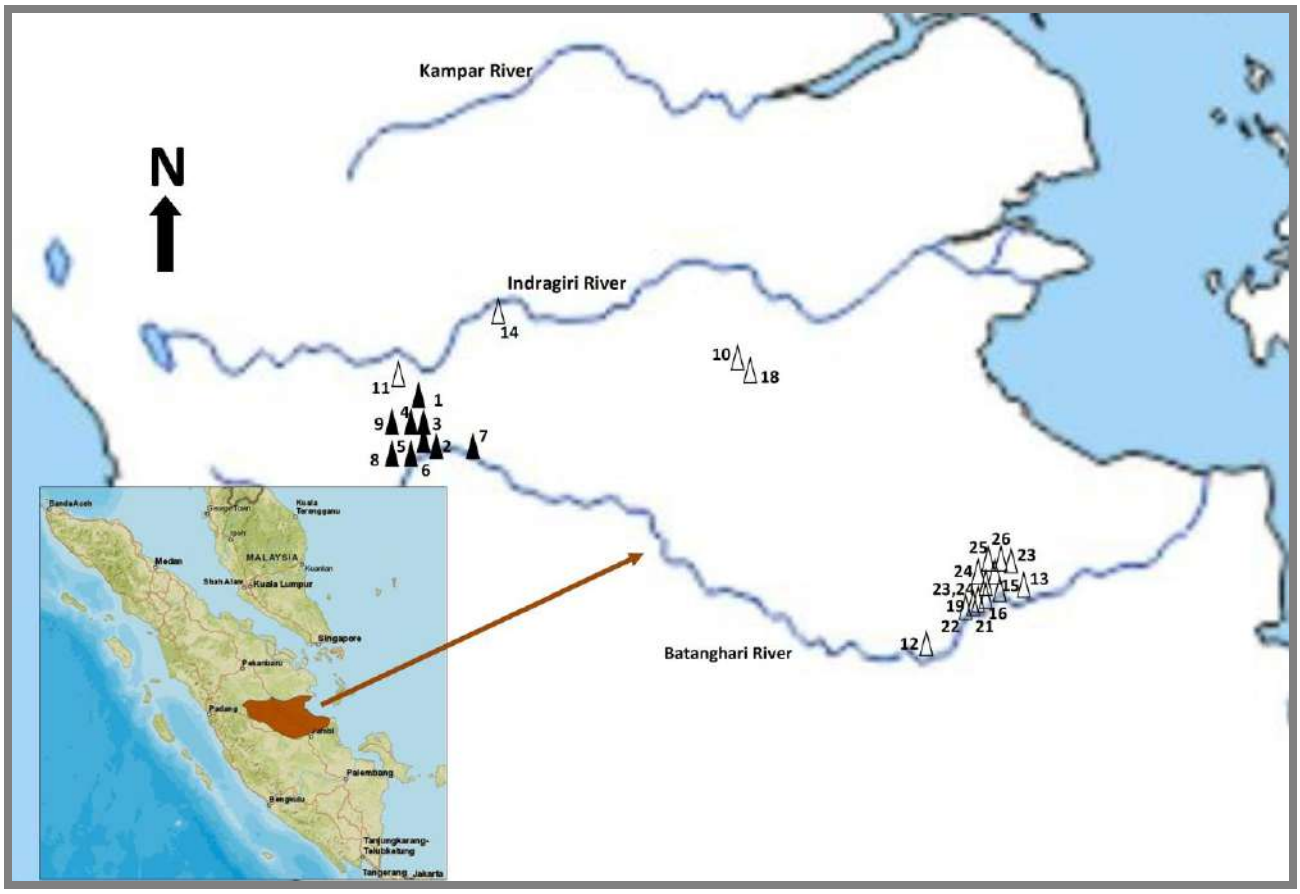

Figure 1. Map of historical and recent distribution records of *P. bicolor*. Insert is a map of Sumatra and the distribution range *P. bicolor* (indicated by solid brown) based on Nijman (2021). Solid triangles indicate specimen records referred to in Aimi & Bakar (1992), and open triangles indicate distribution records after Aimi & Bakar (1992).

