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The Diversity of Reptile Species in Mangrove Ecotourism of Kampung Rawa Mekar Jaya, Siak Regency

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Abstract

Rawa Mekar Jaya mangrove ecotourism is the last mangrove forest on the east coast of Sumatra Island. This mangrove forest is a home for reptiles. The reptilian fauna of the Mekar Jaya mangrove has the potential to become an ecotourism object. This study aims to determine the diversity, evenness, abundance, and status of reptile species in the Mekar Jaya mangrove ecotourism. Four 3 x 400 m transects were conducted in two habitat types: aquatic (10 m of bank) and terrestrial (30 m of bank). Observations were made in the morning and evening at low tide and repeated five times at three-day intervals. Direct collection of reptile data using a visual survey (VES) and passive sampling (glue trap). The researchers managed to capture 52 individuals, which were reptiles, consisting of 4 species (Draco sumatranus, Hemidactylus platyurus, Mabuya multifasciata, and Varanus savator) found directly in the field. The results of the interviews with the managers indicate that there are 2 species of crocodiles: Crocodylus porosus and Tomistoma schlegelii. Shannon-Wiener diversity index value was medium (H'=1.02). Evenness index was labile (0.57). The highest species abundance was M. multifasciata (0.65), while the lowest abundance was H. platyurus (0.12). All reptile species found were not protected. V. salvator is classified as a low-risk species (LC/Minor Concern) and is listed in Appendix II of CITES. Two crocodile species reported by the community are protected. T. schlegelii is vulnerable and listed in Appendix I of CITES. C. porosus is low-risk and listed in CITES Appendix II

Keywords: *Diversity index, Evenness, Least concern, Not protected, Vulnerable*

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INTRODUCTION

The diversity of reptiles on the island of Sumatra is recorded at about 224 species, which is nearly 30% of the total number of reptile species in Indonesia (Widjaja *et al.*, 2014, KLHK_LIPI, 2019). The number of species may decrease due to the use of reptile species, habitat fragmentation and loss, and pollution. Conversely, the number of species may increase as science develops and identifies a cryptic species into several new species or

subspecies. For example, Indonesian water lizards have been identified as *Varanus salvator, V. togianus, V. ziegleri* (Koch *et al*. 2007; Koch *et al*. 2013; Setyawatiningsih *et. al.,* 2016; The Reptile Database, 2023).

The existence of reptiles has a positive impact on the environment and humans. In the ecosystem, reptiles act as predators or prey species, so they can be said to balance the sustainability of the ecosystem in an area (Eprilurahman *et al*. 2009). In addition, there are also reptiles known to be scavengers or necrophagous (Koch and Arida, 2017; Uyeda *et al.,* 2013). The benefits of reptiles to humans, namely some reptiles can be used as pets, ingredients in traditional medicine, food ingredients, medical experiments, and craft materials (Hamdani *et al*., 2013). Some reptiles can also be used as objects of ecotourism (Subeno, 2018).

The mangrove ecotourism of Kampung Rawa Mekar Jaya (RMJ) is a habitat for reptiles. So far, the diversity of reptile species is limited only to the suborder Serpentes (snakes). This study aims to calculate the diversity, evenness, abundance of reptile species, and the conservation status of the species in the mangrove ecotourism of RMJ. The results obtained should provide information on the diversity of non-snake reptile species in the mangrove forest areas.

METHOD

Time and Location of Research

This study was conducted in August-September 2022. It was conducted in the mangrove forest of Kampung Rawa Mekar Jaya, Siak Regency, Riau Province (Figure 1). This study used four transects of 400 m length and 3 m width, which were placed by purposive sampling in two habitat types, namely: aquatic and terrestrial.

Sampling of reptile species

Direct observations were made using the Visual Encounter Survey (VES) method, which is: a method of collecting animal species based on direct encounters on trails in terrestrial and aquatic areas (Lovich, 2012). Reptile observations were carried out by 4 people. Search time was limited to 3-4 hours. Observations were made in the morning at 09-12.00 WIB, while night observations were made at 19-22.00 WIB. Observations were repeated 5 times in each transect with an interval of 3 days. Reptiles were captured, identified, recorded, photographed, and released. Observations were made on each transect focusing on areas that are habitats for reptiles, such as resting places, foraging areas, bushes, over kaya, wood piles, and areas exposed to direct sunlight.

Indirect observation using reptile traps (glue traps). A total of 10 glue traps were used in each transect for a total of 40 traps. The location of the traps was determined using a purposive sampling method. The traps were placed in places where small reptiles could pass, such as sunbathing areas, on trees, under trunks, at nest mouths, or when reptiles were foraging. The traps were set in the morning and checked at the time of observation.

