

## Short Communication: Herpetofauna diversity, potential ecotourism in Mount Galunggung, West Java, Indonesia

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**Abstract.** Riyanto A, Sulaeman TN, Rachman N, Chaidir DM, Trilaksono W, Farajallah A. 2019. Short Communication: Herpetofauna diversity, potential ecotourism in Mount Galunggung, West Java, Indonesia. *Biodiversitas* 20: 1173-1179. Here we provide a list of herpetofauna at Mount Galunggung, West Java, Indonesia as potential biodiversity for ecotourism. Data were collected from our observations in March 2013 and November 2018 using visual and acoustic encounter search methods in the three zones (hot springs, craters, and foothills) on the nature tourism destination of the mount. We revealed 35 species of herpetofauna and their local distribution on these zones. Even though the diversity of herpetofauna has not been observed completely, we suggested that the biodiversity data from this zone should be used as the basic capital in turning nature tourism base into ecotourism base, so that it would provide more benefits to biodiversity conservation itself and to the local community.

**Keywords:** Acoustic, ecotourism, herpetofauna, Mt. Galunggung, visual

### INTRODUCTION

Ecotourism has been worldwide implemented on conservation (Loubseer et al. 2001) and development tool because it provides benefits both in conservation and economic. Theoretically, the distribution of some benefits to local people will give them an incentive to protect the natural area that draw tourist to be more (Charnley 2005). The protection of natural areas, high quality tourism experiences provision and economic stimulation for in local scope, resources provision for conservation, environmental education and local empowerment are the fundamental functions of ecotourism. The effectiveness of an ecotourism site is represented by degree to which these variables are functioning, or have the potential to function. In other words, ecotourism should develop synergistic relationships between tourism, biodiversity, and local communities, facilitated by appropriate management strategy (Wall and Ross 1999).

Indonesia with approximately 17,000 islands and possesses one of the world's greatest expanses of tropical forest and continuous coral systems. At least 10% of the Earth's tropical moist forest biome and the second richest expanse of tropical rainforest in the world next to Brazil is owned by Indonesia (Whitmore 1990). The complexity of nature and geological origins has made many of its islands supporting unique flora and fauna found nowhere else in the world. In contrast, it also possesses the greatest number of species threatened with extinction and destroying its

forests is faster than any other country in the world. Human population is growing over 200 million with consequence of the demands for food, timber and other forest product that will result in the continued destruction of the forest due to agricultural production, shifting cultivation and associated fires, urban development, and mining (Ross and Wall 1999).

Gunung (Mount) Galunggung is one of the destinations of nature tourism in Indonesia. The mount is an active volcano which had latest eruption in 1982-1983 (Katili and Sudrajat 1983; Malingreau and Kaswanda 1986; Dana 2010). At least there are two kinds of nature tourism in this mount namely hot springs and death crater. This mount becomes the most visited nature tourism in the city (Disparbud 2016). Regarding the biodiversity, this mount has high potency, and several authors have reported it. Gunung Galunggung is inhabited by about 213 plant species (Zuhri et al. 2015) and hypotheses of these species number might be increased due to its structure vegetation which hasn't reached its climax yet (Suryana et al. 2018). This landscape supports the life of 20 species of fish (Haryono 2015), 39 species of birds (Widodo 2014) and 67 species of butterflies (Imam 2014). However, there was no reported data on herpetofauna species. Here, we revealed and thus provided the herpetofauna diversity of this area. These biodiversity data should be used as the basic capital in changing nature tourism into ecotourism.

## MATERIALS AND METHODS

### Study area

Our study area is located in tourism route on Gunung Galunggung, West Java, Indonesia. Administratively, it is included in Tasikmalaya District of West Java Province, Indonesia (Figure 1). This route lay on east slope of this mount. The study area was divided into three zones; (i) hot springs, (ii) foothill, and (iii) death crater. Hot springs zone are including several habitat types such as hot springs, shrub, small stream and waterfall (Figure 2.A). In foothill, it included habitat types of pines forest, river, and shrub (Figure 2.B). Meanwhile, the death crater is body water with border of sand come from the last eruption which was overgrown with grasses (Figure 2.C).