Data Collection. We collected all published and unpublished information on *P. bicolor*. The locations where the species reported are put on the map. From January 2016 to April 2022, we conducted field visits to Jambi Province (Batanghari District and Muara Jambi District) and Riau Province (Camp Granit of Bukit Tiga Puluh National Park and a village between Kuantan Singigi District and Kiliran Jao). During these field visits, we have the opportunity to set direct observations of *P. bicolor*. Most of the observations are taken incidentally, without some specific field methods being applied. All the observations of *P. bicolor* are found during daylight, ranging between 08.00 a.m. to 05.30 p.m. To complete our field survey, we also interviewed local people to explore their views and knowledge about this species. Our interview with local people cover some questions about distribution (current and historical), habitat, abundance (changes in number and size structure over time), taxonomy (different colour forms), nesting biology, local custom and beliefs, diet, hunting and trading (past and present).

Identification. The *P. bicolor* is a distinct diurnal primate, compared to other primates that occur in its geographic range. The major features of *P. bicolor* refer to appropriate references (Aimi & Bakar 1992; Anandam *et al.* 2013; Supriatna 2019) are: darkish or grayish black on the back and outer arms contrasting with white underside, limbs, throats, the inner surface of the tail and the tip of the tail; the face is darkish or blackish grey and a black muzzle, there is a fringe along the forehead and the chin is grey.

Newborn *P. bicolor* has whitish-gray with a thick, dark dorsal stripe, and no shoulder cross-stripe (Anandam *et al.* 2013). We can confirm the very young *P. bicolor* has whitish-gray colour, but some bigger infants who have the same adult colour also still held by their parents. Among the group, we observed single and up to five adults holding their babies. One adult holds one baby or infant. Most of them were seen in the normal position of an adult holding the infant (Fig. 2), but we found an unusual position, where an adult put the young between the lower belly and thighs (Fig. 3). This could be the comfortable position for an adult to watch the disturbances before running into the forest.

Figure 2 (Left) Two adult females *P. bicolor* keep an infant while watching observers who get closure, 15 March 2022, Pemayung Subdistrict, Batanghari District, Jambi Province (Photo: Nur Rachman). **Figure 3** (Right) An unusual position of adult female *P. bicolor* when holding infant, putting the young between lower belly and thighs, 15 March 2022, Pemayung Subdistrict, Batanghari District, Jambi Province (Photo: Muhammad Iqbal).

Results and Discussion

There are 30 records of *P. bicolor* from 1977 to 2022 from various localities in Sumatra (Table 1). They were found in three provinces of central Sumatra, including Riau, West Sumatra and Jambi Province (Fig. 1).

Table 1. Historical records of *P. bicolor* from 1977 to 2022. Remarks of observers: AR = Arif Rudiyanto, EOP = Ega Oktavianus Putra, MI = Muhammad Iqbal, NR = Nur Rachman, TR = Tohar Nainggolan, MB= Muhammad Basrowi, AS =Aji Sartono and SPN = Syafruddin Perwira Negara.

Date	Number	Sources/Observers	Number in the map (see note below for locations)
1977 (undated)	NA	Wilson & Wilson 1977	None
22 February 1981	1	Aimi & Bakar 1992	1
Undated, *c.* 1980s	3	Aimi & Bakar 1992	2
Undated, *c.* 1980s	2	Aimi & Bakar 1992	3
Undated, *c.* 1980s	5	Aimi & Bakar 1992	4
Undated, *c.* 1980s	1	Aimi & Bakar 1992	5
Undated, *c.* 1980s	1	Aimi & Bakar 1992	6
Undated, *c.* 1980s	1	Aimi & Bakar 1992	7
Undated, *c.* 1980s	1	Aimi & Bakar 1992	8
Undated, *c.* 1980s	1	Aimi & Bakar 1992	9

