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# Herpetofauna diversity in Tengah Waterfall (Coban Tengah), Krajan, Pandensari village, Pujon district, Malang regency, Indonesia

**B F Hanifa, M A Hasyim and M A Hasanuddin\***

Biology Study Program, Faculty of Science and Technology, UIN Malang, Indonesia

\*Corresponding author: muhammadalihasanuddin14@gmail.com

**Abstract.** Data on herpetofauna diversity in the East Java area is still very minimal, especially in the Malang area. Malang Regency has many rivers which can become herpetofauna habitat. One of the river flows in Malang Regency is the Coban Tengah flow which is in Pandensari Village, Pujon District, Malang Regency. This area has the potential for biodiversity, but there is still minimal exploration and there is no data on reptiles and amphibians. Diversity data collection is important as a first step in conservation efforts. The aim of this research is to determine the diversity of herpetofauna in Coban Tengah. This research uses the Visual Encounter Surveys (VES) method, namely by searching for specimens in a predetermined area and time. The species found are recorded. The data obtained were analyzed using the Shannon weaner diversity index, dominance index, and evenness index. The research data shows the Shannon Weaner diversity value (1.61), which indicates that diversity is moderate. There were 171 individuals found consisting of 10 species, namely *Chalcorana chalconota*, *Odorrana hosii*, *Polypedates leucomystax*, *Leptobrachium hasseltii*, *Phrynoidis aspera*, *Microhyla achatina*, *Duttaphrynus melanostictus*, *Cyrtodactylus marmoratus*, *Elapoidis fusca*, and *Bronchocela jubata*. Keywords: Coban Tengah, reptiles, amphibians, diversity.

## 1. Introduction

Indonesia is the second largest Mega biodiversity country in the world based on the number of endemic species it contains as well as rich species [1]. One of the supporting factors for high species diversity is that there is an unspoiled habitat, which contributes to the survival of species in their natural environment [2]. Indonesia has a diversity of plants and animals, namely 25% of all identified fish species, 17% of all bird species, 16% of the total amphibian and reptile species, 12% of the world's mammal species, and 10% of the world's flowering species [3].

Indonesia has 2000 species of reptiles out of a total of more than 7000 species of reptiles in the world and around 350 amphibians can be found in Indonesia out of a total of 4,950 amphibians in the world [4]. The Amphibia class is divided into 2 groups, namely Anura (338 species of frogs and toads) and Apoda or Gymnophiona (12 species of legless Amphibia) [5].

The existence of amphibians and reptiles has quite an impact on ecological stability. Amphibian and reptiles occupy important positions in ecosystem, namely as predators and prey [6]. As result, these two groups of animal can be used as pest control by acting as natural enemies for these pests [7]. Apart from that, herpetofauna can also be used as an environmental indicator [8]. Reptiles and amphibians can be found in almost all types of habitats, from forests, deserts to grasslands, but some species of reptiles or



amphibians are only found in a specific habitat and therefore can be used as indicators of environmental change [9].

The high diversity of herpetofauna in Indonesia is not commensurate with researchers' interest in studying and researching herpetofauna optimally. This is shown by the decline in the number of reptiles and amphibians over a period of 70 years, down from 60% to 50%. Meanwhile, the comparison between the discovery of amphibian and reptile species in Indonesia is only 262 species. This number is much less than the discovery of amphibian reptiles outside Indonesia, namely 762 species [10].

Data on amphibian diversity in East Java is still recorded in several places [11]. with a lack of further surveys. Previous data only showed 39 amphibian species (mostly dominated by the Anura amphibian species, and 3 Gymnophiona species) [5]. on the island of Java, most of the data came from the West Java region, especially the Gunung Gede Pangrango National Park and the Gunung Halimun-Salak National Park [12-14], and several areas in Central Java Province, especially in the Mount Slamet Region [15]. Several efforts to collect amphibian diversity studies have been carried out in East Java, especially in Batu, Malang, Kediri, and other areas [16], although further exploration still needs to be done. Data collection on amphibian diversity in East Java is very important in assessing their distribution, conservation status and strategies to prevent the threat of declining populations. According to [17], the data obtained can also be used as an initial marker for ecosystem changes.

