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Short Communication: The herpetofauna around human settlements in Lubuklinggau City, South Sumatra, Indonesia: Composition and diversity

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Abstract. *Samitra D, Rozi ZF. 2020. Short Communication: The herpetofauna around human settlements in Lubuklinggau City, South Sumatra, Indonesia: Composition and diversity. Biodiversitas 21: 1432-1437.* Herpetofauna research has been conducted mostly in conservation forest areas, so little is known about herpetofauna outside the conservation areas, such as those around the human settlements. The data of herpetofauna near human settlements are important in carrying out conservation actions. This study aimed to determine the diversity of herpetofauna around human settlements in the city of Lubuklinggau. The study was conducted from February to August 2019. Herpetofauna samples were taken in three habitats around settlements, i.e., plantation, rice field, and river. Sampling was done with the method of visual encounter survey and time-constrained search. The data were analyzed using ecological indexes, i.e., relative abundance, and indexes of diversity, evenness, similarity, and dominance. The results showed that 378 individuals of herpetofauna were found, belonging to 27 species (12 amphibians and 15 reptiles). Eighteen species were found in the plantation (7 amphibians and 11 reptiles), 15 species in the river (10 amphibians and 5 reptiles), and 14 species in the rice field (6 amphibians and 8 reptiles). Similarity index analysis showed that the rice field had quite different species from other habitats. The herpetofauna diversity around settlements was categorized as medium.

Keywords: Amphibians, biodiversity, conservation, reptiles

INTRODUCTION

Herpetofauna is rarely known and little appreciated by society because of the negative feelings people have toward this animal group (Sousa et al. 2016; Indrawati et al. 2018; Devi et al. 2019). In South and Southeast Asia, herpetofauna research has not received much attention in terms of ecological aspects. Moreover, intensive field surveys are rarely conducted and published (Karthik et al. 2018). Herpetofauna diversity is very important because these animals: (i) play an important role in maintaining the sustainability of ecosystems, (ii) aid human socio-economics through utilization as tourism objects (Subeno 2018; Riyanto et al. 2019), (iii) act as a pest controller (rat and insect eaters), and (iv) provide germplasm (Subeno 2018; Cahyadi and Arifin 2019).

Herpetofauna, especially amphibians that are very sensitive to environmental changes such as pollution in waters, can be used as an indicator of biodiversity, and local pressure on the environment (Burlibaşa and Gavrilă 2011; Carlsson and Tydén 2018; Priambodo et al. 2019). Herpetofauna has declined in abundance and diversity, and is even threatened with extinction due to rapid urbanization and intensification of agriculture which lead to invasion of alien species and loss of habitat (Carpio et al. 2015; Cassani et al. 2015), and over-exploitation of reptiles and amphibians for consumption, industry, and pet trade (Natusch and Lyons 2012; Shaney et al. 2017).

Rapid urbanization can have an impact on various components of the environment, including land, and is, therefore, a challenge for conservation of biodiversity (Rebelo et al. 2011; Patra et al. 2018). Urbanization replaces natural habitats with infrastructures, such as houses, buildings, roads and other impervious surfaces, which can result in changes in species composition (Vanegas-Guerrero et al. 2016; Hassan and Hassan 2019). However, various studies throughout the world show that some urbanized habitats can maintain substantial biodiversity, including reptiles and amphibians (Montes 2014).

Herpetofauna research has been conducted mostly in conservation areas; therefore, research on the diversity of herpetofauna outside conservation areas, such as those around human settlements, is needed. The herpetofauna data are important as the world population grows and is mostly concentrated in urban areas (Nath et al. 2012). Given the importance of herpetofauna as a bioindicator, data about herpetofauna and changes in habitat conditions will provide herpetofauna information to those involved in carrying out conservation actions (Subeno 2018). No study of herpetofauna diversity in Lubuklinggau, South Sumatra, Indonesia had been conducted previously, so this study was done to determine the diversity of herpetofauna around human settlements in the city of Lubuklinggau.

MATERIALS AND METHODS

Study area

The study was conducted from February to August 2019 in Lubuklinggau city, South Sumatra (Figure 1). Sampling locations consisted of 3 types of habitats, namely a rice field (Figure 2.A), a river (Figure 2.B) and a plantation (Figure 2.C) around human settlements.