..continued on the next page

TABLE 1

5 June 2015	>4	Rhett Butler *pers. com.*	10
2016 (undated)	2	Ika Yuni Agustin *pers. com.*	11
7 July 2016	1	Suhono, 2016	12
2016 to 2018	>15	AR *pers.obs.*	13
29 Sep 2018	1	Novarino 2018, Novarino *pers. obs*	14
8 Dec 2021	6	MI, TN *pers. obs.*	15
9 Dec 2021	8	MI, TN *pers.obs.*	16
Early Jan 2022	3	Syamsul *pers.com.*	17
25 Jan 2022	9	EOP *pers.obs.*	18
15 Mar 2022	>15	MI, NR, TN, MB, AS *pers.obs.*	19
16 Mar 2022	>20	MI, NR, TN, MB, AS *pers.obs.*	20
16 Mar 2022	>15	MI, NR, TN, MB, AS *pers.obs.*	21
16 Mar 2022	>15	MI, NR, TN, MB, AS *pers.obs.*	22
19 Mar 2022	>15	MI, NR, TN, MB, AS *pers.obs.*	23
20 Mar 2022	>15	MI, NR, TN, MB, AS *pers.obs.*	24
21 Mar 2022	>10	MI, NR, TN, MB, AS *pers.obs.*	25
21 Mar 2022	2	MI, NR, TN, MB, AS *pers.obs.*	26
29 Apr 2022	8	SPN *pers.obs.*	27
c. 2007-2008	3	Meyer 2011, Meyer *et al.* 2011, 2012	28
c. 2007-2008	1	Meyer 2011, Meyer *et al.* 2011, 2012	29

Note of locations in the map:

1. Mentioned as “Batang Kering, West Sumatera” (Aimi & Bakar 1992). Batang Kering (0°42'S,100°49') is an area in Kamang Baru Subdistrict, Sijunjung District, West Sumatra Province.
2. Mentioned as “Sungei Kambut, near Kiliranjao (0°53'S, 101°22'E), West Sumatera”(Aimi & Bakar 1992). The correct spelling of Sungei Kambutis Sungai Kambut. This area is located in Pulau Punjung Subdistrict, Dharmasraya District, West Sumatra Province.
3. Mentioned as “Batang Kering, near Kiliranjao, West Sumatera” (Aimi & Bakar 1992). This location is nearly similar to number 1, located in Kamang Baru Subdistrict, Sijunjung District, West Sumatra Province.
4. Mentioned as “Galagah, near Kiliranjao, West Sumatera” (Aimi & Bakar 1992). The correct spelling of Galagah is Galogah (0°46'S, 101°18E). This area is located in Kamang Baru Subdistrict, Sijunjung District, West Sumatra Province.
5. Mentioned as “Sungei Tambang, near Kiliranjao, West Sumatera” (Aimi & Bakar 1992). The correct spelling of Sunget Tambang is Sungai Tambang (0°51'S, 101°23'E). This area is located in Kamang Baru Subdistrict, Sijunjung District, West Sumatra Province.
6. Mentioned as “Parit Rantang, near Kiliranjao, West Sumatera” (Aimi & Bakar 1992). Parit Rantang or Kunangan Parit Rantang (0°50'S, 101°22'E). This area is located Kamang Baru Subdistrict, Sijunjung District, West Sumatra Province.
7. Mentioned as “Siatang, near Kiliranjao, West Sumatera” (Aimi & Bakar 1992). The location could be Sialang or Sialang Baru (0°54'S, 101°26'E), Pulau Punjung Subdistrict, Dharmasraya District, West Sumatra Province.
8. Mentioned as “Sungei Lansat, near Kiliranjao, West Sumatera” (Aimi & Bakar 1992). The correct spelling of Sungei Lansat is Sungai Lansek (0°54'S, 101°21'E). This area is located Kamang Baru Subdistrict, Sijunjung District, West Sumatra Province.
9. Mentioned as “Kamang, near Kiliranjao, West Sumatera” (Aimi & Bakar 1992). This area is located in Kamang Baru Subdistrict (0 46' S, 101°19'"E), Sijunjung District, West Sumatra Province.
10. The location is Talang Lakat Village (0°50’S, 102°31’E), near Camp Granit, Bukit Tiga Puluh National Park, Riau Province.
11. Reported in Sinjunjung, near Sawah Lunto (0°38'S, 101°18'E), West Sumatra Province.
12. Reported in Danau Embat (1°38'S, 103°9"E), Maro Sebo Ilir Subdistrict, Batanghari District, Jambi Province (based on the map in Suhono, 2016).