Each individual reptile found was identified with several identification books, namely: Naming reptile species with Books: Amfibi dan Reptil Sumatera Selatan: Areal Sembilang–Dangku dan Sekitarnya (Kusrini, 2020); Buku Panduan Lapang Amfibi dan Reptil Kawasan Hutan Batang Toru (Kamsi *et al*., 2017); Buku Panduan Lapangan Jenis

- Jenis Reptil Di Kawasan Hutan Desa Aek Batang Paya, Bulu Mario, laut Lombat dan Marsada (Muhammad *et al.*, 2020); Panduan Lapangan Herpetofauna (Amfibi dan Reptil) Taman Nasional Alas Purwo (Yanuarefa *et al.*, 2012); and Panduan Identifikasi Jenis Satwa Dilindungi: Herpetofauna (KLHK-LIPI, 2019).

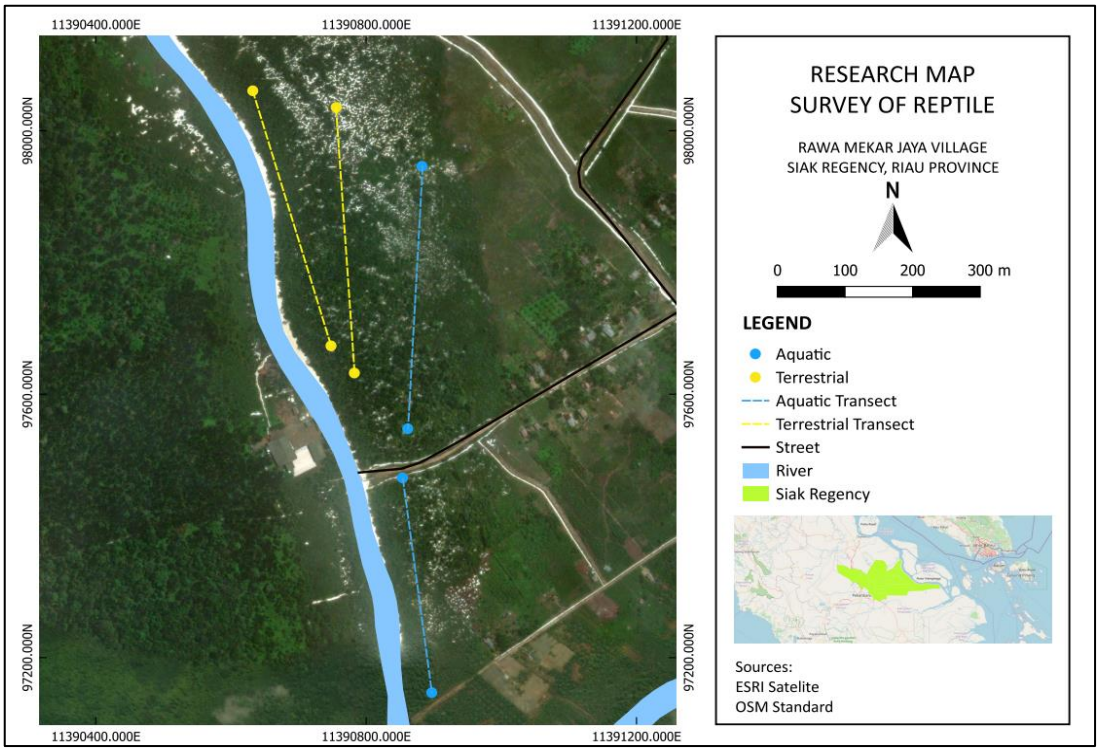

Figure 1. Map of research location

Data Analysis

The diversity of reptile species in the mangrove ecotourism of Kampung Rawa Mekar Jaya was calculated using the *Shannon-Wienner* diversity index (Hidayah *et al.*, 2018), with the following formula:

$$H' = \sum_{i=1}^{S} pi \; ln \; pi$$

Description: H' = Shannon diversity index
S = Number of species
pi = Proportion of the number of Ith individuals (n/N)
ln = Natural logarithm

With The criteria for the value of the Shannon-Wienner diversity index (H'):

H' < 1 = Low diversity
1< H' < 3 = Medium diversity
H' > 3 = High diversity

The species regularity index is used to determine the regularity of each species in each community found at each location, using the following regularity index formula (Siahaan *et al.*, 2019):

$$E = \frac{H'}{ln\ S}$$

Description: E = Species evenness index
H' = Shannon diversity index
ln = Natural logarithm
S = Number of species found

