Amphibian Diversity in the Waterfall of Lubuklinggau City, South Sumatra

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ABSTRACT

Temam and Sando Waterfalls are suitable habitats for amphibian life, the presence of tourist visits and additional facilities can cause disturbance to amphibians. However, amphibian data at the two locations have not been recorded. This study aims to determine diversity amphibians in the Temam and Sando Waterfall, Lubuklinggau City. The study was conducted from June to July 2020. The collection data used Visual Encounter Survey (VES) techniques and time search. The data were analyzed using relative abundance, and indexes of diversity, evenness, similarity, and dominance. 11 species of amphibians belonging to 5 families were found during the study. Odorrana hosii was found mostly during the study. Amphibian diversity in the waterfall of Temam and Sando Waterfall was categorized as low.

Introduction

Sumatra Island is one of the hotspots of Sundanese biodiversity exposure which has a level of biodiversity with endemicity (Setiawan *et al*., 2016). One area that has the potential to support the life of amphibians is Lubuklinggau city. Lubuklinggau City has quite a lot of habitat variations for amphibians because it still has areas in the form of secondary forests, rivers, rice fields, and waterfalls.

Teman and Sando Waterfall are waterfalls located in Lubuklinggau City. The two waterfalls are tourist destinations for people outside and around Lubuklinggau City. The Lubuklinggau City Government has built public facilities at Temam Waterfall to provide comfort for visitors who come. Meanwhile, Sando Waterfall is still natural, but it is well known and is starting to get crowded. The high intensity of visits to the two waterfalls can indirectly threaten the presence of amphibians. As we know, amphibians are very sensitive to changes in environmental quality, for example, water pollution, habitat loss, and climate change (Setiawan *et al*., 2019). While the existence of amphibians is very important for the ecosystem, this is because Amphibians play an important role in the food chain. Most amphibians are predators that feed on various types of insects or insect larvae. Frogs living in rice fields, for example, are known to eat various types of insects that are pests to agriculture (Irwanto *et al*., 2019).

Another role of amphibians in the ecosystem is to maintain the balance of nature and certain types can be used as bioindicators of environmental damage (Yani *et al*., 2015).

Amphibian research in Lubuklinggau City is developing well, such as research conducted by Samitra & Rozi (2020) in the area around community settlements, Rozi & Samitra (2020) in Bukit Sulap and Watervang Dam. However, research on amphibians in Temam and Sando waterfall had been conducted previously, so the research was done to determine the diversity of amphibians in Temam and Sando Waterfalls, Lubuklinggau City.

Materials and Methods

The research was conducted in two locations, namely Temam Waterfall and Sando Waterfall, Lubuklinggau City, South Sumatra. The study was conducted from June-July 2020.

The collection sample used Visual Encounter Survey (VES) techniques at 07.00-10.00 PM West Indonesian Time, the study was limited to 3 hours due to team safety factors (Qurniawan *et al*., 2010; Yudha *et al*., 2015). The tools used are stationery, gloves, head flashlights, dikes, plastic bags, cameras, thermometers, hygrometers, and identification books for amphibians. Each species collected was stored in a plastic bag and given a label. The types and numbers of amphibians were obtained. If you find a sample that is difficult to identify, it will be taken to the Biology Education laboratory to be identified. Identification is carried out through morphological and meristic characters (Cahyadi & Arifin, 2019; Qurniawan & Eprilurahman, 2012). Amphibian identification was guided by Kamsi, *et al*. 2017, Kusrini, 2013. After the identification is complete, the sample will be returned to the research location (Samitra & Rozi, 2020).

The collected data were analyzed for ecological indexes including species abundance, diversity levels using the Shannon-Wiener Index, evenness using the Pielou Index, and species similarity using the Jaccard Index (Ariza *et al*., 2014; Jusmaldi *et al*., 2019; Rozi & Samitra, 2020). Analysis and calculations were carried out with the help of Microsoft Excel 2016.

Results and Discussion

Amphibian composition

Eleven species of amphibians belonging to 5 families were found during the study (Table 1). 8 Species were found in Temam Waterfall and 6 species were found in Sando Waterfall (Table 1). The results of this study are relatively more when compared to the results of amphibian research, at tourist sites in Lubuklinggau (Sulap Hill and Watervang Dam) (Rozi & Samitra, 2020), several waterfalls in Kediri (Utami *et al*., 2016).