13. Reported in Sengeti Subdistrict (1°28'S, 103°30'E), Muaro Jambi District, Jambi Province. Most of them are found in rubber plantations.
14. Observed in the area between Kiliran Jao (West Sumatra) and Kuantan Singingi District (0°53'S, 101°46'E), Riau Province. Found in rubber plantations, with a combination of remaining forest and palm oil plantations.
15. Tanjung Lanjut Village (1°23'S, 103°21'E), Sekernan Subdistrict, Muara Jambi District, Jambi Province. Found in rubber plantations, with a combination of remaining forest and palm oil plantations.
16. Near Danau Bangko (1°32'S,103°20'E), Lubuk Ruso Village, Pemayung Subdistrict, Batanghari District, Jambi Province. Found in rubber plantations, with a combination of remaining forest and palm oil plantations.
17. Around the highway in Sengeti (1°29'S, 103°30'E), Sekernan Subdistrict, Muaro Jambi District, Jambi Province. Found in rubber plantations, with a combination of remaining forest and palm oil plantations.
18. Observed in Camp Granit ($0^0$49'S, $102^0$31'E), Bukit Tiga Puluh National Park, Riau Province. Found in rubber plantations, with the combination of remaining forest and palm oil plantations.
19. Observed in Lubuk Ruso Village (1°30'S, 103°22'E), Pemayung Subdistrict, Batanghari District, Jambi Province. Found in rubber plantations, with a combination of remaining forest and palm oil plantations.
20. Observed in Kuap Village 1 (1°30'S, 103°21' E), Pemayung Subdistrict, Batanghari District, Jambi Province. Found in rubber plantations, with a combination of remaining forest and palm oil plantations.
21. Observed in Kuap Village 2 (1°33'S, 103°18'E), Pemayung Subdistrict, Batanghari District, Jambi Province. Found in rubber plantation, with a combination of remaining forest and palm oil plantations.
22. Observed in Kuap Village 3 (1°33'S, 103°17'E), Pemayung Subdistrict, Batanghari District, Jambi Province. Found in rubber plantations, with a combination of remaining forest and palm oil plantations.
23. Tanjung Lanjut Village (1°24'S, 103°25'E), Sekernan Subdistrict, Muaro Jambi District, Jambi Province. Found in rubber plantations, with a combination of remaining forest and palm oil plantations.
24. Suko Awin Wijaya Village (1°20'S, 103°18'E), Sekernan Subdistrict, Muaro Jambi District, Jambi Province. Found in rubber plantations, with a combination of remaining forest and palm oil plantations.
25. Bukit Baling Village 1 (1°23'S, 103°28'E), Sekernan Subdistrict, Muaro Jambi District, Jambi Province. Found in rubber plantations, with a combination of remaining forest and palm oil plantations.
26. Bukit Baling Village 2 (1°24'S, 103°29'E), Sekernan Subdistrict, Muaro Jambi District, Jambi Province. Found in rubber plantations, with a combination of remaining forest and palm oil plantations.
27. Anak Talang Village (0°45'S, 102°66'E), Batang Cenaku Subdistrict, Indragiri Hulu District, Riau Province. Found in a rubber plantation.
28. Reported in Bukit Tiga Puluh National Park, collected in 2007-2008. (Meyer 2011, Meyer *et al.* 2011, 2012). Specimens recorded JF295109, JF295106 and JF295108.
29. Reported in Sengeti, Muaro Jambi District, Jambi Province, collected in 2007-2008 (Meyer 2011, Meyer *et al.* 2011, 2012), specimens recorded as JF295107.

