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Amphibians from Peat Swamp Forest of Gunung Palung National Park, West Kalimantan, Indonesia

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SYNOPSIS

Peat swamp forests are unique and vulnerable ecosystems that support specialized biodiversity, including amphibian communities that are highly sensitive to environmental changes. However, information on amphibian diversity in peat swamp forests of West Kalimantan, particularly in Gunung Palung National Park, remains limited. This study aimed to document amphibian species richness and composition in peat swamp habitats using Visual Encounter Survey (VES) methods across multiple observation sites with differing environmental conditions. A total of 19 species were recorded, including several species widely associated with peat swamp ecosystems and notable records that expand known distributions in Borneo. Species composition varied across sites and was influenced by vegetation structure, habitat conditions, and acidity levels. These findings provide essential baseline data and highlight the importance of habitat heterogeneity in shaping amphibian communities, supporting future conservation planning and biodiversity monitoring in peat swamp ecosystems.

Keywords: Amphibians; peat swamp forest; amphibian diversity; species composition; Visual Encounter Survey; Gunung Palung National Park; West Kalimantan.

INTRODUCTION

Gunung Palung National Park (GPNP) is a 108,043.90 ha protected area (KLHK, 2016) located in West Kalimantan, Indonesia, and is widely recognized as one of the most biologically diverse national parks in the region. The park encompasses eight distinct ecosystem types with high biodiversity value, one of which is peat swamp forest. This ecosystem is characterized by acidic conditions, low nutrient availability, and a high accumulation of organic matter, making it particularly vulnerable to environmental disturbance and change (Leo et al., 2020; Pratama et al., 2023). In West Kalimantan, peat swamp forest cover has declined at an estimated rate of 98,709.73 ha per year, with approximately 3,016 ha lost within GPNP between 1989 and 2018 (Fawzi et al., 2019; Suryandari, 2017). This decline is primarily driven by forest fires, the expansion of oil palm plantations, and land clearing by local communities (Anamulai et al., 2019; Yeager et al., 2003). The continued loss of peat swamp forests is of particular concern, as it not only diminishes water regulation and carbon storage capacity but also results in the degradation and loss of critical habitats for amphibian communities.

Source: https://www.nature.com/articles/d44151-025-00119-w

Globally, approximately 8,577 amphibian species have been recorded, while Indonesia harbors around 390 species, consisting of 380 frog species and 10 caecilian species (AmphibiaWeb, 2023). Previous studies in peat swamp ecosystems have documented relatively limited amphibian diversity, with 12 species recorded in Zamrud National Park, Riau (Leo et al., 2020), and 11 species in the Sungai Buluh Peat Protection Forest, Jambi (Nugraha et al., 2021). However, information on amphibian diversity in peat swamp forests of West Kalimantan, particularly in Sedahan Jaya, remains scarce (Yule, 2010).

Given the ongoing decline of peat swamp forests, comprehensive biodiversity data, including amphibians, are essential to inform effective conservation strategies. Therefore, this study aims to provide an updated and more comprehensive inventory of amphibian species in the peat swamp forests of Sedahan Jaya Village, GPNP. In addition, this research examines variations in amphibian species composition across different observation sites within the peat swamp ecosystem to support future conservation planning and management efforts.

ARTICLE CONTENT

The study area was divided into two observation sites: one exhibiting clear anthropogenic disturbance (Reforestation Area & Aik Merah) and another with no observable signs of disturbance (Downstream and Upstream of Cabang Dua), with a total transect coverage of 20,000 m² (Figure 1). Each site was further subdivided into two sampling stations, separated by a minimum distance of 500 m. The survey was conducted from April to July 2022, comprising 12 survey days and 72 observation hours. Active surveys were carried out by five observers using the Visual Encounter Survey (VES) method (Heyer et al., 1994; Janiawarti et al., 2016; Kusrini, 2019; Leo et al., 2020). Observations were performed during two daily periods, in the morning (06:00–09:00 AM) and in the evening (06:00–09:00 PM), using equipment such as headlamps and nets.

Source: https://www.frogsofborneo.org/frogs/dicroglossidae/limnonectes/paramacrodon

A total of 139 amphibian individuals were recorded during 12 survey days (Figure 2), representing 19 species, 14 genera, and 6 families (Table 1; Figure 3). Among these, five species were categorized as commonly encountered across the study area, with Limnonectes paramacrodon being the most abundant species and recorded at all observation stations. None of the identified species are currently listed as protected under Indonesian national regulations (Permen LHK No. P.106/MENLHK/SETJEN/KUM.1/12/2018).