Materials

The materials used for the herpetofauna survey were headlamp, grab-stick, thermo-hygrometer, mercury thermometer, scooping-net, camera, stationery, calipers, specimen pouches, and field guide books to identify, i.e., Iskandar (1998), Kusrini (2013), Inger et al. (2017), and Kamsi et al. (2017).

Data collection

We used a visual encounter survey (VES) method and a time-limited search technique (Olson et al. 2016; Freitas et al. 2017; Subeno 2018). The search was conducted at 7:00-10:00 am and 7:00-10:00 pm West Indonesian Time. Sampling was completed using hands, a scoop-net, or a grab-stick. We recorded the species, number of individuals, the habitat and the time each individual was found. If the samples found were difficult to identify in the field, they were taken to the Biology Education Laboratory at the University of Bengkulu, Indonesia to be identified. Identification was done using the organism's morphology and meristic characters, i.e., body length (SVL), limb tail, length of the head, and diameter of eyes (Subeno 2018; Cahyadi and Arifin 2019). All individuals in the study were released where they were found.

Data analysis

The data were analyzed to determine the ecological indices, i.e., relative abundance, the Shannon-Wiener diversity index, Pielou evenness index, Jaccard similarity index, and Simpson dominance index (Aguilar-López et al. 2016; Arista et al. 2017; Muslim 2017; Cruz et al. 2019). Analysis and calculations were performed with Microsoft Excel 2007 and MVSP 3.22.

RESULTS AND DISCUSSION

Species composition

We discovered 378 individuals and classified them into 27 species, 16 families and 2 orders (Table 1). The amphibians consisted of 12 species belonging to 5 families (Table 2) and the reptiles 15 species belonging 11 families (Table 3). The results of the study are similar to the results of other studies conducted in urban areas, forests, and tourist areas. For example, 22 species (11 amphibians and 11 reptiles) of herpetofauna were found in a coal mining area of PT Singlurus Pratama (Muslim et al. 2018). In a national park in West Java, 53 species were found (Cahyadi and Arifin 2019) and 35 species were found in Mount Galunggung (Riyanto et al. 2019).

Figure 1. Location of Lubuklinggau City, South Sumatra, Indonesia

Figure 2. Habitat type around human settlements in Lubuklinggau City, South Sumatra, Indonesia. A Rice field, B. River, C. Community plantation

The rice field had 14 species belonging to 12 families (Table 1), consisting of 6 species within 4 families of amphibians (Table 2) and 8 species within 8 families of reptiles (Table 3). The herpetofauna species observed were common species found in rice fields such as *Dutaphyrnus melanotictus*, *Fajevarya cancrivora*, *Fajevarya limnocharis*, *Hylarana erythraea*, *Takydromus sexlineatus*, and *Enhydris plumbea* (Kamsi et al. 2017; Muslim et al. 2018). *Polypedates leucomystax* and *Bronchocela cristatella* were found during the study because shrubs around the rice fields are a habitat for these two species (Kamsi et al. 2017). The finding of *Malayphyton reticulatus* during the study was unusual because this species is commonly found in primary forests, secondary forests, animal husbandry and settlement areas (Kamsi et al. 2017; IUCN 2019). *M. reticulatus* was discovered because near the rice field there is a settlement that has animal husbandry. Figure 3 shows the relative abundance of *F. cancrivora* in the rice field was 27%, the highest among the species. *Xenopeltis unicolor*, *M. reticulates*, *B. cristatella*, *Acrochordus granulatus*, and *Dendrelaphis pictus* had the same low relative abundance, i.e., 0.6%. The number of herpetofauna species found in rice fields in this study was higher than that found in the same habitat in other studies, such as 3 amphibian species in the rice field of Padang Tepong Village (Nopriansyah et al. 2018) and 3 amphibian species in the rice field in Muning Village (Syarif and Maulana 2018), but it was slightly lower than that in the Wonosobo Agricultural Landscape, i.e., 10 amphibians and 5 reptiles (Kurniawan et al. 2016).