Distribution and Habitat

The *P. bicolor* is distributed between the Indragiri River and the Batanghari River of central Sumatra (Aimi & Bakar 1992; Anandam *et al.* 2013; Beausejour *et al.* 2021). All of our records are recorded within this range (Fig. 1 and Table 1). Based on our observations (localities number 13 to 27 in Fig. 1 and Table 1), the *P. bicolor* is found in the rubber plantations *Hevea brasiliensis* (Euphorbiaceae) in lowland habitats (Figs. 4-5).

Groves (2001) suggest *P. bicolor* is a montane form, with three skins reported in the Leiden Museum from north Kerinci by Hooijer (1962), which are variants of this species grading toward *P. melalophos.* However, north Kerinci is not located between the Indragiri River and Batanghari River, and based photo of *Presbytis* in Kerinci Mountain (Beausejour *et al.* 2021), it is likely refer to *P. m. nobilis.* Further references reported *P. bicolor* inhabits highlands or montane forest habitats (Anandam *et al.* 2013; Supriatna 2019; Beausejour *et al.* 2021), but their map for the distribution range of *P. bicolor* did not reach the highlands zone of Bukit Barisan Mountain range in Sumatra. Based on the available information (Table 1), the highest area where *P. bicolor* was recorded is the Sijunjung District, which has the highest elevation of this area *c.* 902 m (Mapcarta 2022). Whitten *et al.* (2000) classified the average elevation of the forest zones in Sumatra range 0-1.200 m as lowland habitats. According to Nijman (2021), *P. bicolor* inhabits lowland and hill forests.

Figure 4. Aerial view of the typical habitat of *P. bicolor*, 15 March 2022, Pemayung District landscape, Jambi Province. A combination of rubber, palm oil vegetation and remaining forest (Photo: Aji Sartono).

Figure 5. Typical habitat of *P. bicolor*, 20 March 2022, Muaro Jambi District landscape, Jambi Province. A remaining secondary forest border with young palm oil vegetation (Photo: Muhammad Iqbal).

Nijman (2021) summarized some additional localities for *P. bicolor*, including concession areas of the forest plant industry of Riau Andalan Pulp and Paper or RAPP (Riau Province), Rimbang Baling Wildlife Sanctuary (Riau Province), and Bukit Bungkuk Strict Nature Reserve (Riau province). All of these areas are located in the northern part of Sumatra, across the Indragiri River (between Kampar River and Indragiri River, not Indragiri River and Batanghari River). Further investigation suggests that species recorded in Rimbang Baling Wildlife Sanctuary and Bukit Bungkuk Strict Nature Reserve as *P. siamensis*; and species found in Bukit Bungkuk as *P. femoralis* (Bugiono 2001; LPPM-IPB 2015; Lathifa *et al.* 2016; Prayogi & Atmoko 2016; Yasir & Sutrisno 2019). The *P. bicolor* has been reported to occur in Bukit Dua Belas National Park (Supriatna 2019; Beausejour *et al*. 2021), but this still needs further confirmation because the park is located across in southern part of Batanghari River (between the Batanghari River and Musi River). Furthermore, Setiawan (2017) reported three primates (*P. melalophos*, Agile Gibbon *Hylobates agilis* and Siamang *Symphalangus syndactylus*) from Bukit Bulan, Bukit Dua Belas National Park, without information for *P. bicolor.*

Records of *P. bicolor* in forested areas (Bukit Tiga Puluh National Park, Figs. 6-7) and various habitats, such as plantations and near urban areas, suggest this primate can survive in disturbed habitats. Supriatna (2019) reported that *P. bicolor* found in primary forest and secondary hill rainforest, shrub or secondary growth, and plantations, considered this species to be tolerant of habitat changes. In Jambi Province, we found remaining secondary forest and old rubber plantations provide suitable habitats for *P. bicolor* for feeding and roosting (Figs. 2-11).

Figure 6. An individual *P. bicolor* sits on the branch and keeps watching the people who give disturbance, 25 January 2022, Camp Granit, Bukit Tiga Puluh National Park, Jambi Province (Photo: Ega Oktavianus Putra).