### Data collection

Visual Encounter Survey (VES) and Acoustic Encounter Survey (AES) were applied for opportunistic searching the herpetofauna in the target areas. These surveys were conducted in March 2013 and November 2018.

### Nomenclature

We followed Rooij (1915, 1917), Manthey & Grossmann (1997), Mausfeld et al. (2002), and Uetz & Hošek (2019) literature's for taxonomy and nomenclature of reptiles; and for the amphibians by followed Kampen (1923), Manthey & Grossmann (1997), Iskandar (1998), and Frost (2019).

### Conservation status

The national conservation status of each species was checked based on national regulation (PP. 7/1999 and Permen P.92/MENLHK/SETJEN/KUM.1/8/2018), meanwhile, for international conservation status, The IUCN Red List of the Threatened Species (IUCN 2019) and Appendices of CITES (2019) was followed.

### Data analysis

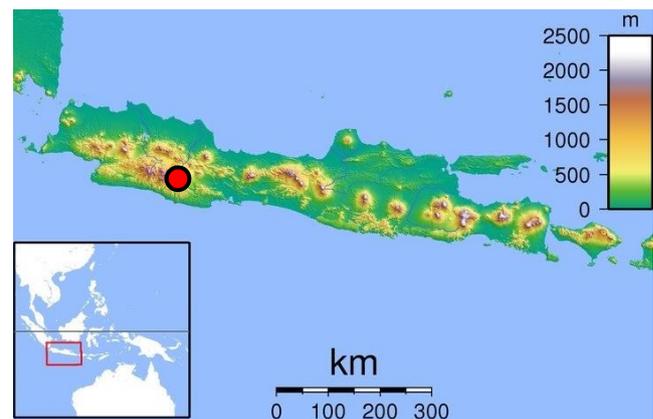
Data were tabulated in an existence matrix (Table 1) and then plotted in a Venn diagram to determine the

distribution pattern of species in this study area. We also compared our total number of species from this study to nature, ecotourism and mountains data in Java found on available literature.

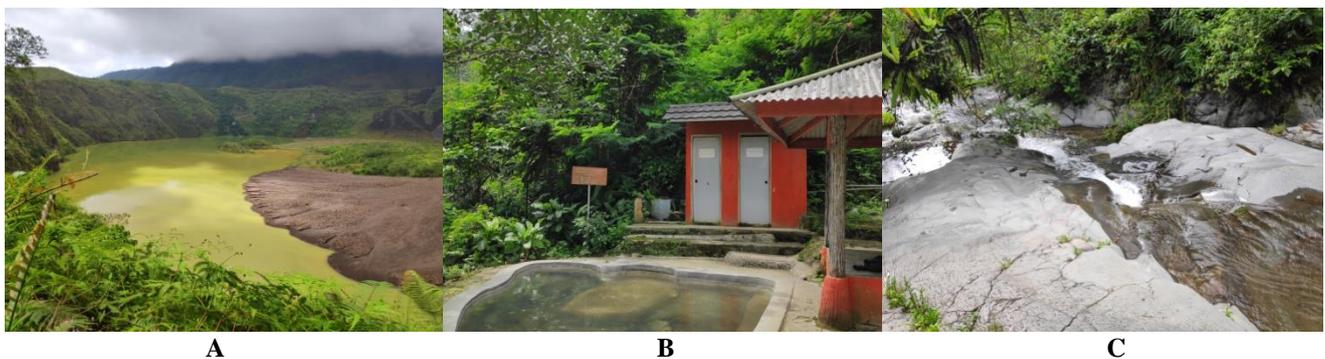
## RESULTS AND DISCUSSION

### Species richness, local distribution, and herping

A total of 35 herpetofauna species were recorded (Table 1) comprising of 14 frogs, 10 lizards and 11 snakes. Of these, four anurans are endemic to Java i.e. *Huia masonii* (Javan torrent frog), *Megophrys montana* (Javan hornet frog), *Microhyla achatina* (Javan chorus frog) and *Limnonectes kuhlii* (Kuhl's creek frog). No species were listed in protected animal under national regulation. One snake has listed in CITES app. II, i.e. *Malayopython reticulatus* (Reticulated python), meanwhile 25 species were listed in IUCN Redlist in which 24 species were categorized as Least Concern (LC) and one species, *Rhacophorus reinwardtii* (Reinwardti's frog) was categorized as Near Threatened (NT). Unidentified and possibly undescribed lizard species of unusual specimen will be referred to the genus *Cyrtodactylus* and *Tythoscinctus*.



