

A Review of Primate Research and Conservation in Sarawak, Malaysia

Tukiman Nur-Aizatul^{1,2}, Mohammad Noor-Faezah^{1,2}, Tingga Roberta Chaya Tawie^{2,3}, Mohamad Fhaizal Bukhori², Jayasilan Mohd-Azlan⁴, Azroie Denel⁵, Badrul Munir Md-Zain³, Muhammad Abu Bakar Abdul-Latiff⁶, Abd Rahman Mohd-Ridwan^{2*}

¹Animal Resource Science and Management, Faculty of Resource Science and Technology, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia

²Centre for Pre-University Studies, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia

³Department of Biological Sciences and Biotechnology, Faculty of Science and Technology, Universiti Kebangsaan Malaysia, 43000 Bangi, Selangor, Malaysia

⁴Institute of Biodiversity and Environmental Conservation, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia

⁵Sarawak Forestry Corporation, Kota Sentosa, Sarawak, Malaysia

⁶Environmental Management and Conservation Research Unit (eNCORe), Faculty of Applied Sciences and Technology (FAST), Universiti Tun Hussein Onn Malaysia (Pagoh Campus), 84000, Muar, Johor, Malaysia

*Email: armridwan@unimas.my

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Abstract

Sarawak is home to a diverse array of primate species in Malaysia, i.e., 14 species from five families. Over the years, many studies on primates' behavior, ecology and conservation have been conducted in Sarawak. Here, we provide a comprehensive overview of previous primate studies in Sarawak from 1960 to 2022 and discuss primates' threats, conservation status, and initiatives. Despite the vast number of these primate studies, the majority of them only focus on proboscis monkeys (n=24) and orangutans (n=21) and lack comprehensive studies that cover all primate species in Sarawak. Studies on ecology and natural history were the most prevalent for all Sarawak primate genera (n=51), accounting for more than half of publications. Thus, it advocates a more holistic approach to fill the knowledge gaps and meet conservation needs. Conservation efforts are urgently needed to protect primates currently threatened by deforestation, habitat fragmentation, hunting, and illegal trade. However, conservation efforts may be restrained by the limited information on primates in Sarawak. To preserve the primates in Sarawak, a robust protection strategy that synergizes the participation of government authorities, non-government organizations, and local communities needs to be developed.

Keywords: Sarawak primates, Primate research, Conservation, Threats, Endangered species

Introduction

Malaysia has a wide range of primate species; the number of non-human primates in Malaysia varies depending on the primatologist (Brandon-Jones *et al.* 2004; Roos *et al.* 2014). An estimated number of 26 species, from nine genera in five families, including nocturnal primates from the Lorisidae and Tarsiidae families and diurnal primates from the Cercopithecidae, Hylobatidae, and Hominidae families, were found in Malaysia (Md-Zain *et al.* 2019; Roos *et al.* 2014). Furthermore, Peninsular Malaysia has 13 species and 6 genera, whereas Malaysian Borneo has 15 species and 8 genera. Sarawak has 14 primate species from eight genera, including *Cephalopachus*, *Nycticebus*, *Macaca*, *Presbytis*, *Trachypithecus*, *Nasalis*, *Hylobates*, and *Pongo* (Table 1). Sarawak also hosts Bornean endemic species, such as the proboscis monkey (*Nasalis larvatus*), orangutan (*Pongo pygmaeus*), and Bornean banded langur (*Presbytis chrysomelas*).

To date, 91% of primate species in Asia are declining (Amano *et al.* 2021). According to the International Union for Conservation of Nature (IUCN), the disappearances of primate populations were primarily driven by the loss of habitat due to agricultural practices, commercial development (e.g., road construction), deforestation (e.g., logging), and livestock farming, in addition to direct losses incurred through hunting and poaching (Estrada *et al.* 2017). Primates are also facing new challenges, such as pollution, climate change, and disease (Chapman & Peres, 2021). In Malaysia, primates are vulnerable to habitat destruction, degradation, and habitat fragmentation. In addition, Malaysian primates are hunted and illegally traded for food, kept as pets, and used for traditional medicine (Brodie *et al.* 2014; Lappan & Ruppert, 2019; Yi & Mohd-Azlan, 2018).

