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Population status of herpetofauna in the rice fields area of Angantaka Village of Badung, Bali, Indonesia

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ABSTRACT

Bali Province, Indonesia has a promising tourism sector potential to continue to be developed as a domestic and global tourism destination. This study aims to monitor the initial data and conservation status of herpetofauna in rice fields in Angantaka Village, Badung Regency, Indonesia. This research uses *Visual Searching* or *Visual Encounter Survey* (VES) techniques. The results showed that there were 5 herpetofauna species that were dominated by the Reptile Class. The species of *Boiga dendrophila* snake found in this study and has a "Near Threatened" (NT) conservation status based on the IUCN Red List. Management of herpetofauna species still has to be developed, especially in this area so that it can increase the potential to be developed as an eco-tourism area

Key word : *Reef Fish, Diversity, Marine, Bama coastal water*

Introduction

The province of Bali with its cultural tourism has spread throughout the region and is able to pay attention to local tourists and foreign tourists (Arismayanti *et al.,* 2019; Muryani *et al.,* 2020). The beauty of tourist objects such as Tanah Lot and Jatiluwih in Tabanan Regency, the uniqueness of Balinese Hindu religious rituals, and its natural beauty are the attractions of the island of Bali as a tourism destination in Indonesia. The traditional agricultural culture called "Subak" in Bali is a traditional agricultural irrigation management system that is based on a sustainable environment and acts as a pillar of the culture and customs of the people of Bali (Geria *et al.,* 2019).

One area in Bali that implements the Subak system in its agricultural sector is Angantaka Village in Badung Regency. Administratively, Angantaka Village is located in the Abiansemal District, Badung Regency, Bali with a population of around 4.016 in 2010 and 3,617 in 2016. Geographically, Angantaka Village is bordered by several villages including Medium (North) Village, Singapadu Gianyar Village (East), Jagapati Village (South and West). Based on the results of field searches, interviews with local communities, and literature studies, it can be seen that agricultural management in the village of Angantaka has been very well managed and some areas have even been developed as Ecotourism activities. However, until now ecotourism activities in the village of Angantaka have focused more on

Subak tourism, customs/culture, and religion.

The diversity of living things, both flora, and fauna, is one of the potential assets in developing ecotourism activities in an area , especially in Bali. Based on the results of the search, it turns out that many areas in Badung Regency are still developing marine tourism, agro-tourism, and culture (Dipadewanda and Mahagangga, 2019) and data on the diversity of species and potential of flora/fauna in a village are still lacking. In addition, people living in this agricultural area still have a high dependence on agricultural and livestock resources such as rice, secondary crops, cattle, pigs, and chickens.

Herpetofauna is a group of animals consisting of the reptile and amphibian classes (Wiranata *et al.*, 2020; Suzuki *et al.*, 2020). Many places in Indonesia have reptile and amphibian classes, however there are not yet used as herpetofauna tourism activities (Yudhana *et al.*, 2020). In Bali such as snakes are still very rare and only a few areas show this tourism such as Tanah Lot, Bali Safari, and Bali Zoo. In addition, the Balinese people believe that snakes are unique in terms of culture and religion so that their existence should be preserved. In addition, based on the government regulation of the Republic of Indonesia No. 108 of 2015 concerning amendments to government regulation No. 2011 Regarding the management of nature reserve areas and nature conservation areas, conservation animal conservation activities are mandatory. Therefore, in order to support ecotourism management in Angantaka Village with an object in the form of biodiversity, we carried out preliminary research on the checklist and conservation status of herpetofauna in rice fields in Angantaka Village, Badung Regency, so that it can provide initial information to the community and related environmental agencies regarding types of herpetofauna in this region.

Materials and Methods

Study Area

The research took place from January to March 2020 in the rice fields of Angantaka Village, Badung Regency, Bali. This research is focused on areas of utilization of the agricultural sector, such as areas for planting rice, maize, chilies, and inflorescences in the village of Angantaka, Badung (8°34'55.1"S 115° 14'36.3" E). The types of ecosystems represented in this study include rice fields, rivers, and several dry fields. The location of the research data is seen in Figure 1.