**Figure 1.** Location of Gunung Galunggung nature tourism destination (red circle) in West Java, Indonesia. Map source from Wikipedia.



**Figure 2.** Habitat type in three observation sites in Galunggung, Tasikmalaya, West Java, Indonesia. A. Crater area, B. Hot springs, and C. Gado Bangkok stream in the foothill

The species richness of herpetofauna in Gunung Galunggung nature tourism destination is relatively high compared to other mount and nature tourism destinations in Java. The number of species is similar to Baturaden nature tourism at southern slope of Mount Slamet in Central Java, Indonesia (Riyanto 2010) and Purbalingga in eastern slope of Mount Slamet (Riyanto and Trilaksono 2012). Although the number of species is still lower than Gunung Ciremai National Park in West Java (35 versus 46 species) (Riyanto 2011) but it is higher than that in the upstream river of Mount Sindoro (35 versus 14 species) (Subeno 2018) and Coban Putri nature tourism in East Java (35 versus 10 species) (Hidayah et al. 2018).

Based on our data, it seems that the hot springs zone is the area with the most species (26 species), followed by death crater zone (15 species) and foothill zone (11 species). There were four species found in all zones, i.e. *Duttaphrynus melanostictus* (Asian common toad), *Limnonectes microdiscus* (Indonesia Wart Frog), *Polypedates leucomystax* (Common tree frog) and *Cyrtodactylus* sp. (Bent-toed gecko). Three species only found at death crater zone were *Ingerophrynus biporcatus*, *Calamaria* sp. and *Elapoidis fusca* (Dark grey ground snake), whereas *Ahaetulla mycterizans* (Malayan green whipsnake), *Xenodermus javanicus* (Dragon snake) and *Trimeresurus puniceus* (Flat-nosed pitviper) were only found at foothill zone. Resume of the local distribution pattern of the herpetofauna among three zones is illustrated in Figure 3.

In this study, the area with highest species richness was in hot springs zone. It might happen because this zone contains more varied habitat types such as hot springs, shrub, small stream and waterfall which were more diverse in microhabitat and patches for supporting the life of herpetofauna. The herpetofauna diversity of this nature tourism destination is a potential and a challenge to create a herpetofauna-based ecotourism base. Furthermore, the habitus, sound, and behavior of these faunal groups are interesting, and to find them in the wild gives an adventurous sensation. We promote a *herping* activity as one of ecotourism forms which should be created in Gunung Galunggung. The *herping* means an activity to look for and watch the herpetofauna at night or day on the certain habitat types by a limited number of people, and this activity should have no negative impact on the herpetofauna. This group of tourists is guided by a tour guide from the local people who have been provided with knowledge about herpetofauna and conservation. The profiles of several species are presented in Figure 4-7.

#### From nature into ecotourism

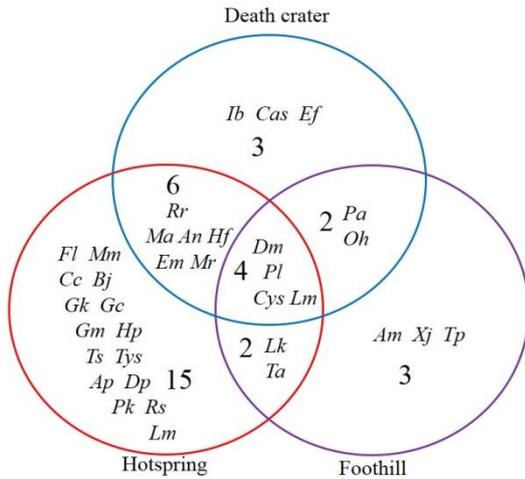
One critical issue in ecotourism is the success of promoting the well being of both local peoples and their environments. For this, Scheyvens (1999) suggested four levels of empowerment in a framework, such as psychological, social, political and economic. Based on this framework, the impacts of ecotourism ventures on local communities, the attempts to emphasize the importance of local communities having some control over it and the benefits for sharing ecotourism initiatives in their area can be analyzed.