In the river, 15 species of herpetofauna belonging to 9 families were found (Table 1), consisting of 10 species within 4 families of amphibians (Table 2) and 5 species within 5 families of reptiles (Table 3). The species most commonly found in the river were *H. erythraea* and *T. Sexilineatus*. *H. erythraea* was the species with the highest relative abundance in the river, i.e., 20% (Figure 4), which was expected because, *H. erythraea* usually lives in areas with stagnant waters (Kamsi et al. 2017), such as ponds around rivers. We did not find *Varanus salvator* in the river, which is its habitat because we only used visual survey. The best sampling technique for *V. salvator* is setting traps. The number of herpetofauna species in the river in Lubuklinggau was relatively higher than that of the same habitat reported in other studies, such as 8 amphibian species in the Opak River (Yudha et al. 2014) and 5 amphibian species around the river in the Bedengan Tourism area of Selorejo Village (Devi et al. 2019), but lower than that in the Code River, i.e., 18 reptile species (Yudha et al. 2016).

Table 1. Number of orders, families and species of herpetofauna around human settlements in Lubuklinggau, South Sumatra, Indonesia

	Habitat			Total
	Rice field	River	Community plantation	
Ordo	2	2	2	2
Family	12	9	12	16
Species	14	15	18	27

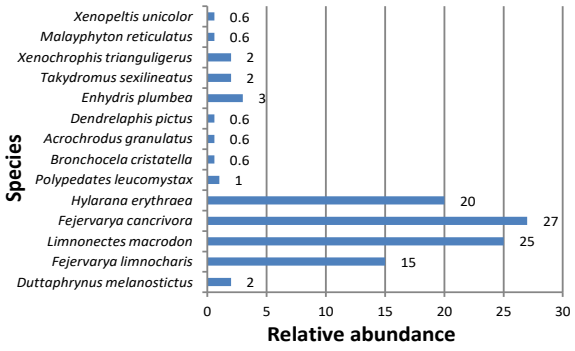

Figure 3. Relative abundance of herpetofauna species in rice field

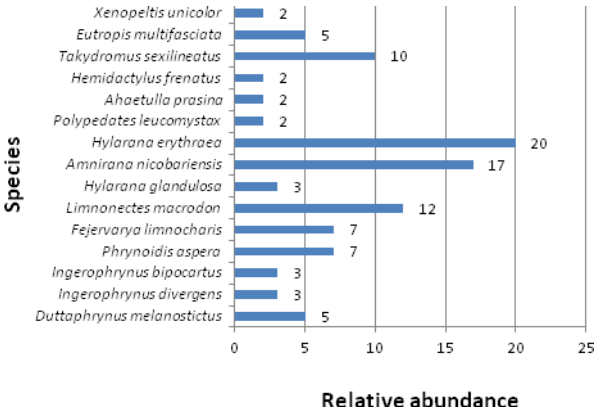

Figure 4. Relative abundance of herpetofauna species in the river

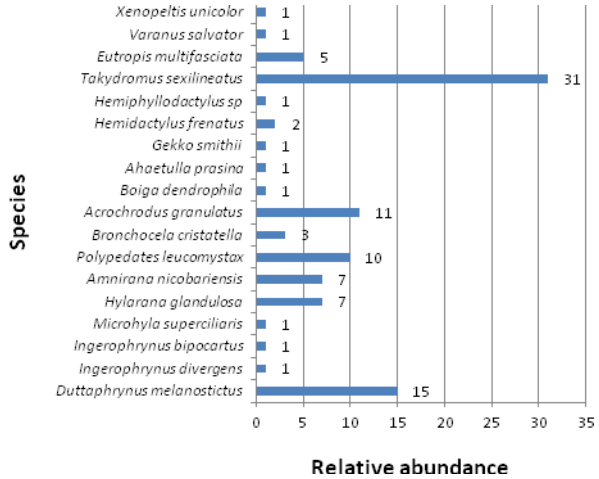

Figure 5. Relative abundance of herpetofauna species in the community plantation

Table 2. Amphibians around human settlements in Lubuklinggau, South Sumatra, Indonesia