The species richness recorded in this study is higher than that reported in previous studies conducted in similar peat swamp ecosystems. On Borneo Island, earlier surveys documented only four species in Sebangau National Park (Maulidi et al., 2020), 16 species in the same area (Wicaksono et al., 2015), and eight species in Lamandau Wildlife Reserve (Maireda & Eprilurahman, 2019). Comparable patterns are also observed in other peat swamp regions of Indonesia, where no more than 12 amphibian species have been recorded, including 12 species in Riau (Leo et al., 2020), 11 species in Jambi (Nugraha et al., 2021), and four species in Jambi (Azhari et al., 2022). Variation in species richness among studies may be influenced not only by environmental differences but also by methodological factors, such as sampling effort and survey techniques (Kusrini, 2019). In this study, the relatively longer survey duration and greater sampling effort may have contributed to the higher number of species recorded.

Source: https://www.flickr.com/photos/jono-dashper/49512898383

The findings of this study also contribute to the overall checklist of peat swamp amphibians in Borneo. Previous compilations reported a total of 24 species associated with peat swamp forest ecosystems on the island (Inger et al., 2005; Silang et al., 2016; Wicaksono et al., 2015). Most of the species recorded in this study have been documented in similar habitats; however, two species, Kalophrynus meizon and Leptomantis rufipes, have not been reported in earlier peat swamp studies. These records therefore represent additional species for the peat swamp amphibian checklist in

Source: https://www.frogsofborneo.org/frogs/rhacophoridae/leptomantis/rufipes

Borneo. Furthermore, five species, namely *Ingerophrynus quadriporcatus, Hylarana raniceps, Occidozyga laevis, Pulchrana baramica* and *Limnonectes paramacrodon* were consistently observed across all sampling stations. These species are known to be widespread and commonly associated with peat swamp habitats and their presence has also been reported in peat swamp forests of Sabah, Malaysia (Inger & Stuebing, 2005; Inger et al., 2005, 2017).

In addition, five of the recorded species are endemic to Borneo, namely *Limnonectes leporinus, Leptobrachium abbotti, Kalophrynus meizon, Hylarana raniceps,* and *Leptomantis rufipes,* representing five different families. Among these, *K. meizon* and *L. rufipes* have relatively limited documented distributions and are not known to occur throughout the entire island (IUCN SSC Amphibian Specialist Group, 2018; Zug, 2015). The occurrence of these two species in the present study, therefore extends their known distribution range to include the southern part of Borneo.

Peat swamp forests originate from the incomplete decomposition of organic materials such as leaf litter, branches, and woody debris accumulated over hundreds to thousands of years. The presence of leaf litter plays a crucial ecological role by providing microhabitats for various amphibian species (Faris et al., 2019; Magee, 2019). In this study, *Leptobrachium abbotti* and *Kalophrynus meizon* were consistently encountered on forest floors with abundant leaf litter, supporting previous findings that these species are closely associated with such microhabitats (Iskandar, 2004; Nadia et al., 2020).

Source: https://www.flickr.com/photos/25872797@N02/50496559976/

The composition of amphibian species in an area can be influenced by environmental factors (Ayuningrum, 2015). The research areas were grouped based on the condition of vegetation, e.g., density, composition, and natural history. The Reforestation Area has drier habitats than other observation stations. The Reforestation Area is an area with vegetation conditions dominated by saplings, the canopy conditions are not dense, the surrounding area has been cleared for palm oil plantation (Elais guinensis), and was burned 2 decades ago. The human activity surrounding this station could increase the forest temperature and reduce the humidity which will affect the stability of amphibian populations as ectothermic creatures (Bickford et al., 2010; Faruk et al., 2013; Rejeki & Santosa, 2019).

Water acidity is a key environmental factor distinguishing peat swamp forests from other forest types, typically characterized by low pH conditions (Rieley, 2016). In Bornean peat swamps, water pH generally falls below 6, while soil pH ranges between 3 and 5 (Djuwansah & Suherman, 2002; Rinaldi et al., 2019; Rosli et al., 2010). In contrast, pH measurements at all stations in Cabang Dua tended to be closer to neutral. The upstream section of Cabang Dua, which exhibited more neutral conditions than downstream stations, may provide suitable habitat for species such as Limnonectes leporinus and Leptomantis rufipes. These patterns suggest that variation in acidity within the peat swamp system may influence local species distribution.

