FORMULATING STRATEGIES BASED ON LOCAL COMMUNITY'S PERCEPTIONS FOR CAVE AND BAT ECOTOURISM DEVELOPMENT: A CASE STUDY OF TOGENRA CAVE IN BARRU, SOUTH SULAWESI

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FORMULATING STRATEGIES BASED ON LOCAL COMMUNITY'S PERCEPTIONS FOR CAVE AND BAT ECOTOURISM DEVELOPMENT: A CASE STUDY OF TOGENRA CAVE IN BARRU, SOUTH SULAWESI. Togenra cave in Madello Village, Barru Regency (South Sulawesi) is located in the Tonasa Karst Formation, known as one of the largest formations in Asia and is also popular for its unique features and functions. Currently, the local government has not yet established a regulation on the management of the cave, and locals are free to access the cave for calcium and guano mining which can threaten the ecosystem of the cave. Therefore, it is necessary to develop non-consumptive use of the cave, through ecotourism that can provide long-term benefits to the local communities. This study aimed to 1) examine the community's perceptions toward the cave, bats and conservation; 2) formulate strategies by assessing the potency of the cave and bat species as an ecotourism spot based on the local's perceptions; and 3) provide recommendations for the local government in supporting both ecotourism and conservation in the area. The study was conducted from August 2020 to February 2021. A set of questionnaires were to 31 respondents living within a radius of 1 km from Togenra cave. Formulation of strategies were done by using combined analyses of Strength, Weakness, Opportunity, Threats (SWOT) and Analysis of Hierarchy Process (AHP). Our analyses indicate a growth strategy trend (Quadrant I). Several strategies drawn emphasize on improving local's knowledge and perceptions, active involvement of locals, establishment of local management initiatives and regulations, capacity enhancement, and implementation of a stakeholders' forum. These findings can become a baseline in planning and developing both bat-cave tourism as well as conservation efforts in the area.

Keywords: Community perceptions, bat conservation, non-consumptive used, cave-bats ecotourism

FORMULASI STRATEGI PENGEMBANGAN EKOWISATA GUA DAN KELELAWAR BERBASIS PERSEPSI MASYARAKAT: STUDI KASUS GUA TOGENRA, BARRU SULAWESI SELATAN. Gua Togenra yang berada di Desa Madello, Kabupaten Barru (Sulawesi Selatan), terletak di Formasi Karst Tonasa yang merupakan salah satu formasi karst terbesar di Asia. Kawasan ini juga terkenal akan keunikan dan fungsinya tidak hanya bagi manusia tetapi juga bagi lingkungan. Saat ini Pemerintah setempat belum menerbitkan aturan terkait pengelolaan gua dan masyarakat local secara bebas dapat mengakses gua khususnya dalam pengambilan kapur dan guano sehingga dapat mengancam ekosistem Gua Togenra. Oleh karena itu diperlukan upaya untuk pengembangan penggunaan gua secara non-konsumtif melalui aktivitas ekowisata yang dapat memberikan memberikan keuntungan jangka Panjang bagi masyarakat Desa Madello. Studi ini bertujuan untuk 1) mengetahui persepsi masyarakat mengenai Gua Togenra, kelelawar, dan konservasi; 2) memformulasi strategi melalui penilaian potensi Gua Togenra dan jenis kelelawar yang hidup didalamnya sebagai spot ekowisata berbasis persepsi masyarakat; dan 3) memberikan rekomendasi bagi Pemerintah Lokal dalam mendukung ekowisata dan konservasi di kawasan tersebut. Studi ini dilakukan antara Agustus 2020 dan berakhir di Februari 2021. Kami menyebarkan satu set kuesioner kepada 31 responden yang tinggal dalam radius 1 km dari Gua Togenra. Perumusan strategi dilakukan dengan menggunakan analisis gabungan SWOT (Strengths, Weaknesses, Opportunities, Threats) dan AHP (Analysis

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of Hierarchy Process). Hasil analisis kami menunjukkan tren strategi pertumbuhan. Oleh karena itu, beberapa strategi yang diambil dari analisis direkomendasikan yang menekankan pada peningkatan pengetahuan dan persepsi lokal melalui proyek-proyek pendidikan, keterlibatan aktif masyarakat lokal, pembentukan inisiatif dan peraturan pengelolaan lokal, peningkatan kapasitas, dan pelaksanaan forum pemangku kepentingan. Hasil penelitian ini dapat dijadikan sebagai dasar dalam perencanaan dan pengembangan baik wisata gua-kelelawar dan juga upaya-upaya konservasi di Kawasan tersebut.