Primate studies are urgently needed to obtain crucial information about primates, including their food preference, social dynamics, territoriality, habitat preference, and carrying capacity (Shook *et al.* 2019). Scientists have emphasized the need to study how distinct primate species react to anthropogenic disturbances; how climate change affects their behavior, distribution, and habitat; and the relevance of primate biodiversity hotspots (Estrada *et al.* 2018; Shook *et al.* 2019). In this review, we delved into past and present studies on each of the primate genera in Sarawak by analyzing the number and the subject of papers published over 60 years, from 1960 to the recent year. Moreover, we outlined some of the issues that need to be elucidated.

In addition to facilitating conservation efforts, this review also presents future insights and suggestions to accelerate future potential research to the next level.

Table 1. List of primate species recorded in Sarawak with the conservation and protection status.

No.	Family Scientific Name	Common Name	IUCN Red List (2022)	CITES Appendices	WLPO 1998
Lorisidae					
1.	<i>Nycticebus menagensis</i>	Philippines Slow Loris	VU	I	TP (as <i>N. coucang</i>)
2.	<i>Nycticebus kayan</i>	Kayan Slow Loris	VU	I	P
Tarsiidae					
3.	<i>Cephalopachus bancanus</i>	Western Tarsier	EN	II	TP
Cercopitheciidae					
Subfamily Colobinae					
4.	<i>Presbytis rubicunda</i>	Red Langur	VU	II	TP
5.	<i>Presbytis hosei</i>	Hose's Langur	VU	II	TP
6.	<i>Presbytis frontata</i>	White-fronted Langur	VU	II	TP
7.	<i>Presbytis chrysomelas</i>	Bornean Banded Langur	CR	II	TP (as <i>P. melalophos</i>)
8.	<i>Trachypithecus cristatus</i>	Silvered Leaf-Monkey	VU	II	TP (as <i>P. cristata</i>)
9.	<i>Nasalis larvatus</i>	Proboscis Monkey	CR	I	TP
Subfamily Cercopithecinae					
10.	<i>Macaca fascicularis</i>	Long-Tailed Macaque	EN	II	P
11.	<i>Macaca nemestrina</i>	Pig-Tailed Macaque	EN	II	P
Hylobatidae					
12.	<i>Hylobates abboti</i>	Abbot's Grey Gibbon	EN	I	P
13.	<i>Hylobates funereus</i>	East Borneo Grey Gibbon	EN	I	P
Hominidae					
14.	<i>Pongo pygmaeus</i>	Bornean Orangutan	EN	I	TP

Note: Wildlife Protection Ordinance 1998 (WLPO, 1998); Protected (P), Totally Protected (TP); Vulnerable (VU), Endangered (EN), and Critically Endangered (CR)

Previous Studies of Primates in Sarawak

Primate study has been active in Sarawak since the 1960s. Since then, primate study has expanded, encompassing studies on other primate species from five primate families found in Sarawak. The species *Nasalis* is the most researched primate in Sarawak ($n = 24$), followed by orangutans and other primate species (Figure 2). Studies on ecology, genetics, and other aspects of primates in Sarawak have been conducted in various settings including field surveys, a study of captive primates, and laboratory settings. Previous primate studies in Sarawak concentrated on ecology and natural history studies (Table 2). Conversely, diseases and molecular studies

received less attention. This is also reflected in the limited research on primate threats and conservation in Sarawak. Subsequently, based on Table 2, we can conclude that previous research on *Nasalis* and *Pongo* covered all aspects, including ecology, phylogeny, diseases, and conservation. Contrarily, research on *Hylobates* and *Nycticebus* solely covered population and veterinary facets, whereas studies on population distribution and ecology are lacking. Primate study in Sarawak showed an increasing trend starting in 1995, reaching its peak between 2015 and 2019 ($n = 28$) (Figure 1). This increase seems to be correlated with primate studies conducted holistically covering most primate genera in Sarawak between 2010 and 2020 (Figure 2). Although the result showed a decreasing trend from 2020 to 2022 ($n = 10$), presumably due to the few numbers of studies conducted in the 2-year period, it is projected to increase in the future.