Family	Species	Habitat		
		Rice field	River	Community plantation
Bufonidae	*Duttaphrynus melanostictus*	1	1	1
Bufonidae	*Ingerophrynus divergens*	0	1	1
Bufonidae	*Ingerophrynus biporcatus*	0	1	1
Bufonidae	*Phrynoidis aspera*	0	1	0
Dicroglossidae	*Fejervarya limnocharis*	1	1	0
Dicroglossidae	*Limnonectes macrodon*	1	1	0
Dicroglossidae	*Fejervarya cancrivora*	1	0	0
Microhylidae	*Microhyla superciliaris*	0	0	1
Ranidae	*Hylarana glandulosa*	0	1	1
Ranidae	*Amnirana nicobariensis*	0	1	1
Ranidae	*Hylarana erythraea*	1	1	0
Rhacophoridae	*Polypedates leucomystax*	1	1	1

Note: 1: presence; 0: absence

Table 3. Reptiles around human settlements in Lubuklinggau, South Sumatra, Indonesia

Family	Species	Habitat		
		Rice field	River	Community plantation
Agamidae	*Bronchocela cristatella*	1	0	1
Acrochordidae	*Acrochrodus granulatus*	1	0	1
Colubridae	*Boiga dendrophila*	0	0	1
Colubridae	*Dendrelaphis pictus*	1	1	0
Colubridae	*Ahaetulla prasina*	0	0	1
Gekkonidae	*Gekko smithii*	0	0	1
Gekkonidae	*Hemidactylus frenatus*	0	1	1
Gekkonidae	*Hemiphyllodactylus* sp	0	0	1
Homalopsidae ·	*Enhydris plumbea*	1	0	0
Lacertidae	*Takydromus sexlineatus*	1	1	1
Natricidae	*Xenochrophis trianguligerus*	1	0	0
Pythonidae	*Malayphyton reticulatus*	1	0	0
Scincidae	*Eutropis multifasciata*	0	1	1
Varanidae	*Varanus salvator*	1	0	1
Xenopeltidae	*Xenopeltis unicolor*	0	1	1

Note: 1: presence; 0: absence

Table 4. Average abiotic data around human settlements in Lubuklinggau, South Sumatra, Indonesia

Parameter	Habitat		
	Rice field	River	Community plantation
Humidity (%)	70.8	82.5	84.1
Air temperature (ºC)	31.9	30.5	30.9
Water temperature (ºC)	27.1	26.2	26.8

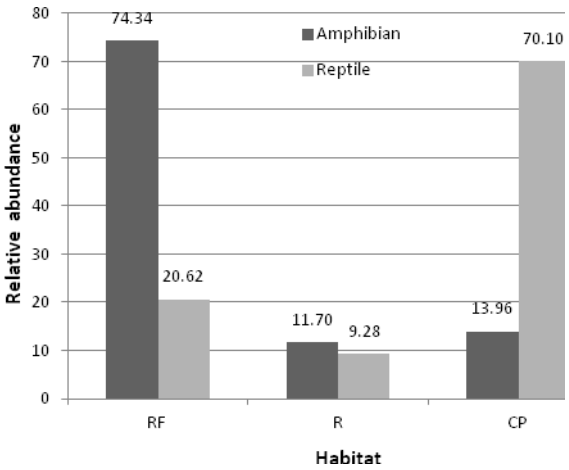

Figure 6. Relative abundance of herpetofauna species by habitat in Lubuklinggau, South Sumatra, Indonesia. RF: rice field; R: river; CP: community plantation.

In the community plantation, 18 species belonging to 12 families were found (Table 1), consisting of 7 species within 4 families of amphibians (Table 2) and 11 species within 8 families of reptiles (Table 3). The species most commonly found in plantation were *Duttaphrynus melanostictus* (18 individuals) representing amphibians and *T. sexilineatus* (45 individuals) representing reptiles. *D melanostictus* belongs to the family Bufonidae that can be found in areas near settlements including agricultural land (Moore et al. 2015). *T. sexlineatus* had the highest relative abundance value in the plantation, i.e., 31% (Figure 5). This finding is not surprising because this species likes areas that have sufficiently thick bushes and grasses (Kamsi et al. 2017). The number of *T. sexlineatus* individuals found in this study was higher than that reported by Kwatrina et al (2019) in the Landscape of oil palm plantation, i.e., 1 individual, presumably because the rubber plantation in Lubuklinggau had grasses, making it an ideal habitat for *T. sexlineatus*.