In the case of Gunung Galunggung tourism, which is still on the nature-based tourist destination, and in order to open the opportunity to shift it into ecotourism-based one, we agree with that empowerment framework. We suggested that among stakeholders in this destination tourism which involves local governments, the ministry of forestry, local people, local NGO, and academics an integrated manner to run that framework should be accommodated.

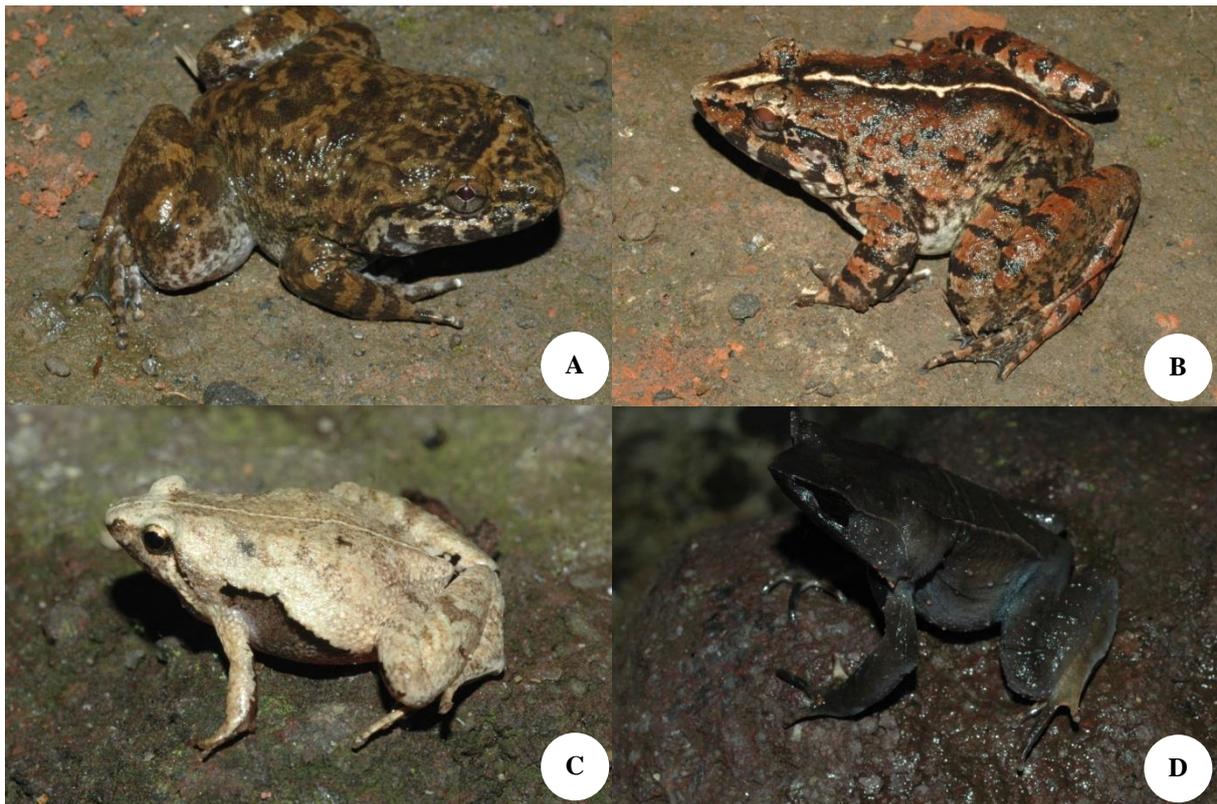
**Table 1.** Checklist of herpetofauna and their local distribution in Gunung Galunggung, Tasikmalaya, West Java, Indonesia