Kata kunci: persepsi masyarakat, konservasi kelelawar, pemanfaatan non-konsumtif, ekowisata kelelawar gua

I. INTRODUCTION

Karst and cave are known for their unique features upholding historical, cultural, and economic and ecological values (Sherwood & Simek 2001; Cigna & Forti 2013; Pipan & Culver 2013; Forti 2015; Lim et al. 2018). Many karst and cave areas in the world have been used as a shelter, protection from predators, concealed places from other human groups, sources of drinking water, warmth, and place for practising spiritual and mythical beliefs during the pre-historic era (Clottes 2005; Ullman et al. 2013; Uomini 2016). From the economic viewpoint, cave and karst areas have positively contributed to the economy especially for water availability and cement mining (Duli et al. 2019; Ramadhan et al. 2020).

The specific ecosystems of both karst and cave are highly vulnerable, especially to anthropogenic pressures (van Beynen & van Beynen 2011). Across the globe, the main causes of karst disturbance include quarrying, pollution, groundwater extraction, construction and agricultural activities (Baker & Genty 1998; Arfib et al. 2000; Calo & Parise 2006; Parise & Pascali 2013). In the Province of South Sulawesi, Indonesia, Tonasa Formation is the largest karst complex, covering five different regencies (Jeneponto, Maros, Pangkep, Bone, and Barru). The Tonasa Formation stretches 100 km in length (Amran & Hamzah 2016) and it has positively contributed to local economic and livelihood and to national income through water resource provision and cement mining (Duli et al. 2019). As for other karst areas, however, anthropogenic activities like cement mining, pollution and land conversion for agricultural or human settlement purposes have become the main triggers threatening the existence of the area (Lim et al. 2018).

Ecotourism may promote conservation and is often considered an important conservation tool (Admasu 2020; Noh et al. 2021). Ecotourism not only provides leisure activities but also educates tourists by requiring them to travel responsibly. It contributes to building community capacity and generating socio-economic benefits for local communities while pursuing conservation goals (Eshoo et al. 2018). Despite some concerns about the effectiveness of ecotourism for conservation (Gössling 1999; Das & Chatterjee 2005; Krüger 2005), ecotourism is still considered a valid option. For example, in recent years, cave and cave bat tourism have been developed in many countries (Pennisi et al. 2004; Kim et al. 2008; Bagstad and Wiederholt 2013; Okonkwo et al. 2017; Constantin et al. 2021; Tanalgo & Hughes 2021). This has opened new opportunities for the non-consumptive use of caves and bats, which have great potential to stimulate and improve the local economy, increase environmental awareness and education, and contribute to conservation (Rindam 2014; Okonkwo et al. 2017; Tanalgo & Hughes 2021).

Togenra cave is one of several important karst caves in the Barru Regency and is also a part of the Tonasa Karst Formation. The cave serves as an important habitat for several cave bat species and is known to host a high diversity of bats from the area (Suhardjono et al. 2012; Asrijaya 2021). One of the cave highlights is that there are many cave ornaments resembling animals (Asrijaya 2021). Togenra has some cultural-related bans known by the locals and spread from word-of-mouth prohibition of

some activities such as not speaking arrogantly and littering inside the cave (Ansharullah 2021). Violation have resulted in people getting lost in the cave. Thanks to these unique features, the cave as a tourism target by the Barru Regency (Government of Barru Regency 2012). Currently, however, there is no specific regulation by the local government of Barru related to cave access and use. This has opened opportunities for some locals to freely access the cave for calcium and guano mining, therefore threatening the ecosystem of the Togenra cave.