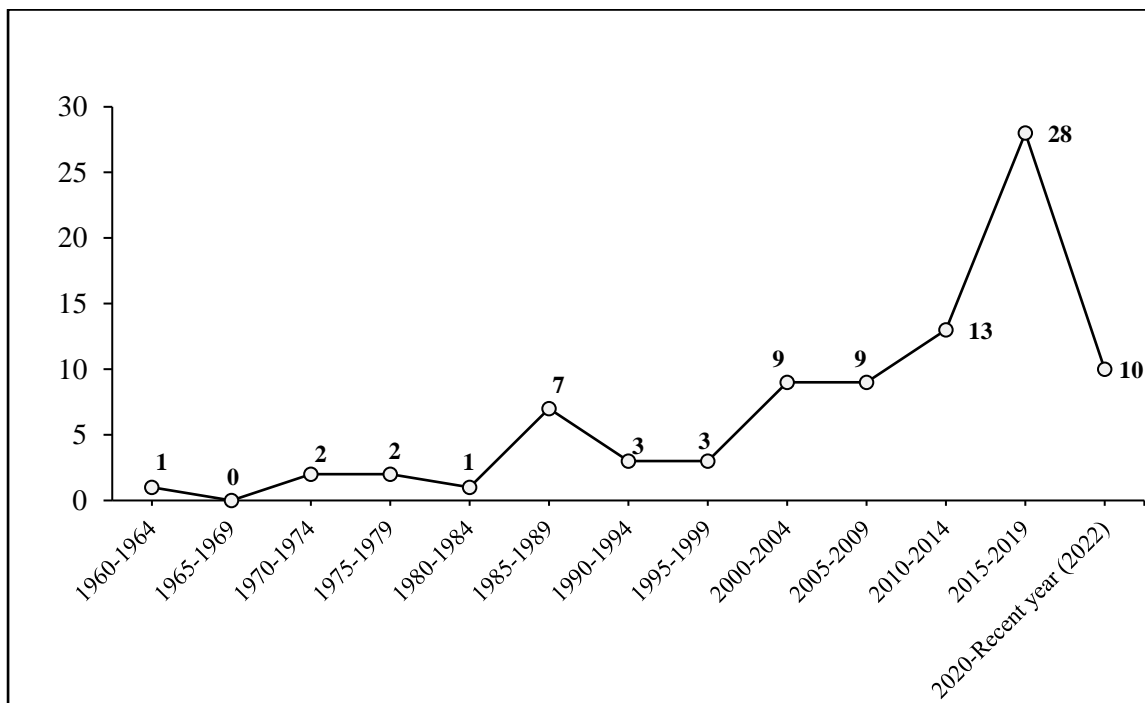


Figure 1. The number of primate studies conducted in Sarawak showed increases trend starting the year 1995.

Table 2. Summary of primate studies conducted in Sarawak.

No	Genus	Checklist and Biodiversity	Ecology and Natural History	Evolution and phylogenetics	New Species and Taxonomy	Diseases and Veterinary	Threats and Conservation	Number of available studies (n)
1.	<i>Pongo</i>	Silang <i>et al.</i> 2016	Ampeng <i>et al.</i> 2016; 2021; Blouch, 1997; Gumal, 2007; Gurmaya & Silang, 2002; Husen, 2001; Meredith, 1993; Mohd-Azlan <i>et al.</i> 2015; Mohd-Hatta, 2005; Mohd-Rahmatullah, 2001; Pandong <i>et al.</i> 2018; Silang <i>et al.</i> 2006; Schaller, 1961; Voigt <i>et al.</i> 2018; Wesley, 2001	Zhi <i>et al.</i> 1996		Salina <i>et al.</i> 2004; Teo <i>et al.</i> 2019	Pandong <i>et al.</i> 2019; Tisen & Silang, 2016; Voigt <i>et al.</i> 2018	21
2.	<i>Hylobates</i>	Shanahan & Debski, 2002; Shanahan <i>et al.</i> 2000	Bennett, 1989a; Ramlee, 2006	Renitha, 2022		Teo <i>et al.</i> 2019	Bennett, 1989b; Bennett, 1992	8
3.	<i>Nasalis</i>		Aziz, 2019; Aziz <i>et al.</i> 2015; Aziz & Laman, 2018; Aziz & Mohd-Azlan, 2022; Bennett, 1987; Bennett & Sebastian, 1988; Bennett & Rajaratnam, 1990; 1992; Budeng, 2014; Kombi & Abdullah, 2013; 2016; Laman & Aziz, 2019; Meijaard & Nijman, 2003; Nightingale, 1981; Salter & MacKenzie, 1985; Salter <i>et</i>	Bigoni <i>et al.</i> 2003; Ho, 2013; Mazlan <i>et al.</i> 2019; 2021		Adrus <i>et al.</i> 2019; Thayaparan <i>et al.</i> 2014	Bennett, 1987; Kombi & Abdullah, 2016; Salter & MacKenzie, 1985	24