Species	Zones			Status	
	Hot spring	Death crater	Foothill	IUCN	CITES
<b>Bufonidae</b>					
<i>Ingerophrynus biporcatus</i>	0	1	0	LC	-
<i>Phrynooidis aspera</i>	0	1	1	LC	-
<i>Duttaphrynus melanostictus</i>	1	1	1	LC	-
<b>Dicroglossidae</b>					
<i>Fejervarya limnocharis</i>	1	0	0	LC	-
<i>Limnonectes kuhlii</i>	1	0	1	LC	-
<i>Limnonectes macrodon</i>	1	0	0	LC	-
<i>Limnonectes microdiscus</i>	1	1	1	LC	-
<b>Megophryidae</b>					
<i>Megophrys montana</i>	1	0	0	LC	-
<b>Microhylidae</b>					
<i>Microhyla achatina</i>	1	1	0	LC	-
<b>Ranidae</b>					
<i>Ammirana nicobariensis</i>	1	1	0	LC	-
<i>Chalcorana chalconota</i>	1	0	0	LC	-
<i>Odorrana hosii</i>	0	1	1	LC	-
<b>Rhacophoridae</b>					
<i>Polypedates leucomystax</i>	1	1	1	LC	-
<i>Rhacophorus reinwardtii</i>	1	1	0	NT	-
<b>Agamidae</b>					
<i>Bronchocela jubata</i>	1	0	0	LC	-
<i>Gonocephalus chamaeleontinus</i>	1	0	0	-	-
<i>Gonocephalus kuhlii</i>	1	0	0	-	-
<b>Gekkonidae</b>					
<i>Cyrtodactylus</i> sp.	1	1	1	-	-
<i>Gehyra mutilata</i>	1	0	0	-	-
<i>Hemidactylus frenatus</i>	1	1	0	LC	-
<i>Hemidactylus platyurus</i>	1	0	0	-	-
<b>Lacertidae</b>					
<i>Takydromus sexlineatus</i>	1	0	0	LC	-
<b>Scincidae</b>					
<i>Eutropis multifasciata</i>	1	1	0	-	-
<i>Tytthoscintus</i> sp.	1	0	0	-	-
<b>Colubridae</b>					
<i>Ahaetulla prasina</i>	1	0	0	LC	-
<i>Ahaetulla mycterizans</i>	0	0	1	LC	-
<i>Calamaria</i> sp.	0	1	0	-	-
<i>Dendrelaphis pictus</i>	1	0	0	-	-
<i>Elapoidis fusca</i>	0	1	0	LC	-
<i>Ptyas korros</i>	1	0	0	-	-
<i>Rhabdophis subminiatus</i>	1	0	0	LC	-
<i>Xenodermus javanicus</i>	0	0	1	LC	-
<b>Phytonidae</b>					
<i>Malayophyton reticulatus</i>	1	1	0	LC	II
<b>Viperidae</b>					
<i>Trimeresurus albolabris</i>	1	0	1	LC	-
<i>Trimeresurus puniceus</i>	0	0	1	LC	-
<b>Total</b>	<b>26</b>	<b>15</b>	<b>11</b>		