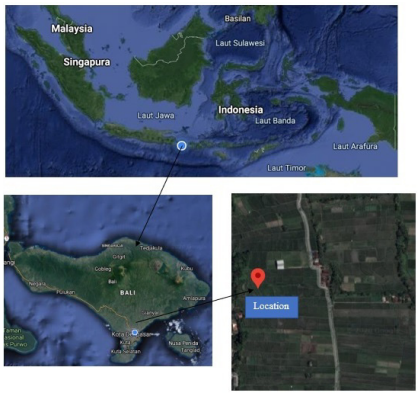

Fig. 1. Study area

Method of collecting data

The research was conducted exploratively using the *Visual Searching* or *Visual Encounter Survey* (VES) technique (Maulidi *et al.*, 2019), namely the search for amphibians and reptiles is actively carried out in all environments deemed suitable as natural animal habitats, such as litter, piles of rocks, bushes shrubs, water sources, puddles, and rivers. Animal search is conducted at 07.00 a.m - 14.00 p.m and continued at 18.00 - 23.00 p.m. Fauna found in the research location was identified directly in the field. Identification and nomenclature of the species referred to. Individuals found were also documented for further identification at the Zoology Laboratory, Biology Study Program, Faculty of Mathematics and Natural Sciences, Udayana University, Bali.

Results and Discussion

The number of herpetofauna species found in the rice fields of Angantaka Village was 5 species, which were dominated by the Reptile class. The largest species of reptile found in the field is the Asian grass lizard or the long-tailed grass lizard *(Takydromus sexlineatus)*. There were 4 species of snakes, which were dominated by Painted bronzeback *(Dendrelaphis pictus)*. Meanwhile, only one species of amphibian was found, namely the Rice-paddy frog *(Fejervarya limnocharis)*. The composition of herpetofauna species found in the rice fields of the village of Angantaka, Badung, Bali is shown in Table 1.

Based on Table 1, it can be seen that the highest number of faunae was obtained by the Asian grass

lizard *(T. sexlineatus)* from the Lacertidae family, as many as 29 individuals. *T. sexlineatus* (Reptilia: Lacertidae) is a lizard that has a wide distribution in Southeast Asia, such as in India, Myanmar, China, Vietnam, Laos, Malaysia, Singapore, Indonesia, Cambodia, and Thailand (Hawkeswood, 2017). The IUCN conservation status (Table 2) shows, this animal is listed as the *Least Concern* (LC) category. This is because the distribution and tolerance possessed by these animals include a very wide range of habitats including modified habitats so that there is no significant threat to the survival of these reptiles (Auliya, 2010). Research also states that Lacertid lizards have a sharp sense of smell with a sensory epithelium, thus helping this species detect the presence of saprophage snakes in the surrounding environment (Sunyer and Bosch, 2014). This is what can support the high number of lizard species found in this study.

The interesting thing that was obtained from this study was the discovery of the Boiga dendrophila snake from the Colubridae family (Figure 2). Basically, in nature, the habitats inhabited by the Genus Boiga are coastal areas, river waters, to brackish waters such as mangroves (Dolorosa, 2014). Similar results were also reported by Putra, (2015) who conducted an inventory study of snake species in Singapadu Village, Gianyar-Bali based on rice fields and residential areas. The results of this study indicate that there are 14 species of snakes from the Colubridae family, one of which is *B. dendrophila*. Based on the status of this snake venom, this snake is in the "moderate venom" category with a bite effect in the form of severe swelling but does not cause death.

IUCN Red List conservation data (Table 2) shows that this snake species is included in the Near Threatened (NT) category or nearly threatened with extinction. This has a bad impact on the survival of this snake in the wild. Several things or factors that can have a negative impact on the survival of snakes in the wild are anthropogenic disturbances, decreased availability of food and shelter, the presence of predators, and environmental factors such as climate change which are the main factors that can affect the level of stress and the well-being of the snake population in nature. In addition, improper snake breeding activities can also provide chronic stress and health problems for snakes (Van Waeyenberge *et al.*, 2018).

Measurement of snake biomarkers such as corticosterone in plasma, feces and skin can be done to determine the environmental impact. Another type of snake found was *Dendrelaphis pictus* as many as 8 individuals. The species belongs to the Colubridae family and is commonly found in various regions in Indonesia. Several local names are also used to identify this type of snake, such as "ulo tambang" or "ulo lewora" (Javanese), "duwata" or "ule lewora" (Toraja language). This snake is easy to find, especially in soil or grass areas and during the day this snake is found in trees to shrubs. But in terms of conservation, this snake still does not have a conservation status or has not yet been evaluated when viewed on the IUCN RedList website. These results can also be used as a consideration for Conservation

Table 1. Composition of herpetofauna species in the rice fields of Angantaka Village, Badung, Bali and conservation status based on the IUCN Red List.