			<i>al.</i> 1985; Tuen & Pandong, 2007			
4.	<i>Trachypithecus</i>		Laman <i>et al.</i> 2007; Mohd-Izhar, 2006; Wan- Azman, 2017; Wan-Azman <i>et al.</i> 2021; Wan-Azman & Khan, 2022	Tamrin <i>et al.</i> 2020; Wan-Azman <i>et al.</i> 2021	Ag-Tuah, 2015; Lee, 2015	8
5.	<i>Presbytis</i>	Hatta-Ramlee, 2011; Mohd-Azlan & Kaicheen, 2022	Ampeng, 2007; Ampeng & Md-Zain, 2012; Duckworth <i>et al.</i> 2011; Hatta-Ramlee, 2011; Silang <i>et al.</i> 2016;	Aifat <i>et al.</i> 2016; Meyer <i>et al.</i> 2011; Vun <i>et al.</i> 2011	Hatta-Ramlee, 2011	9
6.	<i>Macaca</i>	Mohd-Azlan & Engkamat, 2006; 2013; Mohd-Azlan <i>et al.</i> 2018a; 2018b; 2022; Silang <i>et al.</i> 2016; Zahidin <i>et al.</i> 2016	Mohd-Izhar, 2006; Mohd-Azlan <i>et al.</i> 2017; Normaisharah, 2017		Nada-Raja <i>et al.</i> 2018; 2022; Teo <i>et al.</i> 2019	13
7.	<i>Cephalopachus</i>	Abdullah, 1999; Zahidin <i>et al.</i> 2016	Naharudin, 2017; Niemitz, 1973a; 1973b; 1974; 1979; Sahimi <i>et al.</i> 2018	Naharudin, 2017		8
8.	<i>Nycticebus</i>		Miard <i>et al.</i> 2017	Munds <i>et al.</i> , 2013	Madani & Nekarlis, 2014; Utap <i>et al.</i> 2019	4

Genus *Nasalis* was the most studied primate in Sarawak ($n = 24$), followed by *Pongo* ($n = 21$), and *Macaca* ($n = 13$). Meanwhile, the genus *Nycticebus* ($n = 4$) was the least studied primate in Sarawak, suggesting that these genera require the most attention from researchers. Research on the genus *Nasalis* has been consistently conducted for the past four decades, with the highest between 2010 and 2020. Similarly, the number of studies on the genus *Presbytis* was significantly higher in 2010–2020 ($n = 7$) than in the past decade ($n = 1$), indicating a rising focus on research concerning colobine monkeys. The number of studies on primate genera may have been influenced by the species distribution, population size, accessibility to locations within the species distribution, and availability of research centers. For example, studies on *Nasalis* and *Pongo* were mostly conducted in the same locations where they are abundant (i.e., Samunsam WS and Bako NP for *Nasalis*; Batang Ai NP and Lanjak-Entimau WS for *Pongo*). In 2010 to 2020, the number of studies conducted was relatively high, presumably due to the recent advances in technology, such as next-generation sequencing, Global Positioning System tracking, and unmanned aerial vehicle approaches (Hale *et al.* 2018; Lhota *et al.* 2019; Stark *et al.* 2017a; 2017b).