Coban Tengah is a waterfall located between Coban Manten and Coban Rondo which is part of Pandesari village, Pujon district, Malang regency, located at coordinates -7.891653, 112.475420. Coban Tengah is located above the Coban Rondo tourist area [18]. Coban Tengah has the potential for high herpetofauna diversity because the area is heterogeneous forest and has river flows that are still maintained.

## 2. Method

The research was carried out on rainy season from February-march 2022 with purposive sampling Visual Encounter Survey twice a month at 7 pm- 11 pm. The research location was in Coban Tengah, Krajan, Pandesari Village, Pujon District, Malang Regency. Species identification was carried out in the field and in the Ecology Laboratory of the Biology Study Program, Faculty of Science and Technology, Maulana Malik Ibrahim State Islamic University of Malang using identification book as a guide Amfibi Jawa Bali by Djoko T. Iskandar [12].

The diversities value of amphibians and reptiles were calculated based on the Shannon Wiener diversity index [19]. The Evenness Index will be analyzed according to [20-21]. Dominance index and species richness value can be calculated according to [22].

## 3. Result and Discussion

The result of our study divided into three main discussions: Species finding, Diversity analysis, and Environmental factors.

### 3.1. Species Finding

The results of the identification of herpetofauna species found in Coban Tengah, Pandesari Village, Pujon District, Malang Regency, East Java, include the following:

**Table 1.** Species found during field study

No	Species	Total Species in replication				$\Sigma$
		1	2	3	4	
1	<i>Odorrana hosii</i>	11	16	14	18	59
2	<i>Chalcorana chalconata</i>	6	7	10	8	31
3	<i>Microhyla achatina</i>	18	13	8	14	53
4	<i>Leptobrachium hasseltii</i>	3	3		3	9

5	<i>Duttaphrynus melanostictus</i>	3	2	2	1	8
6	<i>Phrynoidis aspera</i>	3	1			4
7	<i>Polypedates leucomystax</i>	1				1
8	<i>Cyrtodactylus marmoratus</i>		1		1	1
9	<i>Broncochela jubata</i>			2	1	3
10	<i>Elapoidis fusca</i>	1				1
<b>Total</b>						<b>171</b>

Based on the results of the species findings (Table 1), the most frequently found species were from the Ranidae family, namely the *Odorrana hosii* species with 18 individuals and also *Chalcorana chalconata* found with 10 individuals. One species was found the Microhylidae family, namely *Microhyla achatina*, with 18 individuals. The fewest species found were *Elapoidis fusca*, *Cyrtodactylus marmoratus*, and *Polypedates leucomystax*, each of which was found one individual.

### 3.2. Diversity Analysis

According to the finding during filed survey, the analysis result as follow:

**Table 2.** Herpetofauna Analysis result in Coban Tengah

Analysis	Total
Total samples	171
Total Species	10
Diversity Index (H')	1,61
Evenness index (E )	0,49
Species richness index (Dmg)	1,75
Dominancy index (D)	0,25

The results of the diversity index calculation can be obtained that the diversity (H') in Coban Tengah is 1.78 (Table 2). Therefore, Coban Tengah has moderate diversity. According to Leksono [19], if  $H' = > 3$ , then diversity is high,  $H' = 1 - 3$ , then diversity is medium,  $H' = < 1$ , then diversity is low [23]. states that the more varied the physical environment in an ecosystem, the more complex the plant and animal communities there and the greater the diversity of their species.

The evenness value (E) of herpetofauna in Coban Tengah is 0.77 (Table 2). This value shows that the herpetofauna community is high. The species that dominate in the area was *Odorrana hosii* can be seen as not to dominate the area. This can be seen from the greater number of individual findings in each plot. while [24] categorizes the range of this index, namely if  $E < 1$  is classified as high evenness;  $0.4 < E < 0.6$  means medium species evenness and  $E < 0.4$  means low species evenness. while [25] stated that if a species has the same number of individuals, the evenness value is maximum.