No	Family	Scientific name	English name	Number of individual	IUCN Status
Reptile					
1	Pareidae	*Pareas carinatus*	Keeled slug-eating snake	3	LC
2	Lacertidae	*Takydromus sexlineatus*	Asian grass lizard or long-tailed grass lizard	29	LC
3	Colubridae	*Dendrelaphis pictus*	Painted bronze back	8	NE
4	Gekkonidae	*Boiga dendrophila*	Black mangrove cat snake	2	NT
		Gekko gecko	Tokay	1	LC
Amphibians					
1	Ranidae	*Fejervarya cancrivora*	Rice-field frog or marsh frog	20	LC
			TOTAL	63	

Note : IUCN : International Union for Conservation of Nature, LC: Least Concern, NE: Near Threatened, NE: Not Evaluated.

and Environmental Institutions to continue to carry out further studies on biodiversity in Indonesian territory.

For amphibians, only one species is obtained in the rice fields of Angantaka Village, namely *Fejervarya cancrivora* or Rice-paddy frog which is very common in rice fields. In some areas, amphibians are widely used as food and traded, such as in West Kalimantan (Saputra *et al.,* 2014). The existence of these frogs is indeed very rare in primary forest but will be abundant in rice fields, because rice fields are man-made habitats that these animals love. The rice fields in the village of Angantaka have good irrigation, which can cause a high population of these frogs. However, its existence can decrease if the availability of water starts to be low and the rice plants wear out. Seasonal factors also affect the presence of these frogs, especially when the rainy season has arrived.

Decreases and recommendations in the management of herpetofauna

The decline in herpetofauna around the world is reported to always increase every year for various reasons. Some of the reasons that can cause this are habitat loss and fragmentation, pollution, killing by local people, indirect killing, persecution, and illegal trade.

Efforts to save and conserve herpetofauna species are still very rare. Various parties such as the government, citizen participation such as: NGO organizations, academics, and animal-loving communities play an important role in the conservation of herpetofauna during the rapid development of development in urban areas that indirectly eliminates the preservation of these animals (Putri *et al.,* 2019; Sa'adah *et al.,* 2021). In Indonesia, institutions such as the KSDA Office of the Ministry of Environment and Forestry have the duty and authority to protect wildlife and endangered species including snakes and other herpetofauna. Legal basis such as Law No. 5 of 1990 concerning Conservation of Natural Resources and their Ecosystems in Constitution 21 paragraph 2 states that every person is prohibited from capturing, injuring, killing, keeping, possessing, maintaining, transporting and trading protected animals in a state of life or death.

This regulation provides a protection policy for wild animals, in this case, snakes and herpetofauna which are protected. Also, research activities carried out by researchers are also very necessary to maintain and monitor the preservation of these animals in the wild. Research through taxonomy, population genetics, autecology, monitoring of critical habitats and species, migration patterns, to the application of Barcoding DNA, Environmental DNA, and Biomarkers related to snake health is very necessary for the future. Management of herpetofauna habitat, especially those that are rare and protected, must be managed properly to prevent a decline in the species population. Sustainable use of snake natural habitat can be done by providing good access in the form of the metapopulation, preventing fragmentation, minimizing the use of pesticides in agricultural environments, and protecting or restoring. Providing support to animal lovers can also be done to provide comfort to them to keep these animals from extinction.

Conclusion

The island of Bali provides open opportunities in sustainable environmental management through ecotourism efforts in several areas. Angantaka is an area that has the potential to be developed as an eco-tourism area through its rice fields. Research shows that there are 5 species of herpetofauna found in this area, dominated by the Reptile Class. *Boiga dendrophila* was found with the conservation status of Near Threatened (NT) based on the IUCN Red List. The species most commonly found in the field frog Fejervarya cancrivora which has the potential to be consumed and developed by local communities. Management of herpetofauna requires roles from various parties such as the relevant government, NGO institutions, and academics to the local community. Community involvement in sustainable management is also an important factor in the conservation of herpetofauna.

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References

Arismayanti, N.K., Sendra, I.M., Suwena, I.K., Budiarsa,

M., Bakta, I.M. and Pitana, I.G. 2019. Tourism Villages, Development in Bali, Mass or Alternative Tourism? *J. Tour. Hosp. Manag.* 7 : 117–139. https://doi.org/10.15640/jthm.v7n2a11

Auliya, M. 2010. Exploited for the international fashion industry: The trade in the Reticulated Python reticulatus in Peninsular Malaysia. TRAFFIC Southeast Asia, Petaling Jaya, Malaysia. Internal Report.