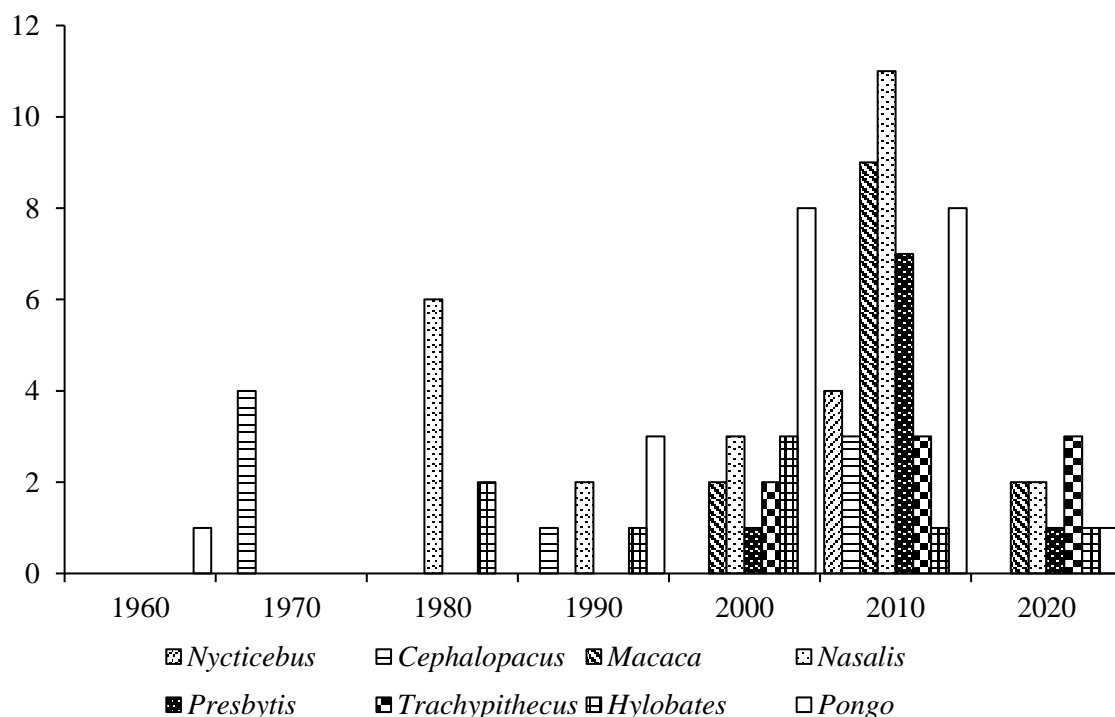


Figure 2. Studies of primates in Sarawak by genus per decade from 1960 to 2020 showing research concentration for the last two decades

Conservation Status

IUCN Red List

Six primate species in Sarawak have been classified as Vulnerable including slow lorises (i.e., *N. kayan*, and *N. menagensis*), and leaf-monkey (i.e., *P. rubicunda*, *P. hosei*, *P. frontata* and *T. cristatus*). Meanwhile, Western tarsiers (*C. bancanus*), macaques (*M. fascicularis* and *M. nemestrina*), gibbons (*H. abbotti* and *H. funereus*), and Bornean orangutans were categorised as Endangered. Contrarily, Bornean endemic species proboscis monkey (*N. larvatus*) and Bornean banded langur (*P. chrysomelas*) have been listed as Critically Endangered. Furthermore, the conservation status analysis revealed that 43% of Sarawak primate species are vulnerable and endangered, and 13% are critically endangered (Figure 3).

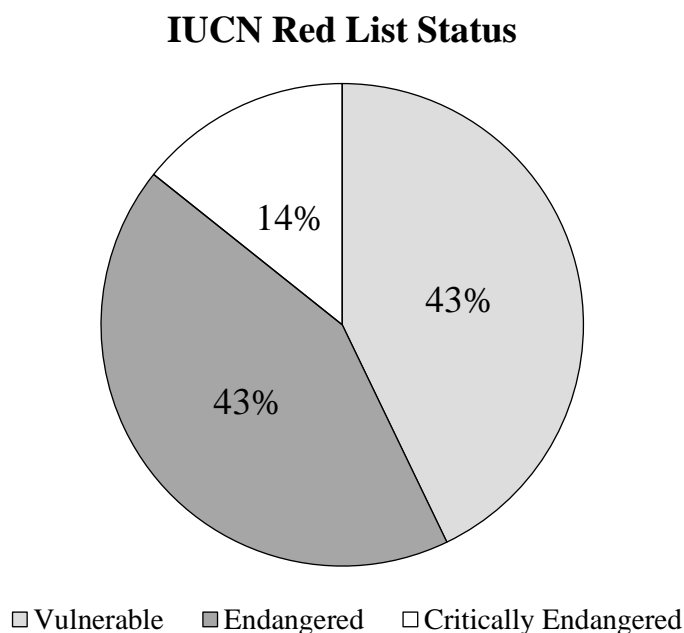


Figure 3. Chart of IUCN Red List Status of Sarawak Primate

CITES

All primate species in Sarawak are CITES-listed, with eight species included in Appendix II and the others in Appendix I (Table 1). Appendix II includes about half of the primates in Sarawak, including the critically endangered Bornean banded langur (Figure 4). Appendix I species are generally those facing extinction, such as *Nycticebus* spp., *N. larvatus*, *Hylobates* spp., and *P. pygmaeus*.