Figures & Tables

Table 1 Checklist of Amphibians from the Peat Swamp Forest of Gunung Palung National Park

No	Scientific Name	Common Name	Site 1		Site 2		OT	n
			RA	AM	DCD	UCD		
Bufonidae								
1	*Duttaphrynus melanostictus*	Southeast Asian Toad					√	1
2	*Ingerophrynus quadriporcatus*	Four-ridged Toad	√	√	√			**19**
3	*Pseudobufo subasper*	False Toad	√	√				**4**
Dicroglossidae								
4	*Fejervarya cancrivora*	Crab-eating Frog					√	**16**
5	*Fejervarya limnocharis*	Cricket Frog					√	**16**
6	*Limnonectes leporinus**	Giant River Frog				√		**6**
7	*Limnonectes paramacrodon*	Lesser Swamp Frog	√	√	√	√		**26**
8	*Occidozyga laevis*	Puddle Frog	√	√		√		**10**
Megophryidae								
9	*Leptobrachium abbotti**	Lowland Litter Frog	√	√				**6**
Microhylidae								
10	*Kalophrynus meizon**	Borneo Big Sticky Frog			√			**1**
Ranidae								
11	*Hylarana baramica*	Baram River Frog	√	√	√			**19**
12	*Hylarana erythraea*	Green Paddy Frog	√					**1**
13	*Hylarana megalonesa*	Large White-lipped Frog			√	√		**3**
14	*Hylarana raniceps**	White-lipped Frog	√	√		√		**4**
Rhacophoridae								
15	*Kurixalus chaseni*	Frilled Tree Frog	√					**1**
16	*Leptomantis rufipes**	Red-legged Tree Frog				√		**1**
17	*Polypedates colletti*	Collett's Tree Frog			√	√		**2**
18	*Polypedates leucomystax*	Four-lined Tree Frog					√	**2**
19	*Polypedates macrotis*	Dark-eared Tree Frog		√				**1**
		TOTAL						**139**

Source: Primary data obtained from field surveys conducted in Gunung Palung National Park

Notes: * = Endemic of Borneo; RA = Reforestation Area; AM = Aik Merah; DCD = Downstream of Cabang Dua; UCD = Upstream of Cabang Dua; OT = Outside Transect; & n = number of individuals