To provide economic alternatives to local communities and sustainably develop ecotourism in the area, we explored the community's knowledge, attitudes and behaviours towards the cave, its bats, and conservation. Indeed, a comprehensive understanding of human attitudes and behaviour may contribute to set up strategic approaches and actions required for successfully conserving animal species and their habitats (Pennisi et al. 2004; Clements et al. 2018; Maulany et al. 2021). In this study, therefore, samples of people from the local communities living within a radius of 1 km from Togenra cave were interviewed, to examine the community's perceptions toward the Togenra cave, bats and conservation which were used to formulate strategies by assessing the potency of Togenra cave and its bat species as an ecotourism spot based on the local's perceptions. Some recommendations would be generated for the local government of Barru Regency in supporting both ecotourism and conservation in the area.

II. MATERIAL AND METHODS

A. Study Site

The Togenra cave is the cave inhabited by bats belonging to the karst formation of Tonasa, in Maros-Pangkep Geopark, in South Sulawesi (Indonesia). The Togenra cave is situated in the Madello Village, Balusu District, Barru Regency, and it lies between 04°19'51.71941" S and 119°38'19.39078" E (Figure 1). Total population of the village is 4,637 where 4,339 people come from Bugis Tribe. The majority of the people work as farmers. From the capital of South Sulawesi Province, Makassar, the distance to the research location is 97.9 km or about 2 hours and 30 minutes. There were two entrances to the cave: the main entrance located 300 m from the main provincial road, and a secondary entrance on the other side, facing the hills and more difficult to access. The cave's shape is a combination of horizontal and vertical cave, with seasonal water flowing inside.

Figure 1. Map of study site in the Togenra cave, Barru Regency, Sulawesi

The length of the cave is 455 m, from the main entrance to the last point where the bats could be found (Asrijaya, 2021).

B. Data Collection and Analysis

To better understand local people's knowledge and attitude toward the cave and its cave-dwelling bats and assess their potential as an ecotourism spot, a set of mixed closed and open questions was designed to gain quantitative data. Later, for open questions, the answers will be grouped based on the similarity of answers given by the respondents, including for the ease of processing data. Questions were structured based on the topics: Characteristic of Respondents (Socio-cultural-economy, demography); Perceptions toward Togenra cave and activities inside the cave; Perceptions toward Cave Bats, Bat Interactions with Humans, and Bat Conservation including health risks; and Togenra cave as Ecotourism Spot. The written questionnaires were distributed to the targeted local communities. The purposive sampling method was applied to identify key actors based on a criterion. The criteria set for the locals were living within a radius of 1 km from Togenra cave and/or people conducting activities inside or near the cave (the residents of Madello Village). We also interviewed community leaders (2 persons). Within the radius of 1 km surrounding Togenra cave, 31 people were met during the survey and interviewed as targeted respondents (from 50 households). This particular group of people could play a vital key for the sustainability of the cave. Descriptive statistics were generated to summarize the findings.

Finally, to propose a recommendation to the local government of Barru regarding the potential management for Togenra cave, we identified potential strengths, weaknesses, threats and opportunities using SWOT analysis (Ommani 2011; Tambunan 2020). This would allow further analysis of internal and external factors involved and formulation of strategies for future ecotourism development of Togenra cave. Meanwhile, Analysis of Hierarchy Process (AHP) was employed to assist in the decision-making process and in setting important priorities as recommendations for the local government of Barru. The research was carried out from August 2020 until February 2021.

III. RESULT AND DISCUSSION

Demographic information was collected from 31 respondents of Madello Village living within 1 km of Togenra cave. Most respondents (38%) worked in the agricultural sector as farmers, animal breeders, gardeners or fishermen, whereas 28% were entrepreneurs and 19% worked in the private sector (Table 1). Only 9% of the respondents have a high school/college education. Eighty seven percent of the respondents were between 26 and 55 years old with 74% males and 26% females (Table 1).