The low results of this study, when compared to the results of research by Jusmaldi, *et al* (2019), due to differences in altitude, where the altitude is 129 meters above sea level, with an area of 21,000 m^2 and a total of 72 hours of search time. While researching Jusmaldi *et al* (2019) study site, reaching heights of 200 meters above sea level, with an area of research 300,000 m^2 and a total time of 180 hours. Research by Das *et al* (2007) which was conducted at an altitude of 800 masl with a total time of 1930-2000 hours obtained 55 species of amphibians. The variation in the number of species found is influenced by differences in environmental factors, vegetation, microhabitat, altitude, and geographic area (Jusmaldi *et al*., 2019; Samitra & Rozi, 2020). In addition, it is also caused by differences in efforts to search for amphibians, the length of time searching

and the area of land (Kusrini, 2008; Setiawan *et al*., 2016).

Table 1. Amphibians in Temam and Sando

Family	Species
Bufonidae	*Duttaphrynus melanostictus*
	Phrynoidis aspera
Digroclossidae	*Fejervarya cancrivora*
	Fejervarya limnocharis
	Limnonectes macrodon
Megophryidae	*Megophrys nasuta*
Ranidae	*Chalcorana chalconota*
	Odorrana hosii
	Amnirana nicobariensis
	Hylarana erythraea
Rhacophoridae	*Polypedates leucomystax*

The highest number of species was found in the Ranidae family with 4 species and followed by the Digroclossidae family with 3 species, while the Bufonidae and Megophryidae families were 2 species, and the Rhacophoridae family 1 species (Table 1). The most abundant individuals were *Odorrana hosii* (41.32%, Figure 1) and *Phrynoidis aspera* (14.05%, Figure 1). The number of *O. hosii* found is the same as the research of Qurniawan & Trijoko (2012), Sanhayani *et al*., (2019), and Utami *et al*., (2016). The abundance of *O. hosii* and *P. aspera* is due to these 2 species that can be found in river flows (Kamsi *et al*, 2017).

O. hosii is a species of the family Ranidae (Kamsi *et al*, 2017). *O. hosii* is found in the Temam Waterfall area because there is a rocky and swift river. This is following with the characteristics of *O. hosii* which can be found in clear and swift rocky rivers, in hills of primary forest, and old secondary forest (van Djik *et al*., 2004; Kamsi *et al*., 2017). The genus Odorrana currently has 59 recognized species, inhabiting mountain streams in subtropical and tropical Asia, during the 2015-2020 period, 3 new species were founded (Frost, 2020).

P. aspera is a species of the Bufonidae family (Kamsi *et al*, 2017). *P. aspera* is found in Temam in the Waterfall area because this species can be found around waterfalls or rivers (Kamsi *et al*, 2017). The distribution of *P. Aspera* is Sumatra, Kalimantan, Java, Malaysia, Myanmar and Thailand (IUCN SSC Amphibian Specialist Group, 2014b). Another Bufonidae family we found was *Duttaphrynus melanostictus* (5.79%, Figure 1). This species cannot be found in primary forest, but can be found in residential or plantation areas (Kamsi *et al*., 2017; Moore *et al*., 2015). The presence of this species of Temam Waterfall Area and Sando Waterfall shows that there are settlements not far from the area.

We found *Fejervarya cancrivora* (5.79%, Figure 1) and *Fejervarya limnocharis* (13.22% Figure 1). Both species belong to the Digroclosside family, which are usually found in rice fields, and are rarely found along rivers (Kamsi *et al*., 2017). These species are found because there are rice fields around the location, so that during the dry season these species look for water to moisturize the body.

Two species very few were found, namely *Polypedates leucomystax* (0.83%) in the Temam Waterfall area and *Megophrys nasuta* (0.83%, Figure 1) found in the Sando Waterfall area. The findings of *P. leucomystax* are relatively the same as those of Jusmaldi *et al* (2019), and less when compared to research Triesita *et al*., (2016) which found 8 specimens. The number of *P. leucomystax* that was found during the study was of considerable concern because in the research location there were still many trees that became the habitat for *P. leucomystax*. Whereas *P. leucomystax* can be found in plants in secondary forests (Kamsi *et al*., 2017).

M. nasuta is a species of the Megophryidae family. *M. nasuta* can be found in secondary forest litter, primary forest and sometimes on garden borders (Kamsi *et al*., 2017). The distribution of *M. nasuta* is Borneo, Sumatra, Malaysia and Thailand (IUCN SSC Amphibian Specialist Group, 2014a). Another Megophrys genus that was not found at the time of the study, but was in Sumatra, namely *Megophrys paralella* (Kamsi *et al*., 2017).