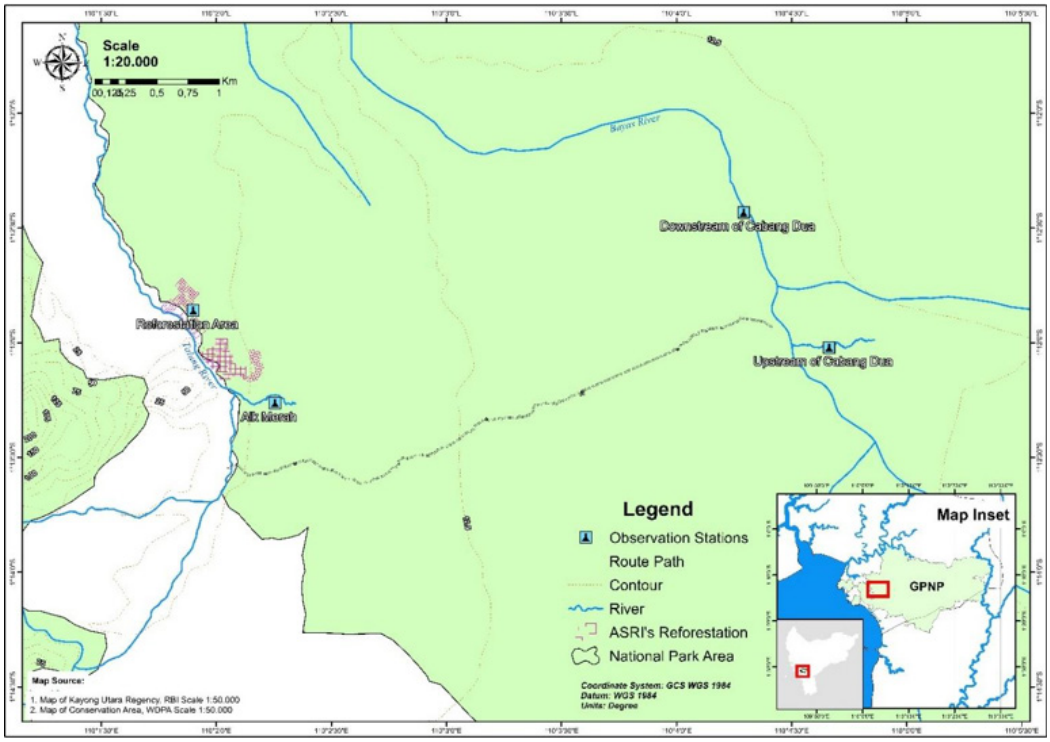

Figure 1 Study Area in the Peat Swamp Forest of Sedahan Jaya, Gunung Palung National Park

Source: Developed by the authors using GIS data, 2026.

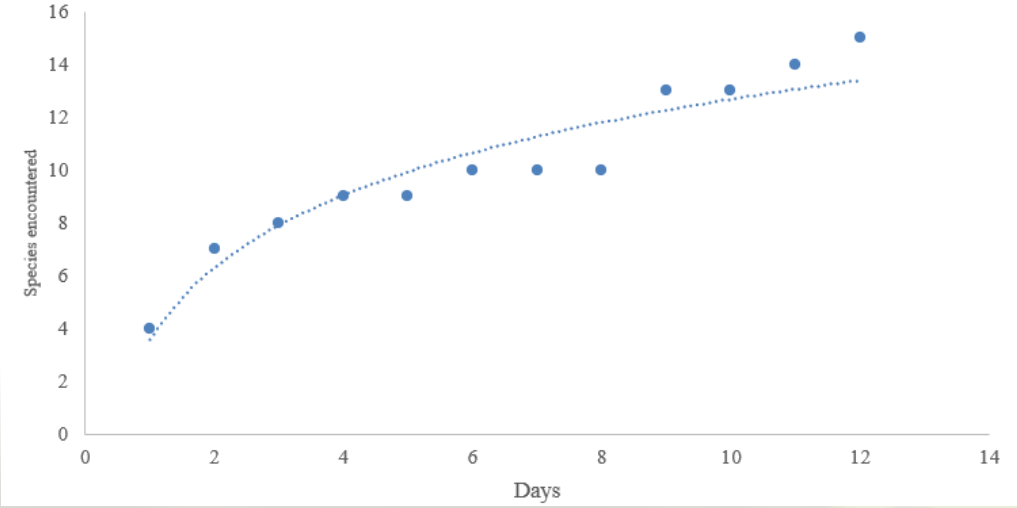

Figure 2 Species Accumulation Curve of Amphibians Recorded During 12 Days of Sampling

Source: Developed by the authors based on field data analysis, 2026.

Source: https://frogsofborneo.org/frogs/dicroglossidae/occidozyga/laevis

Figure 3 Eight of the 19 Amphibian Species Recorded in This Study: (A) *Pseudobufo subasper*, (B) *Limnonectes leporinus*, (C) *Occidozyga laevis*, (D) *Leptobrachium abbotti*, (E) *Kalophrynus meizon*, (F) *Hylarana baramica*, (G) *Kurixalus chaseni*, (H) *Polypedates colletti*

Source: Photographed by the authors, 2026.

FUTURE DIRECTIONS

Future study should aim to expand surveys of amphibian diversity across a wider range of peat swamp habitats in Gunung Palung National Park and other underexplored regions of Borneo to improve baseline biodiversity data. It is recommended that future studies incorporate standardized and long-term monitoring, including seasonal sampling and detailed measurements of environmental variables such as pH, temperature, and humidity, to better understand factors shaping species composition. Additionally, integrating conventional survey methods with molecular approaches, such as environmental DNA (eDNA), would enable more comprehensive and non-invasive detection of amphibian communities, including rare, cryptic, and habitat-specialist species, thereby strengthening conservation planning and management efforts.

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READINGS

AmphibiaWeb. (2023, January 18). New Described Species by Year. https://amphibiaweb.org/amphibian/newspecies.html.

Anamulai, S., Sanusi, R., Zubaid, A., Lechner, A. M., Ashton-Butt, A., & Azhar, B. (2019). Land use conversion from peat swamp forest to oil palm agriculture greatly modifies microclimate and soil conditions. PeerJ 7:e7656, 1-16. https://doi.org/10.7717/peerj.7656.