Dipadewanda, I.M. and Mahagangga, I.G.A.O. 2019. Perkembangan Pariwisata Di Daya Tarik Wisata Pantai Berawa Kabupaten Badung. *J. Destin. Pariwisata*. 6 : 309. https://doi.org/10.24843/jdepar.2018.v06.i02.p16

Dolorosa, R.G. 2014. Notes on mangrove snake Boiga dendrophila multicincta (Boulenger, 1896) in Iwahig River, Puerto Princesa City. *Palawan Sci.* 6 : 39–41.

Geria, I.M., Sumardjo, N., Sutjahjo, S.H., Widiatmaka, N. and Kurniawan, R. 2019. Subak sebagai Benteng Konservasi Peradaban Bali. *Amerta*. 37 : 39. https://doi.org/10.24832/amt.v37i1.39-54

Hawkeswood, T.J. and Sommung, B. 2017. A record of the Long-tailed Lizard, *Takydromus sexlineatus* (Daudin, 1802) (Reptilia: Lacertidae) from the farming district of Ubon Ratchathani, Thailand. *Calodema.* 564: 1-3.

Lanuza, G.P. and Font, E. 2014. A Ultraviolet vision in lacertid lizards: evidence from retinal structure, eye transmittance, SWS1 visual pigment genes and behaviour. *The Journal of Experimental Biology.* 217: 2899-2909 doi:10.1242/jeb.104281

Maulidi, A., Jakaria, M., Fitriyana, N. and Rizki, M. 2019. Herpetofauna Diversity at Munggu Village, Landak Regency, West Kalimantan Province, Indonesia. *Biog. J. Ilm. Biol.* 7. https://doi.org/10.24252/bio.v7i2.10072

Muryani, Permatasari, M.F. and Esquivias, M.A. 2020. Determinants of Tourism Demand in Indonesia: A Panel Data Analysis. *Tourism Analysis.* 25 : 77–89.

Putra, I.G.A.P. 2015. Jenis – Jenis Ular (Serpentes)Yang Ditemukan Di Desa Singapadu Kabupaten Gianyar - Bali. Udayana University.

Putri, N.K., Syahansyah, R.J. and Tazaroh, N. 2019. Citizen's Participation Through E-Petition: New Wave of Green Movement in Indonesia. *IOP Conf. Series: Earth and Environmental Science*. 246 (2019) 012038.doi:10.1088/1755-1315/246/1/012038.

Sa'adah, T.K., Alfiniyah, C. and Fatmawati, 2021. Mathematical model of deforestation effects on wildlife with Holling type-II and type-III functional response. *AIP Conference Proceedings.* 2329 : 040005 (2021), https://doi.org/10.1063/5.0042160.

Saputra, D., Rima Setyawati, T. and Hepi Yanti, A. 2014. Karakteristik Populasi Katak Sawah (*Fejervarya cancrivora*). *Protobiont*. 3 : 81–86.

Suzuki, J., Kobayashi, S., Yoshida, N., Azuma, Y., Kobayashi-Ogata, Kartikasari, D.P., Yanagawa, Y. and Iwata, S. 2020. Phylogenetic position of Nyctotherus teleacus isolated from a tortoise (*Astrochelys radiata*) and its electron microscopic features 2. *J Vet Med Sci.* 82(6) : 699-703.

Van Waeyenberge, J., Aerts, J., Hellebuyck, T., Pasmans, F. and Martel, A. 2018. Stress in wild and captive snakes: quantification, effects and the importance of management. *Vlaams Diergeneeskd. Tijdschr.* 87: 59–65. https://doi.org/10.21825/vdt.v87i2.16082.

Wiranata, T.A., Hidajati, N., Poetranto, D., Yuliani, M.G.A., Wahjuni, R.S. and Widjiati, W. 2020. Description of Hematological Value on Leopar Gecko (*Eublepharis macularius*). *Advances in Animal and Veterinary Sciences*. 8(8): 882-887.

Yudhana, A., Praja, R.N., Yunita, M.N. and Wardhana, D.K. 2020. 4. Molecular Evidence of Spirometra erinaceieuropaei in Asian Wild Frogs (*Rana rugulosa*) from Banyuwangi City, Indonesia. *World Vet J*. 10(2): 170-174.