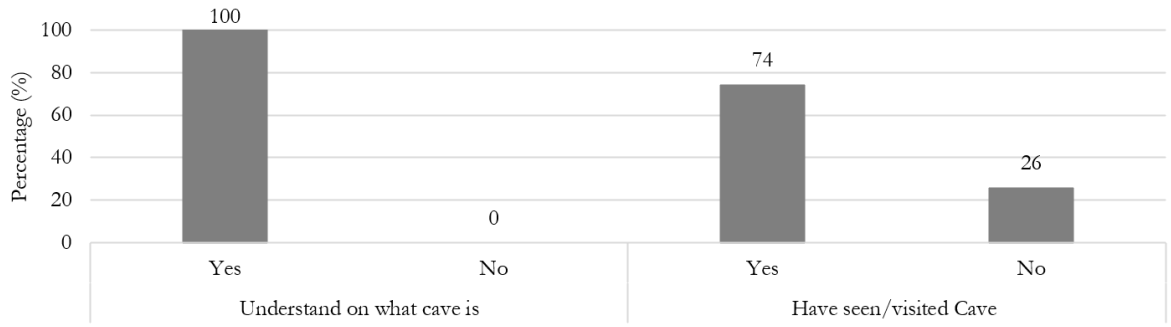
A. Respondents' Knowledge about the Togenra cave and Activities inside the Cave

As shown in Figure 2a, all the respondents already knew about cave in general, although only 74% had ever visited or seen it (Figure 2a). Some respondents reported negative

Table 1. Profile of the respondents living in the Togenra cave area, including their (a) occupation and (b) age

Characteristics		Number of individuals
Sex	• Male	23
	• Female	8
Main Occupation	• Government Officers	6
	• High School/College Students	9
	• Entrepreneurs	28
	• Agricultural Sector's Workers	38
	• Other private workers	19

	Characteristics	Number of individuals
Age (years)	• <25	8
	• 26-35	11
	• 36-45	8
	• 46-55	3
	• >55	1
Educational Background	• Elementary School	11
	• Junior High School	3
	• Senior High School	14
	• College/University Graduates	3
Monthly Income	• No Income/Unemployed	4
	• Uncertain	17
	• <1,000,000 rupiahs (<USD 70)	3
	• 1,000,001-2,000,000 rupiahs (USD 70-140)	2
	• 2,000,001-3,000,000 rupiahs (USD 140-210)	2
	• >3,000,000 rupiahs (>USD 210)	3



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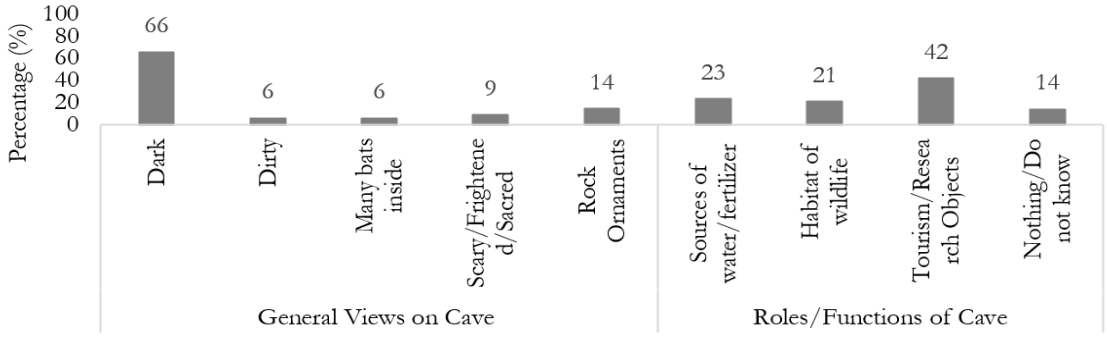