The *P. bicolor* was presumed a forest-dependent species, and the conversion of forests for various purposes (particularly large-scale plantation) have been given impacted on the loss of habitat. Our survey in Jambi Province revealed that this species is tolerant to degraded forest, and also survive in the human-modified habitats, such as rubber plantation or agricultural scale of local people. However, we fail to spot *P. bicolor* in the Industrial Timber Plantation (locally called Hutan Tanaman Industri or HTI), of the *Eucalyptus* plantation. It is likely *P. bicolor* avoided *Eucalyptus* trees.

Figure 7. One individual *P. bicolor* watching in great care to the people who get closer, 5 June 2015, Talang Lakat, Bukit Tiga Puluh National Park, Jambi Province (Photo: Rhett Butler).

Figures 8 and 9. One adult *P. bicolor* fed leaf of Mango *Mangifera* sp (Anacardiaceae), 15 March 2022, Pemayung Subdistrict, Batanghari District, Jambi Province (Photo: Muhammad Iqbal).

Behaviour

The *P. bicolor* is diurnal, arboreal, moves quadrupedally in trees and lives in groups of between 8 to 12 individuals consisting of both females and males (Supriatna 2019). Our observation found there are few groups consisting of up to 15 and more than 20 individuals. On a few occasions, we also found single or two individuals, suggesting they usually live in solitary. Like many other primate species, surilis emit loud, conspicuous vocalizations termed loud calls or long-distance calls (Meyer *et al.* 2011). Based on our observations, *P. bicolor* is commonly silent (Fig. 6), but when their feel disturbance, at least one of them in the group will prepare a voice that we assume as an early alarming call (Fig. 7). On one occasion, we have observed their response with noisy calls when a drone flew around them.

Diet and Feeding Ecology

The *P. bicolor* is known to be folivorous or leaf-eating but has also been seen to consume fruit, flowers, seed and some species of small insects (Anandam *et al.* 2013; Supriatna 2019; Nijman 2021). Further details of diets are lacking. During field visits, We were observed *P. bicolor* consuming leaves of Para rubber tree *Hevea brasiliensis* (Euphorbiaceae) and Mango *Mangifera* sp (Anacardiaceae) (Figs. 8-11). Local people reported that *P. bicolor* was observed consuming some agricultural plants, including leaf of Cassava *Manihot esculenta* (Euphorbiaceae), the leaf of Chili *Capsicum annuum* (Solanaceae), the young fruit and seed of Para rubber tree, the leaf and fruit of Jengkol *Archidendron pauciflorum* (Caesalpinioideae), the fruit of Mangosteen *Garcinia mangostana* (Clusiaceae) and fruit of *Psidium guajava* (Myrtaceae). Even though *P. bicolor* fed the plants of the local people, but this species reported does not cause severe economic damage, such as Long-tailed macaque *Macaca fascicularis* and Southern pig-tailed macaque *Macaca nemestrina*.

Supriatna (2019) reported *P. bicolor* has been seen on the ground where they access food and water. On one occasion, we observed *P. bicolor* go down to the ground, possibly searching for suitable food (Fig 12). Furthermore, we saw this species escaping to avoid disturbance, crossing the road from old palm oil vegetation to dense rubber vegetation (Fig. 14).

Figures 10 and 11. Another adult *P. bicolor* fed leaf of Para rubber tree *Hevea brasiliensis* (Euphorbiaceae), 15 March 2022, Pemayung Subdistrict, Batanghari District, Jambi Province (Photo: Muhammad Iqbal).

Figure 12. One adult *P. bicolor* is on the ground, 9 December 2021, Lubuk Ruso Village, Pemayung Subdistrict, Jambi Province (Photo: Muhammad Iqbal).

Figure 13. An individual of *P. bicolor* becomes prey by the Domestic dog *Canis familiaris*, 8 December 2021, Sekernan Subdistrict, Muaro Jambi District, Jambi Province (Photo: Muhammad Iqbal).

Figure 14. A series of pictures when *P. bicolor* go down to the ground and across the road between old palm oil vegetation and rubber vegetation, 19 March 2022, Muaro Jambi District, Jambi Province (Photo: Muhammad Iqbal).