With Criteria for community similarity index values (Odum, 1996).
0.00 < E < 0.50 = Stressed community
0.50 < E < 0.75 = Labile community
0.75 < E < 1.00 = Stable community

Abundance (Cox, 1996 in Widodo, 2013) uses the following equation:

$$KR = \frac{Ki}{\sum Ki} \ which\ Ki = \frac{ni}{N}$$

Description: KR = Relative abundance
Ki = Absolute abundance
Ni = Number of individuals of the 1st species
N = Total number of individuals

RESULTS AND DISCUSSION

Reptile species composition

This study identified 52 individuals of reptiles belonging to 4 species, namely *Draco sumatranus, Hemidactylus platyurus, Mabuya multifasciata and Varanus savator* (Figure 2). In addition, two species of crocodiles, *Crocodylus porosus* and *Tomistoma schlegelii*, are present in the area (Sutiono, personal communication, 2022). In general, it can be said that more reptiles are found in aquatic than aquatic habitats as reptiles are arboreal, terrestrial, and semi-aquatic (Kamsi *et al.*, 2017).

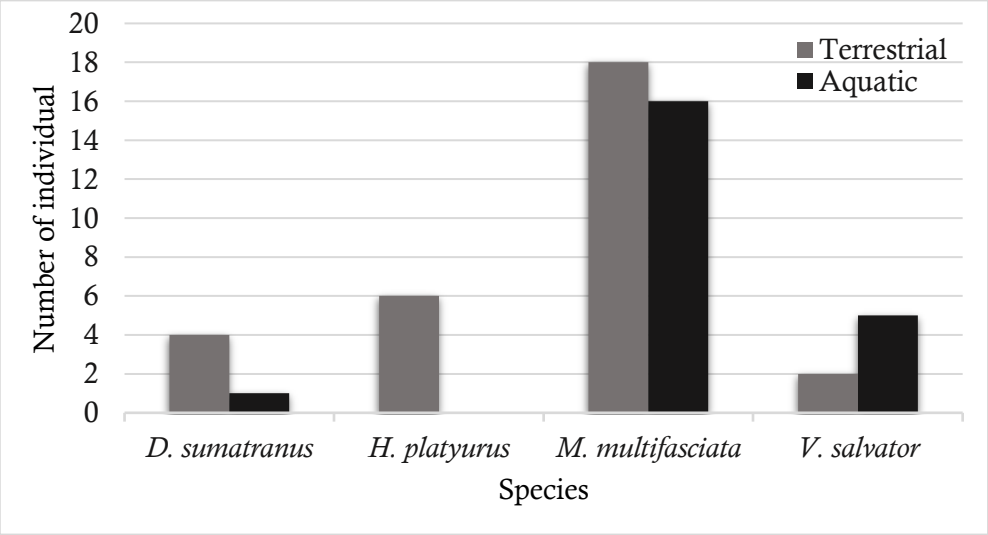

Figure 2. Composition reptile species in Mangrove Ecotourism of Kampung Rawa Mekar Jaya

The abundance of *M. multifasciata* (Figure 3.a) in the study site is assumed to be influenced by two factors, namely litterfall abundance and food sources: litterfall abundance and food sources. The abundance of litter creates a favorable microclimate for foraging by reptiles. The presence of tides in the study area creates pools of water at low tide, which provide a habitat for insects. Many small insects, such as mosquitoes, spiders, and midges, have been observed. Insects are the food of lizards, including *M. multifasciata.* It can therefore be said that the presence of lizards in a habitat is an indicator of insect abundance (Kurniati, 2016).

Figure 3. Reptile species composition (a). *M. multifascita*, (b). *D. Sumatranus*

The least common reptile species was *Draco sumatranus* with 5 individuals (Figure 3.b). The small number of species found is probably due to the condition of the mangrove in RMJ village, which has a short, dense shade and is different from natural forests. This makes it difficult for species to fly, as these species prefer to inhabit vegetation with a forest canopy layer of more than 30 m in height (McGuire and Iskandar, 2019).

The RMJ Village mangrove ecotourism area has two types of crocodiles, namely: *Crocodylus porosus* and *Tomistoma schlegelii*. During the study, the two crocodile species were not observed in the RMJ Kampung mangrove ecotourism area, which is believed to be related to the nature of the crocodiles and the sampling method. As wild animals, crocodiles are shy (Nuryanti, 2013), which means that they are secretive and rarely seen. According to information provided by the local community, the crocodile can be found at 22:00 WIB, where there is very little human activity. A Sampling of crocodile populations is usually done by purposive sampling and using a pompong along the riverbanks while highlighting the area traveled with a torch between 20:00 and 01:00 WIB (Sosilawaty *et al.*, 2020). However, in this study, only surveys were conducted by walking along the riverbank, which made it difficult to search for crocodiles.