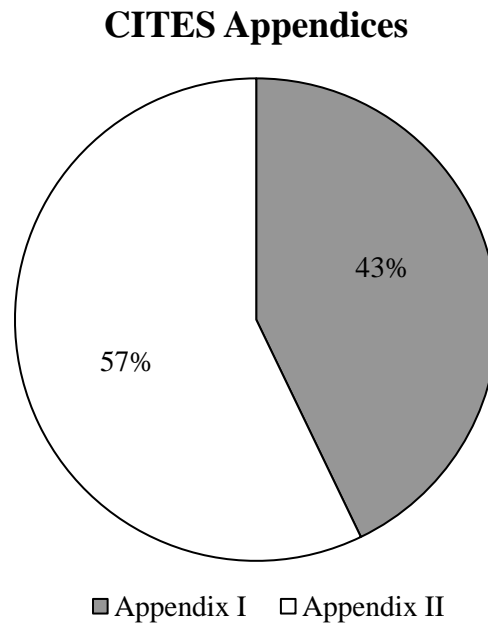


Figure 4. Chart of CITES Appendix of Sarawak Primate

Threat for Sarawak Primate

Habitat loss and degradation

Habitat loss and degradation are the greatest threats to primates due to the increases in land-use for monoculture practice, timber production, and industrial development (Chapman & Peres, 2021). Particularly in Sarawak, deforestation has been attributed to land conversion for oil palm plantation, agricultural practices, logging, and road development (Alamgir *et al.* 2020; Hon & Shibata, 2013; Mohd-Azlan & Lawes, 2011). The forest area in Sarawak boasts 62% of the total state land covering the Totally Protected Area, permanent forest estates, and state land forest (Koh *et al.* 2023). It is concerning that 23% of the land in protected areas was logged. Sarawak has been most logged than Sabah and Brunei (Bryan *et al.* 2013).

Deforestation is the greatest threat to certain primate species, including Bornean banded langur (Ehlers Smith, 2014; Meyer *et al.* 2011) and orangutan (Ancrenaz *et al.* 2016a; 2016b; Marshall *et al.* 2008; Pandong *et al.* 2019; Voight *et al.* 2018; Wich *et al.* 2012a; 2012b). Approximately 83% (900 individuals) of the overall orangutan population has been reduced in Sarawak due to logging activities in both primary and selectively logged forests between 1999 and 2015 (Voight *et al.* 2018). Furthermore, the density of the *P. rubicunda* and *P. frontata* population drastically declined in response to the logging activities in Kapit (Dahaban *et al.* 1996). Contrarily, primates have more behavioral and ecological resilience than other species when challenged

with habitat loss, degradation, and forest fragmentation, which also alter their daily activities, such as behavior and diet. For example, some primates, including macaques (Ruslin *et al.* 2019; Koh *et al.* 2020), *T. cristatus* (Sahmat & Mohd-Azlan, 2022), and *P. hosei* (Nijman *et al.* 2021), found foraging in oil palm plantation and other human-dominated areas, including residence, agricultural plantation, and tourist attraction.

Habitat fragmentation

Forest fragmentation in Malaysia was mostly caused by land conversion for crops, plantation, and road construction (Abdullah & Nakagoshi, 2007; Brühl *et al.* 2003; Lappan & Ruppert, 2019). Most of the protected areas in Sarawak are typically small and fragmented; thus, primates in Sarawak occupy small forest fragments embedded in the anthropogenic landscape (Chapman & Peres, 2021; Estrada *et al.* 2017). In fact, the protected areas in Sarawak only encompass a small portion of the forest (Bryan *et al.* 2013). Forest gap created by road development had detrimental effects on population density and diversity and caused disturbance to large mammals, including primates; it also affected their behaviour due to the restriction of primate and arboreal species movements (Brodie *et al.* 2014; Clements *et al.* 2014; Laurance *et al.* 2009; Mohd-Azlan *et al.* 2018b; Mohd-Azlan & Lawes, 2011; Tsuyuki *et al.* 2011). In addition, road construction increases the probability of roadkill among wildlife (Jamhuri *et al.* 2020; Mohd-Azlan & Engkamat, 2006; Mohd-Azlan *et al.* 2020; Lappan & Ruppert, 2019). Although no cases of roadkill among primates in Sarawak have ever been reported, a survey documented that *Macaca nemestrina* cross the Pan-Borneo Highway to access the forest in the opposite side (Mohd-Azlan *et al.* 2020). Furthermore, this land development facilitates hunting activities and non-timber forest production.