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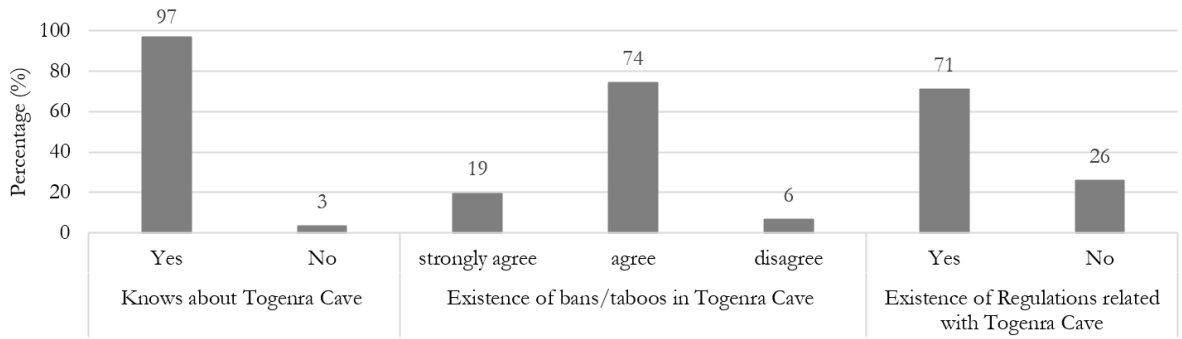

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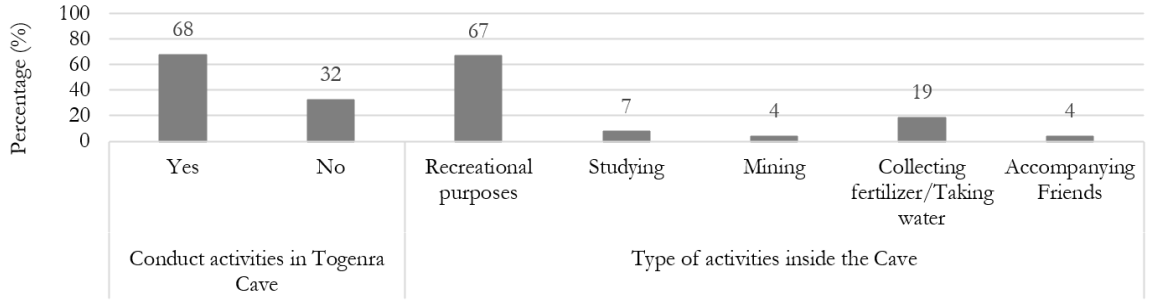

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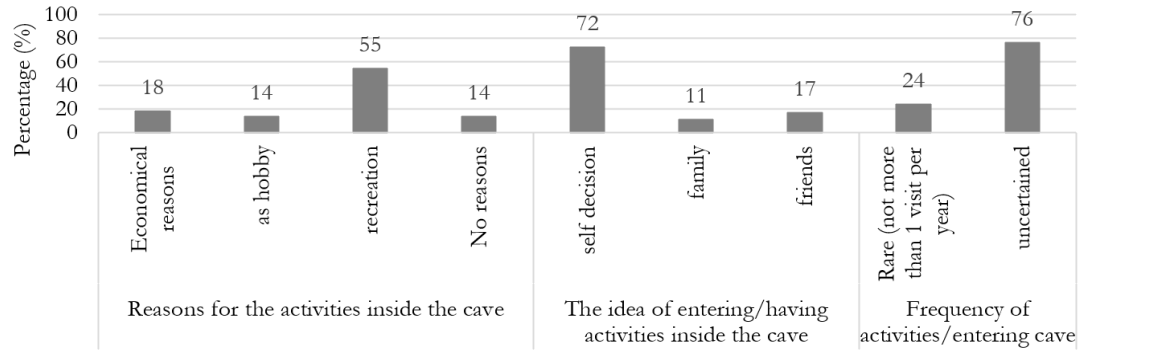

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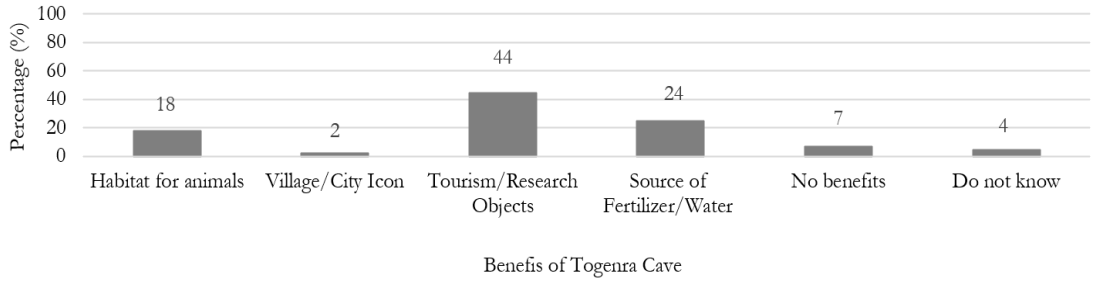