The species richness of reptiles in mangrove forests is relatively low (Table 1). This is thought to be related to the lower heterogeneity of the mangrove ecosystem affecting reptile diversity. This is in agreement with Alikodra's (2018) assertion that the more heterogeneous and complex the floristic community of an ecosystem, the higher the level of faunal and floral diversity.

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Table 1. Comparison of the number of reptile species in several mangrove forest ecosystems in Indonesia.

No	Study location	Number of Individual	Number of Species	Source
1	Muara Angke,Kapuk, Jakarta.	6	5	Mujadid *et al.* (2020)
2	Mempawah,Kalbar.	6	4	Maulana (2020)
3	Teluk Bungus, Padang.	24	6	Driptufani *et al.* (2021)
4	Rawa Mekar Jaya, Siak, Riau.	52	4	This study (2022)

Reptile species diversity index and evenness index

The overall index of reptile species diversity in the Kampung RMJ mangrove ecotourism is rated as moderate (H'=1.02). The lack of reptile species diversity is mainly because since the mangrove ecosystem is a typical ecosystem that lacks spatial heterogeneity. This indicates that only certain reptiles can survive in mangrove ecosystems. The specificity of mangrove ecosystems results in low species diversity, but on the other hand, the population density of each species is generally high Hanum *et al.* (2014).

The reptile species diversity index in terrestrial habitats is higher than in aquatic areas (Figure 4). This would be due to the life cycle of the reptiles present in the study site which generally live in terrestrial habitats and are semi-aquatic. According to Kurniati (2016), in general, the life cycle of reptiles takes place first on land and the second cycle is semi-aquatic. Terrestrial habitats are fairly dry, with bushes, wood piles, litter, and fallen trees. They provide reptiles with shelter, breeding, feeding, playing, and resting places. In addition, vegetation plays an important role in the distribution of reptiles in habitat, including as a source of food, shelter from the effects of climate change, and protection from predators and humans (Priyo *et al*. 2008).

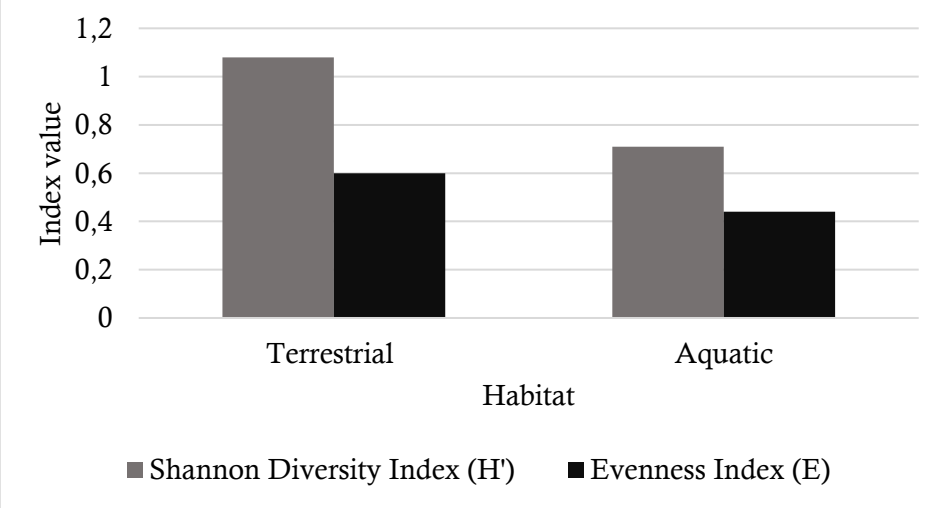

Figure 4. Diversity and Evenness Diagram of Reptile species

The level of evenness of reptile species in terrestrial habitats, E = 0.60, shows unstable criteria (Figure 4). A labile evenness index shows that the individuals found have an almost equal distribution between species, meaning that there are species that dominate but are not too dominant in a community (Arfiati *et al.*, 2019). In aquatic habitats, the evenness index (E = 0.44) with depressed criteria, means that the individuals found have an uneven distribution (Adelina *et al.*, 2016). Furthermore, the depressed evenness index would be due to the high dominance of other species, resulting in many other species with depressed individuals. According to Khatimah (2018), the depressed level of species evenness may be caused by the dominance of certain types of individuals. Conversely, the more stable the species evenness index is, it means that the distribution of individuals is homogeneous, i.e. There are no dominant species in a community (Irham *et al.*, 2017).