Threats and Conservation Actions

The *P. bicolor* has been listed in CITES Appendix II and is protected by Indonesian law (Anandam *et al.* 2013; Ministry of Forestry and Environment 2018; Nijman 2021). Nijman (2021) assumed this species was targeted for illegal collecting for the pet trade, but our field visits and interview with local people suggest no indications of hunting for this purpose. The *P. bicolor* is usually found near settlements, but local people explain this species does not give significant disturbances, particularly to their harvested plants, compared to other primates in this area, Long-tailed macaque and Southern pig-tailed macaque. Both primates usually fed on their crops, and also frequently entered the home for searching food.

Based on our field visits, there are three potential threats, including electrical power lines, domestic dogs and roadkill. On 8 December 2021, we observed *P. bicolor* with some wounds on the body, roosting in a tree near an electrical power line (Figs. 15-16). We presumed the wounds were caused by an open electrical power line. In the same location, we found a *P. bicolor* eaten by the Domestic dog *Canis familiaris* (Fig. 13). This primate presumed fall and weak from being electrocuted; then attacked and eaten by a Domestic dog. From January to February 2022, local people reported some roadkills *of P. bicolor* when this species try to cross the street, with at least two accidents in Pemayung District, Jambi Province. Local people reported that when crossing the street, *P. bicolor* will not aware of the conditions, and they just jump down and across; this differ from other primates, *M. fascicularis* and *M. nemestrina*, who are usually able to watch carefully the situation before across the street.

Figure 15 and 16. Two adults *P. bicolor* were observed near the location where *P. bicolor* was fed by a Domestic dog, 8 December 2021, Sekernan Subdistrict, Muaro Jambi District, Jambi Province (Photo: Muhammad Iqbal).

Mortality due to electrocution from power lines and road accidents are among the major direct anthropogenic threats to the survival of primates (Al-Razi *et al.* 2019). A case from Peninsular Malaysia from 2012 to 2017 reported 27 leaf monkeys, but none for Macaques (Kasmuri *et al.* 2020). In addition, Indonesia and Southeast Asia are regions with the most species number of threatened species in the world negatively impacted by dogs *Canis familiaris* (Doherty *et al.* 2017).

There are four protected areas reported as habitats for *P. bicolor*, including Rimbang Baling Wildlife Sanctuary (Riau Province), Bukit Bungkuk Strict Nature Reserve (Riau province), Bukit Tiga Puluh National Park (Riau and Jambi Province) and Bukit Dua Belas National Park (Jambi Province) (Supriatna 2019;

Beausejour *et al*. 2021; Nijman 2021), but only Bukit Tiga Puluh National Park confirmed as habitat for this primate. Recently, more than 15% of Indonesia's landmass is formally protected, with 527 reserves (wildlife reserves, nature reserves, nature recreation parks, hunting parks and forest parks) and 50 national parks (Gaveau *et al*. 2016). Despite these commendable conservation commitments, losses of Indonesia's lowland old-growth forests, the preferred habitat of most primates, remain critical today. As *P. bicolor* found in many human-modified habitats and all of them are not protected areas, it is clear Bukit Tiga Puluh National Park as a most important area in the conservation concerns of this species. As proposed by Anandam *et al.* (2013) and Nijman (2021), further surveys and clarification are needed to assess the distribution and conservation status of *P. bicolor*. The status of *P. bicolor* is currently classified as Data Deficient on the IUCN Red List (Nijman 2021). Further studies and more information will help to determine IUCN Red List status in the future, and will the give best conservation action plans to be taken.

Acknowledgments

We thank Daemeter Consulting, Triputra Agro Persada Group and PT Brahma Binabakti Plantation for supporting and facilitating us conduct biodiversity assessment in the Muaro Jambi district. We thank Dr. Rhett Butler (Mongabay) and Ika Yuni Agustin for sharing their photos and information regarding Black-and-white langur.