Ayuningrum, N. (2015). Komunitas Amfibi di Beberapa Sungai pada Suaka Margasatwa Nantu Provinsi Gorontalo. Thesis. Institut Pertanian Bogor. Bogor.

Azhari, A., Sukmono, T., Nugraha, A. P., Ihsan, M., & Suprayogi, D. (2022). Keanekaragaman amfibi (ordo anura) di Hutan Lindung Gambut Londerang Tanjung Jabung Timur. Biospecies, 15(1), 10–15.

Bickford, D., Howard, S. D., Ng, D. J. J., & Sheridan, J. A. (2010). Impacts of Climate Change on the Amphibians and Reptiles of Southeast Asia. Biodiversity and Conservation, 19(4), 1043–1062. https://doi.org/10.1007/s10531-010-9782-4.

Djuwansah, M., & Suherman, D. (2002). Shallow groundwater chemistry of Podzols in Central Kalimantan. Proceeding International Symposium on Land Management and Biodiversity Is South East Asia. Palangkaraya.

Faris, M., Marina, M. T., Shamarina, S., Ghani N.I., A., & C., F. (2019). Types of leaves preference by Kalophrynus palmatissimus in two forest reserves. International Journal of Scientific and Research Publications (IJSRP), 9(10), p9443. https://doi.org/10.29322/ijsrp.9.10.2019.p9443.

Faruk, A., Belabut, D., Ahmad, N., Knell, R. J., & Garner, T. W. J. (2013). Effects of oil-palm plantations on diversity of tropical anurans. Conservation Biology, 27(3), 615–624. https://doi.org/10.1111/cobi.12062.

Fawzi, N. I. I., Indrayani, A. M., & DeKay, K. (2019). Forest change monitoring and environmental impact in Gunung Palung National Park, West Kalimantan, Indonesia. Jurnal Ilmu Lingkungan, 17(2), 197–204. https://doi.org/10.14710/jil.17.2.197-204.

Heyer, W. R., Donnelly, M. A., McDiarmid, R. W., Hayek, L. C., & Foster, M. S. (1994). Measuring and Monitoring Biological Diversity: Standard Methods for Amphibians. Smithsonian Institution. Washington.

Inger, R. F., & Stuebing, R. B. (2005). A Field Guide to The Frog of Borneo (Second Edition). Natural History Publications (Borneo). Kinabalu.

Inger, R. F., Stuebing, R. B., Grafe, T. U., & Dehling, J. M. (2017). A Field Guide to the Frogs of Borneo (Third Edition). Natural History Publications (Borneo). Kinabalu.

Inger, R. F., Stuebing, R. B., & Zainudin, R. (2005). Peat swamp frogs of Borneo. In A. Tuen & I. Das (Eds.), An International Conference on Biogeography and Biodiversity (pp. 178–181). Institute of Biodiversity and Environmental Conservation, Universiti Malaysia Sarawak. Sarawak.

Iskandar, D. T. (2004). The Amphibians and Reptiles of Malinau Region, Bulungan Research Forest, East Kalimantan: Annotated checklist with notes on ecological preferences of the species and local utilization (D. Sheil & M. Wan, Eds.). Center for International Forestry Research (CIFOR).

IUCN SSC Amphibian Specialist Group. (2018). Rhacophorus rufipes, Malaysian Flying Frog. https://doi.org/10.2305/IUCN.UK.2018.

Janiawarti, I. A. A., Kusrini, M. D., & Mardiastuti, A. (2016). Structure and Composition of Reptile Communities in Human Modified Landscape in Gianyar Regency, Bali. HAYATI Journal of Biosciences, 23(2), 85–91. https://doi.org/10.1016/j.hjb.2016.06.006.

KLHK. (2016). Informasi 521 Kawasan Konservasi Region Kalimantan-Sulawesi. Kementrian Lingkungan Hidup dan Kehutanan. Jakarta.

Kusrini, M. D. (2019). Metode Survei dan Penelitian Herpetofauna. IPB Press. Bogor.

Leo, S., Suherman, M., Permatasari, A., Suganda, D., Zulamri, & Winarni, N. L. (2020). Herpetofauna Diversity in Zamrud National Park, Indonesia: Baseline Checklist for a Sumatra Peat Swamp Forest Ecosystem. Amphibian and Reptile Conservation, 14(2), 250–263.

Magee, R. (2019). Effects of leaf litter on amphibian site selection. Thesis. Louisiana Tech University. Louisiana. USA.