The herpetofauna dominance value in Coban Tengah is 0.22 (Table 2). This shows that the dominance of herpetofauna in Coban Tengah is low, even some particular species seems to dominate the community (*Odorrana hosii*), because this species was found in all plots. Based on the dominance criteria, namely if and  $D = 0.61 - 1.0$  then dominance is high,  $0.31 - 0.60$  then dominance is medium, and  $D = 0.01 - 0.30$ . while [22] stated that low dominance indicates that the area has high diversity, in other words, the level of diversity of a species is inversely proportional to the level of dominance in a particular area.

The Species richness Margalef Index (Dmg) value of herpetofauna in Coban Tengah shows a value of 2.19 (Table 2). This value shows that the richness of the Coban Tengah species is low, because the

index value is less than 2.5. According to [25], the criteria for the Margalef index include  $If < 2.5$  indicates a low level of species richness,  $2.5 > R > 4$  indicates a medium level of species richness.  $R > 4$  indicates a high level of species richness. According to Santosa [25] the value of this index is influenced by the total number of individuals found in a certain area.

### 3.3. Environmental Factors

Based on the measurement of several parameters, the results obtained were not significantly different in each sampling (Table 3 and Table 4), while [26] stated that amphibians can live at temperatures in the range of  $3^{\circ}$ -  $41^{\circ}$ C, the optimum temperature for frog habitat is in the range of  $25^{\circ}$ - $30^{\circ}$ C. According to [27] that reptiles are active in a relatively wide temperature range between  $20^{\circ}$ -  $40^{\circ}$ C. According to [28] stated that amphibians can live at temperatures ranging from  $3^{\circ}$  -  $41^{\circ}$ C, and the optimum temperature in amphibian habitats ranges from  $25^{\circ}$  -  $30^{\circ}$ C. while reptiles live actively at temperatures between  $20^{\circ}$  -  $40^{\circ}$ C. In general, frogs can live in any place, both beaches and highlands, with water temperatures between  $20^{\circ}$  -  $35^{\circ}$ C.

The humidity obtained can be seen at (Table 3 and Table 4). If seen from the results of measurements of high air humidity. This can be due to the rainy season, which increases humidity. The second sampling had higher humidity than the others because the sampling was carried out when it rained. According to [29], the temperature on the earth's surface decreases with increasing latitude, and the higher the place, the lower the temperature and the higher the humidity.

**Table 3.** Aquatic environmental variables

Variables	Replication			
	1	2	3	4
Air Temp	18,9°C	19,0°C	19,8°C	20,0°C
Air Humidity	82,2 %	93,6%	84,1%	85,1%
Water temp	16,6°C	16,2°C	16,7°C	16,8°C

**Table 4.** Terrestrial environmental variables

Variable	Replication			
	1	2	3	4
Air temp	17,5°C	19°C	20,5°C	20°C
Air Humidity	82,5 %	95,5%	83%	85,5%

The humidity obtained can be seen at (Table 3 and Table 4). If seen from the results of measurements of high air humidity. This can be due to the rainy season, which increases humidity. The second sampling had higher humidity than the others because the sampling was carried out when it rained. According to Istiawan [29], the temperature on the earth's surface decreases with increasing latitude, and the higher the place, the lower the temperature and the higher the humidity.

## 4. Conclusion

A total of 10 Herpetofauna species were found in the Coban Tengah area, consisting of 7 groups of amphibians, namely: *Odorrana hosii*, *Chalcorana chalconata*, *Duttaphrynus melanostictus*, *Leptobrachium haseltii*, *Phrynoidis asper*, *Polypedates leucomystax*, *Microhyla achatina*, and there are 3 species of reptiles *Cyrtodactylus marmoratus*, *Bronchocela jubata* and *Elapoidis fusca*. The Diversity Index (H') in Coban Tengah was 1.78. while the species evenness value (E) was 0.77, the species dominance value (D) was 0.22, while the species richness value (DMg) was 2.19. The calculated

physical factors of aquatic and terrestrial areas include water temperature, air temperature and air humidity which are optimum conditions to support herpetofauna life.

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