Species abundance value

Mabuya multifasciata has the highest relative abundance (RA) of all reptile species identified in the Kampung RMJ mangrove ecotourism (Table 2). This is thought to be because since this species tolerates a wide range of habitats, so it is found in all habitats. According to Kartika *et al.* (2021), *M. multifasciata* is a species with a high capacity to spread and adapt to habitat changes. On the other hand, this species is an insect predator in the food chain, or it can be said to be a pest controller, namely: insect pests such as mosquitoes (Fitriana *et al.*, 2017).

Table 2. Abundance values of reptile species in the mangrove area of Kampung RMJ.

No	Species	Relative Abundance	
		Terrestrial	Aquatic
1	*Mabuya multifasciata*	0,60	0,73
2	*Hemidactylus platyurus*	0,20	-
3	*Draco sumatranus*	0,13	0,05
4	*Varanus Salvator*	0,07	0,23

The lowest relative abundance is that of *H. platyurus*. It is thought that the low abundance of this species is due to its shy nature which makes it difficult to find. Another contributing factor is the unsuitable habitat conditions for this species. This species was found hanging on tree trunks and wood piles during the study. According to Obi *et al.* (2013), H. platyurus is a species that lives very close to residential buildings, especially wooden ones. Its main prey is small insects. The species hunts actively at night (nocturnal), while during the day this species hides between the wood or walls of the house (Fitriana *et al.*, 2017).

Reptile conservation status

All reptile species found in the mangrove area of Kampung Rawa Mekar Jaya, Siak Regency, do not have protected status based on P.108/ Menlhk/ Setjen/ Kum.1/12/2018 (Table 3) regarding the preservation of protected plants and animals (KLHK-LIPI, 2019). All of them is categorized as Least Concern (LC). This indicates that the reptiles population are abundant and widespread in the wild after careful evaluation. *V. salvator* is classified as *V. salvator* is listed in Appendix II, which means that the use of this species

should be internationally monitored to prevent exploitation, illegal capture, and harmful populations (CITES, 2021).

Table 3. Conservation status of reptiles in the Kampung RMJ mangrove ecotourism area

No	Species	P.106/Menlhk/Setjen/ Kum.1/12/2018	IUCN	CITES
1	*Draco sumatranus*	Not protected	Least concern	Non Appendix
2	*Hemidactylus platyurus*	Not protected	Least concern	Non Appendix
3	*Mabuya multifasciata*	Not brotected	Least concern	Non Appendix
4	*Varanus salvator*	Not protected	Least concern	Appendix II

Kampung Rawa Mekar Jaya mangrove ecotourism has two species of crocodiles, namely: *C. porosus* and *T. schlegelii*, which have a protected status under Law P.108/Menlhk/Setjen/Kum.1/12/2018 on the Preservation of Protected Plants and Animals (KLHK_LIPI, 2019). *T. schlegelii* has the highest conservation status because its numbers in the wild are decreasing. *T. schlegelii* has the status Vulnerable (VU) based on the criteria (A2cd/decline), namely: a reduction in population size of mature individuals based on declining habitat quality (IUCN, 2023). Factors that threaten this species in the wild are habitat fragmentation, and natural disasters such as forest and land fires. In addition, deforestation, land conversion and even poaching remain major factors (Bezuijen *et al.*, 2014). *T. schlegelii* is listed in Appendix I of CITES, which means that the use of this species must be internationally monitored to prevent illegal exploration and capture due to its limited numbers (CITES, 2021). CITES prohibits international trade in these specimens.

CONCLUSION

This study managed to find 52 individuals belonging to 4 species of reptiles, namely *D. sumatranus, M. multifasciata, V. salvator, H. platyurus* directly in the field. In addition, 2 crocodile species, *T. schgelii* and *C. porosus*, were reported by the community. The Shannon-Wiener diversity index (H'=1.02) was classified as medium. Species evenness was labile, namely (E'=0.57) : (E'=0.57). The highest abundance of reptile species was *M. multifasciata* (0.65), while the lowest abundance of reptile species was: *H. platyurus* (0.12). Of all the reptile species identified, none had a protected status, *V. salvator* was categorized as low risk (LC/least concern) and included in Appendix II. In addition, two crocodile species were reported by local communities to be protected, listed on the IUCN Red List, and included in the CITES Appendices, namely: *T. schlegelii* and *C. porosus.*

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