Hunting & Illegal trade

Hunting for pets, bushmeat, and traditional medicine is a significant threat to some primate species, including *Nycticebus* spp. (Nekaris *et al.* 2020; Zubaidah *et al.* 2012), *T. cristatus* (Ang *et al.* 2020; Meijaard & Nijman, 2020), and *Presbytis* spp. (Hatta-Ramlee, 2011). Hunting was reported to have a more severe impact on 10 of 11 primates in Borneo compared with logging activities (Brodie *et al.* 2014), including *N. larvatus*. Which, the decline in the *N. larvatus* population in Sarawak is mainly due to hunting activities (Bennett & Gombek, 1993; Khan *et al.* 2021). Furthermore, several indigenous groups in Sarawak consumed primates (Yi & Mohd-Azlan, 2020; Zubaidah *et al.* 2012). In Sarawak, approximately 23,500 tons of wild meat are

harvested annually (Bennett, 2002, Chapman & Peres, 2021). However, this practice was stopped due to religious beliefs and cultural prohibitions in certain communities, particularly Muslim communities (Horowitz, 1998; Santika *et al.* 2017). Hunting has also significantly increased due to factors such as forest loss, road construction, improved hunting equipment, and increasing human population (Milner-Gulland *et al.*, 2003). Human population growth ultimately increases the desire for primates as pets; hence, primates have been overexploited to fulfill this need. In recent years, primates have been illegally hunted and traded as pets, including *Nycticebus* spp. (Nekaris *et al.* 2020), *T. cristatus* (Ang *et al.* 2020), and *Hylobates* spp. (Bartlett, 2007, Campbell *et al.* 2008, 2015, Cheyne *et al.* 2016; Nijman *et al.* 2020a).

Furthermore, some primate species were hunted for certain parts of their body, such as bezoar stone in colonies (Caldecott, 1992; Cheyne *et al.* 2020a; 2020b; Ehlers Smith, 2014; Hatta-Ramlee, 2011; Khan *et al.* 2021; Kombi & Abdullah, 2016; Nijman, 2005) and gibbon bones. They are highly regarded for its curative properties and are used as tonic additives in traditional medicine (IUCN, 2022). On the other hand, *T. cristatus* was hunted for meat and to prevent nuisance and crop raiding (Meijaard & Nijman, 2020; Sahmat & Mohd-Azlan, 2022). In recent years, hunting has become more prevalent, highlighting the need for comprehensive conservation efforts to safeguard these imperilled primate species.

Conservation Efforts

Habitat Protection

By the year 2020, 8% of the forested areas in Sarawak were announced as Totally Protected Area under the provisions of the National Parks Ordinance (1998) and Wildlife Protection Ordinance (1998), mainly for the conservation and protection of wildlife, preservation of natural geographical landscape, and research (FDS, 2023; SFC, 2022). Some of the protected areas are specifically established for the conservation of specific species, whereas Lanjak-Entimau NP and Batang Ai NP are established for the conservation of *P. pygmaeus*, *N. larvatus* in Bako NP, and *Rafflesia* spp. in Gunung Gading NP (Mohd-Azlan & Lawes, 2011; SFC, 2022). Furthermore, the tri-national adjacent initiative involving Malaysia (Sabah and Sarawak), Brunei, and Indonesia (Kalimantan) through a large-scale project named Heart of Borneo in 2007 is among the conservation initiatives to protect Borneo's forests and wildlife. This project aims to balance ecological protection and sustainable development in Borneo, which includes 2.5 million ha of high montane forest and an international watershed (Hitchner *et al.* 2009; Sloan *et al.* 2019; Stone, 2007).

Ex-Situ Conservation

As wild primate habitats continue to decline unabatedly, *ex situ* conservation can help safeguard the species through the maintenance of viable populations in captivity as assurance populations. Rehabilitation centers in Sarawak (i.e., Matang WC and Semenggoh WC) were established particularly for orangutan conservation, working on their rehabilitation and reintroduction into the wild. Apart from orangutans, captive facilities in Sarawak, particularly Matang WC, also hold other primate species, including macaques, gibbons, and tarsiers. Also, several behavioral and veterinary studies on captive primates have been conducted as an attempt at *ex situ* conservation (Adrus *et al.* 2019; Ag-Tuah, 2015; Lee, 2015; Nada-Raja *et al.* 2020; Renitha, 2022; Teo *et al.* 2019; Thayaparan *et al.* 2014).

Suggestions and Recommendations

Based on metadata, we suggest a few key areas that additional research needs to focus on to determine the best conservation action to preserve primate diversity in Sarawak, Malaysia.