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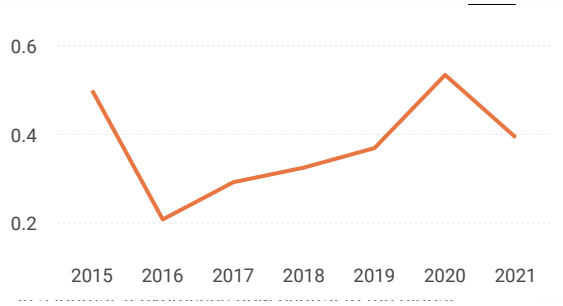

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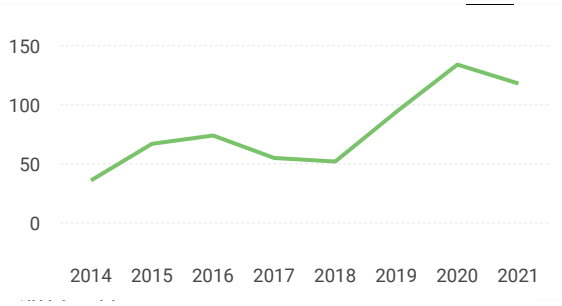

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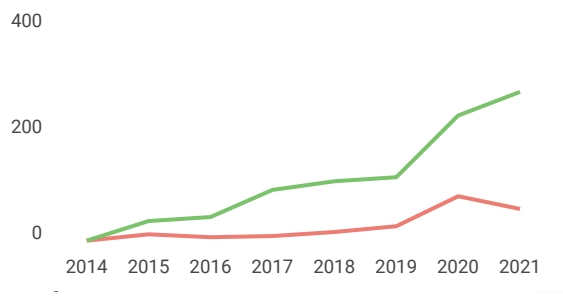

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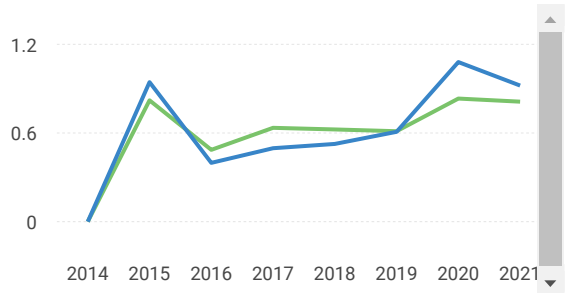

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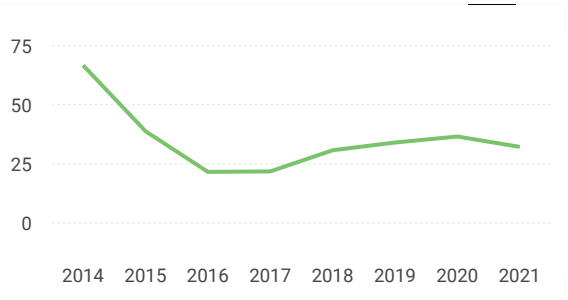

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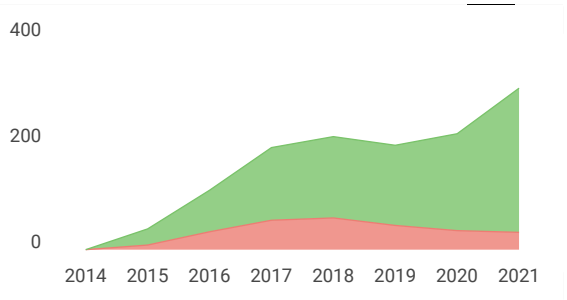

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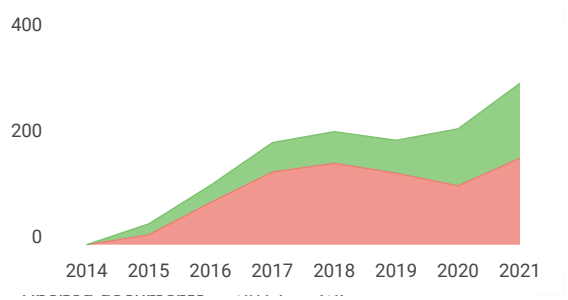

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