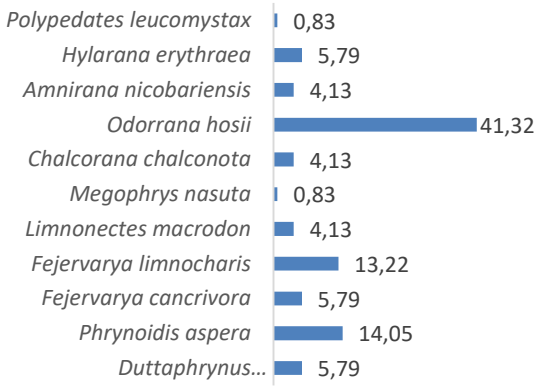

Figure 1. Amphibia composition

We did not find a Gymnophiona order like the results of research at the Watervang Dam, Lubuklinggau which found *Ichthyophis sp* (Rozi & Samitra, 2020). This is because the Gymnophiona order is difficult to find because of its habit of living in burrows (fossorial) and only comes out of the ground when heavy rains occur (Jusmaldi *et al*., 2019). The genus Ichthyophis has 50 species spread across Southern Asia to the western part of the Indo-Australian Archipelago; Philippines (Frost, 2020).

Table 2. Ecology Index

Index	Location		Total
	Temam	Sando	
Diversity	1.40	1.69	1.88
Evenness	0.67	0.95	0.78
Dominance	0.35	0.19	0.22

Overall, the diversity index is categorized as low, the evenness index is 0.78 in the high category and the population is stable, and the dominance is 0.22 in the low category (Table 2). The Temam Waterfall area has a low diversity index (H': 1.40) and an evenness index categorized as medium and unstable population (E: 0.67). Meanwhile, in the Sando Waterfall area, the diversity index is low (H': 1.69) and the evenness index is high and the population is stable (E: 0.95). This result is more different than the results of the research at Berambai Waterfall, Samarinda, where diversity is moderate and the population is stable (Jusmaldi *et al*., 2019) and the results of research in the waterfall area, Kediri where diversity is moderate and population is stable (Utami *et al*., 2016). Amphibian diversity is influenced by air humidity, area and habitat variation in an area (shrubs, litter, canopy cover, and stagnant water) (Dharma & Meitiyani, 2019; Jusmaldi *et al*., 2019; Samitra & Rozi, 2020).

Domination at Temam Waterfall (0.35) and Sando Waterfall 0.19. The dominance value ranges from 0-1. If the dominance index is 0, it can be seen that almost no individual dominates the community (Harmoko *et al*., 2020). The dominating species in Temam Waterfall is *O. hosii*, this causes the amphibian population in Temam Waterfall to become unstable. The existence of *O. hosii* is always related to rivers in primary and secondary forests and depends on good water quality, so by dominating *O. hosii* in an area it can mean that the area has good water quality (Septiadi *et al*., 2018).

The environmental conditions of Temam and Sando Waterfalls are quite good with vegetation, litter. The currents at Temam Waterfall are heavy, slow and rocky, while at Sando Slow Waterfall, temperatures range from 26.1-29.1℃, humidity 80-88%, water pH, 6.1-7.4. Amphibians have a temperature tolerance between 3-41℃ and can live in conditions of 91% humidity (Beljai &

Worabai, 2018; Izza & Kurniawan, 2014). Temperature and water influence virtually every aspect of organismal biology from providing the proper conditions for biochemical reactions (Mitchell & Bergmann, 2016).

The similarity index is needed to determine the level of similarity in species composition between two habitats (Ariza *et al*., 2014). The results of the similarity analysis using the Jaccard index obtained 0.75, which means that high species similarity between the Temam and Sando Waterfall habitats where 3 similar species were found, namely (*D. melanostictus*, *F. cancrivora* and *F. limnocharis*). There is the same habitat, which is close to the settlement for the habitat characteristics of *D. melanostictus* and the presence of forest areas that have been logged and the slow currents are characteristic of the habitat of *F. cancrivora* and *F. limnocharis*.

Conclusion

Taken together, from this study results, it can be concluded that the diversity of amphibians is in the low category, the amphibian population is stable, and the species similarity in Temam and Sando Waterfalls is high.

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