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Figure 2. Local respondents' knowledge about cave in general and Togenra cave: (a) general knowledge; (b) understanding of the functions of cave; (c) knowledge about Togenra cave; (d) type of activities conducted in Togenra; (e) frequency and reasons for the activities in Togenra; and (f) benefits of the Togenra cave for the locals

perceptions toward cave, claiming that the place was dark (66%), dirty (6%), or scary (9%) (Figure 2b). Regarding the function of the cave, many respondents answered two functions of cave as a tourist/research object (42%) altogether. Some mentioned that cave served as a source of fertilizers/water (23%) and as a habitat for wildlife (21%). However, 14% of the respondents gave no answer about cave's functions (Figure 2b).

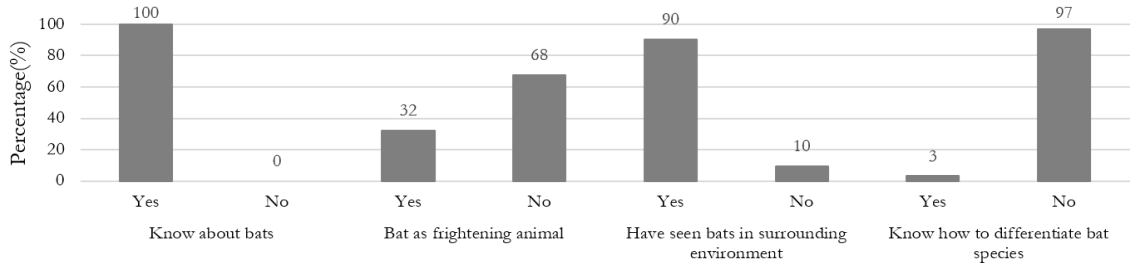
In the case of Togenra cave, most of the respondents were familiar with the cave (97%). Around 68% have claimed to conduct activities inside the cave. Most activities mentioned

were related to recreation (55%) and 44% of respondents acknowledged tourism and recreation as the main benefits offered by the cave. Only 18% of the respondents who entered the cave for economic reasons such as collecting guanos or fetching water although the frequency of entering the cave was uncertain (76%). Most respondents (74%) were also aware of the existence of taboos and/or bans in the Togenra cave (74%), and agreed on the need to establish regulations for the future management of the cave (71%).

B. Knowledge and Perceptions Toward Cave Bats and Conservation

Several questions aimed to assess respondents' knowledge and perception toward cave bats, their interactions with the animals and bat conservation (Figure 3). Thirty-eight % of respondents know "bats" as nocturnal animals. Although 68% of respondents claimed that bats are not frightening, many used negative descriptions for the bats in the Togenra cave (i.e. creepy eyes, bad odor, dog-shaped head), and have insufficient knowledge about these species. Eighty-seven % of respondents know the existence of bats in the Togenra cave but only few respondents knew about the number of bat species in the cave and/or noticed changes in the population size of bats.

Most respondents (64%) reported having visual contact with the bats in the Togenra cave, which is not surprising considering that most respondents entered the cave for recreational purposes (Figure 4a). No respondents reported having direct interactions with the bats (e.g.,



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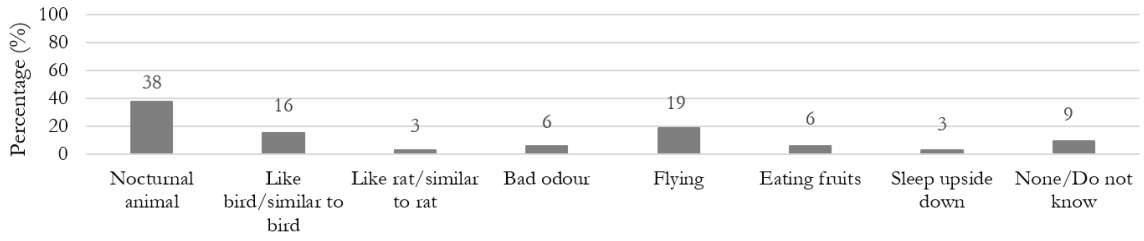