Maireda, N. L., & Eprilurahman, R. (2019). Keanekaragaman dan distribusi amfibi di Suaka Margasatwa Lamandau, Kalimantan Tengah. Thesis. Universitas Gadjah Mada. Yogyakarta.

Maulidi, A., Rizki, M., Gunawan, Y. E., Adawiyah, R., Yosua, Y., & Panda, A. (2020). Inventarisasi dan Status Konservasi Herpetofauna di Punggualas, Taman Nasional Sebangau. Jurnal Jejaring Matematika Dan Sains, 2(1), 1–5. https://doi.org/10.36873/jjms.2020.v2.i1.301.

Nadia, S., Marina, M. T., Nadirah, R., Siti Fara Najua, M. N., Muhammad Faris, A. A., Mohamad Roslan, M. K., & Alias, M. A. (2020). The diversity of anuran species in urban forest in Selangor. 14th International UMT Annual Symposium, 494(1). https://doi.org/10.1088/1755-1315/494/1/012009.

Nugraha, A. P., Suprayogi, D., Kartika, W. D., & Setiawan, A. (2021). Distribusi Herpetofauna di Kawasan Hutan Lindung Gambut (Hlg) Sungai Buluh Tanjung Jabung Timur. Majalah Ilmiah Biologi Biosfera: A Scientific Journal, 38, 55–59.

Pratama, F. W., Junardi, Riyandi, Izza, Q., Leo, S., & Setiawan, E. (2023). Keanekaragaman jenis reptil pada ekosistem hutan rawa gambut di Desa Sedahan Jaya kawasan penyangga Taman Nasional Gunung Palung Kalimantan Barat. Zoo Indonesia, 32(1), 9–23.

Rejeki, S. S. S., & Santosa, Y. (2019). Impact of oil palm plantation on herpetofauna species diversity at PT Waimusi Agroindah South Sumatera. ICNREC 2018, 336(1). https://doi.org/10.1088/1755-1315/336/1/012030.

Rieley, J. O. (2016). Biodiversity of tropical peatland in Southeast Asia. 15th International Peat Congress 2016, 707–711.

Rinaldi, P. S., Akromah, Z. N., Ramadhan, H., Husna, S., Syamsudin, D. L., Panggabean, P. B., Murdianti, R. A., Fatahillah, M. H., Perala, I., Rizqia, E. K., Yahya, S. A., Novitasari, A., & Wibowo, C. (2019). Physical and chemical analysis of land in forest peat swamp in Resort Pondok Soar, Tanjung Puting National Park, Central Kalimantan. ICTS, 394(1). https://doi.org/10.1088/1755-1315/394/1/012037.

Rosli, N., Gandaseca, S., Ismail, J., & Jailan, M. I. (2010). Comparative study of water quality at different peat swamp forest of Batang Igan, Sibu Sarawak. American Journal of Environmental Sciences, 6(5), 416–421.

Silang, S., Tisen, O. B., Chung, W. T., & Sundram, K. (2016). The terrestrial fauna composition of the peat swamp forest of Ulu Sebuyau National Park, Sarawak, Malaysia. Proceedings of The15th International Peat Congress.

Suryandari, R. Y. (2017). Dinamika Perubahan Penutup Lahan Kalimantan Barat. Universitas Esa Unggul. Jakarta.

Wicaksono, G., Makur, K., & Baihaqi, A. (2015). Herpetofauna Punggualas Taman Nasional Sebangau: Panduan Visual dan Identifikasi Lapangan Amfibi dan Reptil. WWF-Indonesia. Palangka Raya.

Yeager, C. P., Marshall, A. J., Stickler, C. M., & Chapman, C. A. (2003). Effects of fires on peat swamp and lowland dipterocarp forest in Kalimantan, Indonesia. Tropical Biodiversity, 8(1), 121-138.

Yule, C. M. (2010). Loss of biodiversity and ecosystem functioning in Indo-Malayan peat swamp forests. Biodiversity and Conservation, 19(2), 393–409. https://doi.org/10.1007/s10531-008-9510-5.

Zug, G. R. (2015). Morphology and systematics of Kalophrynus interlineatus-pleurostigma populations (Anura: Microhylidae: Kalophryninae) and a taxonomy of the genus Kalophrynus Tschudi, Asian Sticky Frogs. Proceedings of the California Academy of Sciences, 135–190.

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