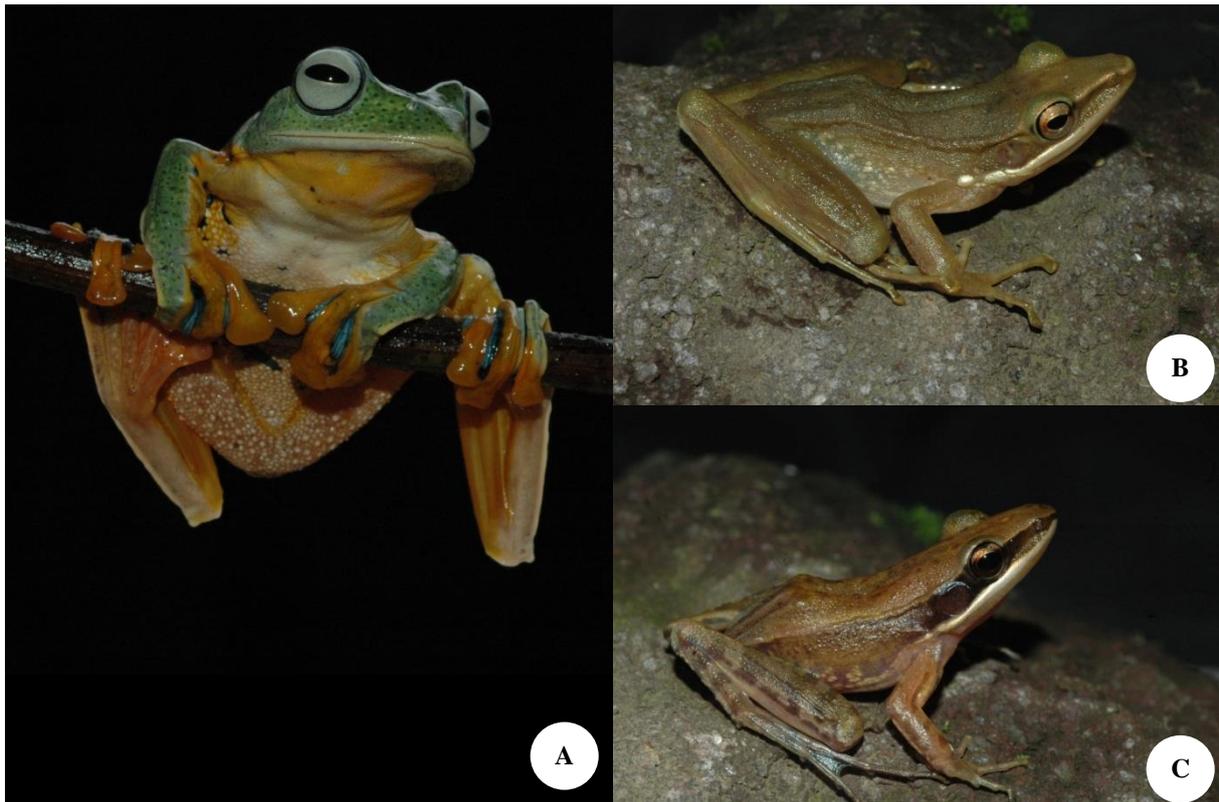
Note: I: present, 0: absent, LC: least concern, NT: near threatened, II: appendix II. -: not listed.