The number of herpetofauna in the community plantation in this study was relatively higher than that of other studies, such as 7 amphibians and 6 reptiles in the Salak plantation Wonosobo (Kurniawan et al. 2016), 7 amphibians and 7 reptiles in PT ASMR's oil palm plantation, Central Borneo (Santosa and Rejeki 2019) and 9 amphibians and 8 reptiles in the oil palm plantation of PT. Central Borneo BLP (Kwartina et al. 2018).

The relative abundance based on habitat (Figure 6) shows that rice field had the largest number of amphibians (70.34%) and the plantation had the largest number of reptiles (70.10%). The difference in abundance and number of herpetofauna species is due to environmental conditions, i.e., vegetation types, water quality, humidity, and temperature (Kurniawan et al. 2016; Subeno 2018). The temperature and humidity at the study site (Table 4) were still in the range for the life of herpetofauna, i.e., 20-40ºC and 40-100% respectively (Khartik et al. 2018; Septiadi et al. 2018).

Table 5. Ecological indices of herpetofauna around human settlements in Lubuklinggau, South Sumatra, Indonesia

Habitat	Diversity index	Evenness index	Dominance index
Rice field	1.82	0.69	0.20
River	2.41	0.89	0.11
Community plantation	2.20	0.76	0.16
Overall	2.55	0.77	0.10

Table 6. Jaccard similarity index of herpetofauna around human settlements in Lubuklinggau, South Sumatra, Indonesia

Habitat	Diversity index	Evenness index	Dominance index
Rice field	-	-	-
River	0.32	-	-
Community plantation	0.23	0.43	-

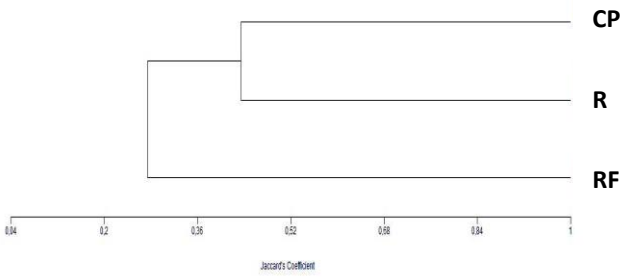

Figure 7. Dendrogram of similarity in three habitats, using MVSP 3.22. CP: Community plantation; R: river: RF: rice field

Ecological indices

Overall, the diversity index is categorized as medium, the evenness index high, and the dominance index low (Table 5). This indicates that the habitat around community settlements is still good for herpetofauna. The presence of water, bushes, litter, and lush trees around the settlements make an ideal place for herpetofauna to live. The moist microhabitat, due to the tight canopy cover and lots of litter, becomes an influential factor on herpetofauna especially for amphibians (Wanger et al. 2011; Qurniawan 2015; Kwatrina et al. 2019).

The value of diversity index in the rice field (1.82) was lower than that of the river (2.41) and plantation (2.20), which means that the river and plantation diversity was medium, while that of the rice field was low. The difference in diversity index values between habitat types is caused by humidity (Dutta and Mukhopadhyay 2013). This is proven by the fact that rice field had lower humidity (Table 4). Evenness Index is important because it can assess the abundance of each species in a community that is evenly distributed (Dutta and Mukhopadhyay 2013; Chatterjee and Mondal 2016). The Evenness Index in the rice field (0.69), was lower than that in the river (0.89) and plantation (0.76). These findings may be interpreted that the herpetofauna species in the river and plantation were more evenly distributed than in the rice field.

The dominance index in the rice field was higher than that of other habitats (Table 5) because several species from the rice field had relatively high abundance (Figure 3), indicating that rice field is the ideal habitat for these three species (Kamsi et al. 2017). Homogeneous microhabitats such as in the rice field reduce the number of niches which lead to the low diversity of herpetofauna (Muslim et al. 2018). In addition, without litter and lack of tree canopy cover, the rice field has low relative humidity and high fluctuation of temperature between night and day, which cause herpetofauna diversity to decrease (Gillespie et al. 2015; Saccol et al. 2017; Kwatrina et al. 2019).

Species similarity for among habitats was calculated using the Jaccard index (Table 6) and analyzed using MVSP 3.22. (Figure 7). The rice field habitat was separated because the number of common species was less when compared to the river and plantation habitats. The river and plantation habitats had higher common species (10 species) because there were shrubs, trees, and litter around the river.

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