1. *Nycticebus* spp.—This genus is poorly studied. Field studies on wild slow loris in Sarawak are scarce. Thus, additional studies are needed to investigate the population size, distribution, ecology (i.e., home range, activity pattern, feeding), and molecular genetics of this genus in Sarawak.
2. *Cephalopachus* spp. —This genus requires more research as the existing data from previous studies are outdated. More ecological and molecular studies are also needed due to limited molecular data of Western tarsier in Borneo, Malaysia.
3. *Macaca* spp.—Although macaques are abundant and widely dispersed, information on its population, social behavior, diet, and ranging pattern are still brief. Therefore, additional surveys are needed to minimize human–macaque conflicts. Furthermore, the studies conducted in Sarawak were mostly for medical research. Meanwhile, ecological studies on pig-tailed macaque have not yet been conducted.
4. *Presbytis* spp.—This genus requires the most research attention due to the lack of ecological (i.e., population, distribution, behavior, feeding, and genetic information) that would be useful to study its taxonomy. In addition, the health status of *Presbytis* spp. must be evaluated by identifying zoonotic illnesses using cutting-edge technologies, such as next-generation sequencing.
5. *Hylobates* spp.—Lack of both ecology and molecular studies, little information on the population size, distribution, and current status as the last population study on

gibbons in Malaysia was done in the 80s. Genetic information of gibbons in Sarawak is specially needed to identify the species of gibbons in captivity and to construct complete phylogenetic trees.

Overall, the primate studies in Sarawak are biased, with most of them focusing only on Bornean iconic species, such as *N. larvatus* and *P. pygmaeus*. Thus, other primate species have been neglected due to the scarcity of studies about them. As mentioned, the genus *Presbytis* requires considerable attention from researchers due to the sparse information of most of its species. For example, *P. rubicunda* was the most extensively studied endemic *Presbytis* species (Ehlers-Smith, 2014), yet no study of *P. rubicunda* in Sarawak was ever conducted, the same with *P. frontata*. Apart from *Presbytis* spp., *Nycticebus* spp. and *Hylobates* spp. also need additional research attention as these genera remain understudied despite the primate study in Sarawak being conducted since the 1960s.

Although all primates in Sarawak are legally protected under state legislation, WLPO (1998), neither a proper protection plan nor a specific management plan or long-term conservation project has been implemented. This makes these primates perpetually vulnerable to habitat loss, land conversion, agricultural practices, habitat fragmentation, illegal trade, and hunting (for bezoar stone in colobines, to be kept as pets, and to consume their meat) (Bennett & Gumal, 2001; Harrison, 1961; Ramlee-Hatta, 2011; Setiawan *et al.* 2009). This put them on the verge of extinction, similar to the critically endangered *P. chrysomelas*.

Therefore, comprehensive studies, including surveys, behavioural and ecological studies, and studies on species distribution or occurrence, are required to help us evaluate the current and predict the future distribution of the species, similar to population census to provide data on the species' current status. Meanwhile, more molecular studies also need to be conducted because molecular data are crucial for resolving taxonomic uncertainties and elucidating evolutionary history and phylogeny. The data will also enable primate populations to adapt to continuous environmental changes (Blairs *et al.* 2011; Hendry *et al.* 2010).

Conclusion

Over time, primates in Sarawak will remain susceptible to habitat loss, hunting, illegal trade and more severe threats. The information from the past is undoubtedly significant for understanding the behaviour, ecology and natural history of these animals. However, the focus on Sarawak iconic primate genera such as *N. larvatus* and *P. pygmaeus* has left us with gaps in our understanding of other species, which could be important for future conservation efforts. Thus, in this review, we highlighted large gaps on distribution, population status and ecology of the neglected primate genera in Sarawak. In the absence of adequate inventories and management, threatened species may go extinct, both locally and globally within few decades. It is critical that we expand our research efforts. Hence, this review lays the groundwork for future primate research in Sarawak by incorporating specific conservation strategies within theoretical research designs. These include studies of a broader range of primate genera, including molecular biology, natural history, evolution, health status, and responses to environmental changes. Also, emphasised the significance of collaboration among scientists, conservationists, policies makers, local authorities and other stakeholders. Though the ongoing conservation efforts in Sarawak already include reforestation effort as well as establishing protected areas, but protecting primate habitat is still top priority to ensure the long-term survival of primate in Sarawak. Thus, comprehensive overview of the current state of knowledge about Sarawak primates provided in this review could be helpful to local authorities, which may employ it help to shape conservation policies and approaches that are tailored to the needs of species-specific and ecosystem conservation strategies in this region.

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