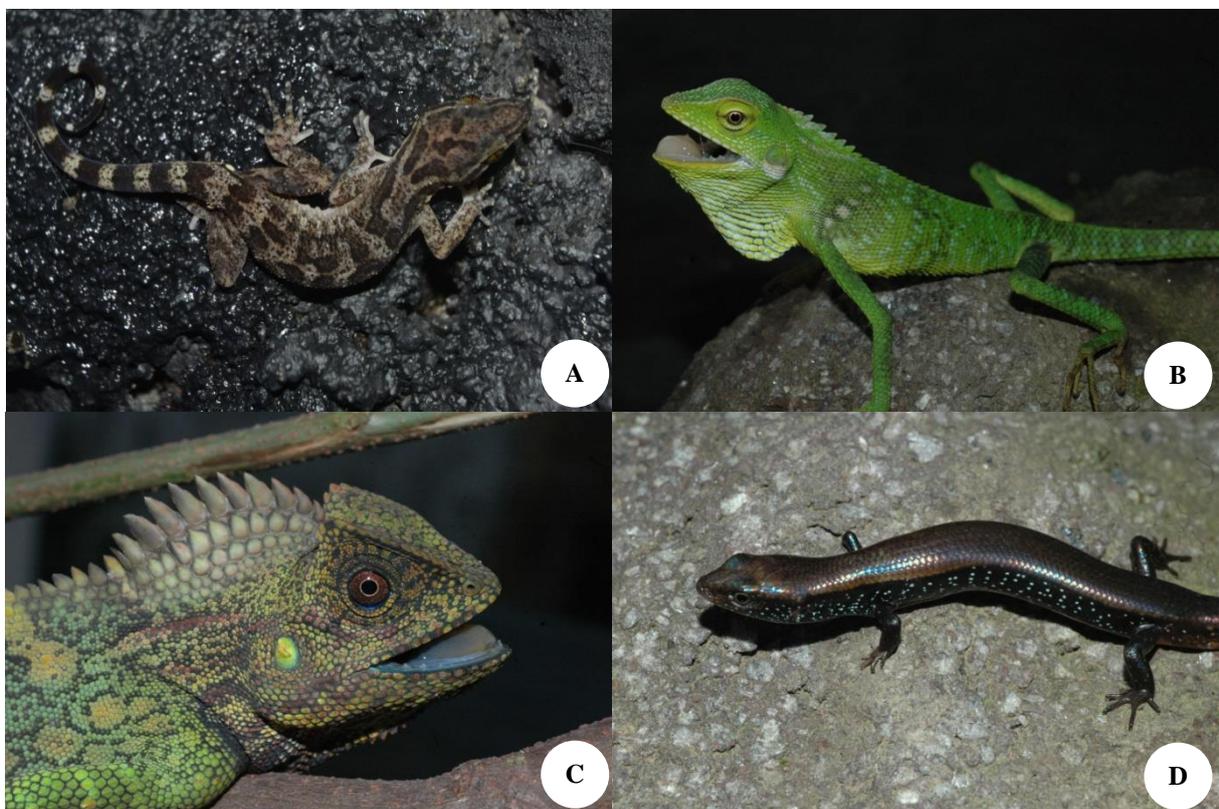
**Figure 3.** A Venn diagram showed the species distribution among three zones surveyed in Gunung Galunggung nature destination. *Ib*-*Ingerophrynus biporcatus*, *Cas*-*Calamaria* sp., *Ef*-*Elaphoidis fusca*, *Am*-*Ahaetulla mycterizans*, *Tp*-*Tremeresurus punicius*, *Xj*-*Xenodremus javanicus*, *Fl*-*Fejervarya limnocharis*, *Mm*-*Megophrys montana*, *Cc*-*Chalcorana chalconota*, *Bj*-*Bronchocela jubata*, *Gk*-*Gonocephalus kuhlii*, *Gc*-*G. chamaeleontinus*, *Lm*-*Limnonectes macrodon*, *Hp*-*Hemidactylus platyurus*, *Gm*-*Gehyra mutilata*, *Ts*-*Takydromus sexlineatus*, *Tys*-*Tytthoscintus* sp., *Ap*-*Ahaetulla prasina*, *Dp*-*Dendrelaphis pictus*, *Pk*-*Ptyas korros*, *Rs*-*Rhabdophis subminiatus*, *Rr*-*Rhacophorus reindwardtii*, *Ma*-*Microhylla achatina*, *An*-*Amnirana nicobariensis*, *Hf*-*Hemidactylus frenatus*, *Em*-*Eutropis mulatifasciata*, *Mr*-*Malayohpyton reticulatus*, *Pa*-*Phrynoidis aspera*, *Oh*-*Odorrana hossi*, *Lk*-*Limnonectes kuhlii*, *Ta*-*Trimeresurus albolabris*, *Dm*-*Duttaphrynus melanostictus*, *Pl*-*Polypedates leucomystax*, *Cys*-*Cyrtodactylus* sp. and *Lm*-*Limnonectes microdiscus*.



**Figure 4.** Some frogs found in Mt. Galunggung nature tourism destination. A. *Limnonectes kuhlii*, B. *Limnonectes macrodon*, C. *Microhylla achatina*, and D. *Megophrys montana*. Photographs by A. Riyanto



**Figure 5.** Some frogs which were in Mt. Galunggung nature tourism destination. A. *Rhacophorus reinwardtii*, B. *Chalcorana chalconota*, and C. *Amnirana nicobariensis*. Photographs by A. Riyanto



**Figure 6.** Some lizards found in Mt. Galunggung nature tourism destination. A. *Cyrtodactylus* sp., B. *Bronchocela jubata*, C. *Gonocephalus chamaeleontinus*, and D. *Tythoscintus* sp. Photographs by A. Riyanto



**Figure 7.** Some snakes found in Mt. Galunggung nature tourism destination. A. *Dendrelaphis pictus*, B. *Malayophyton reticulatus*, C. *Ptyas korros*, and D. *Rhabdophis subminiatus*. Photographs by A. Riyanto

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