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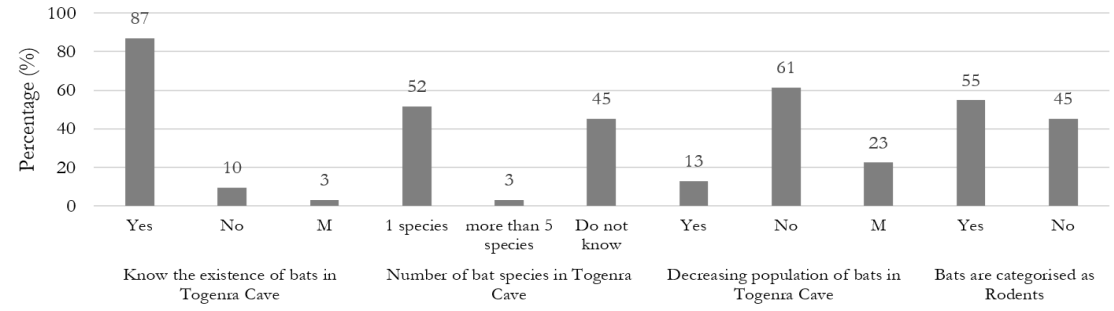

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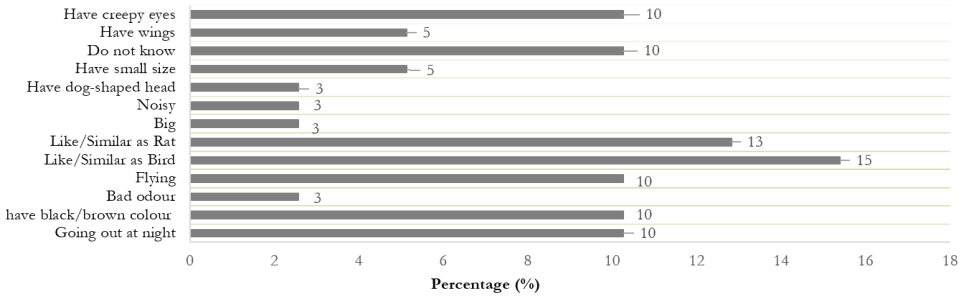

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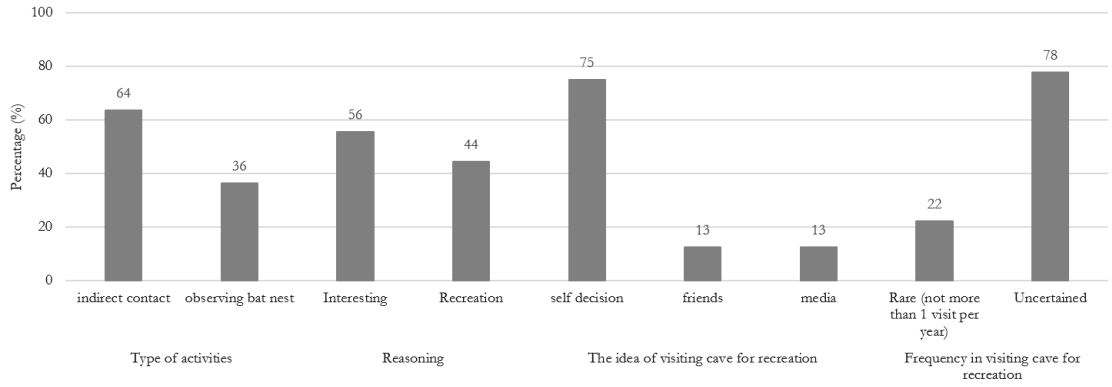
Figure 3. Responses by locals living close to Togenra cave in Barru to assess (a,b) their knowledge about bats and (c) about the presence of bats in the Togenra cave; and (d) their description of bats in Togenra



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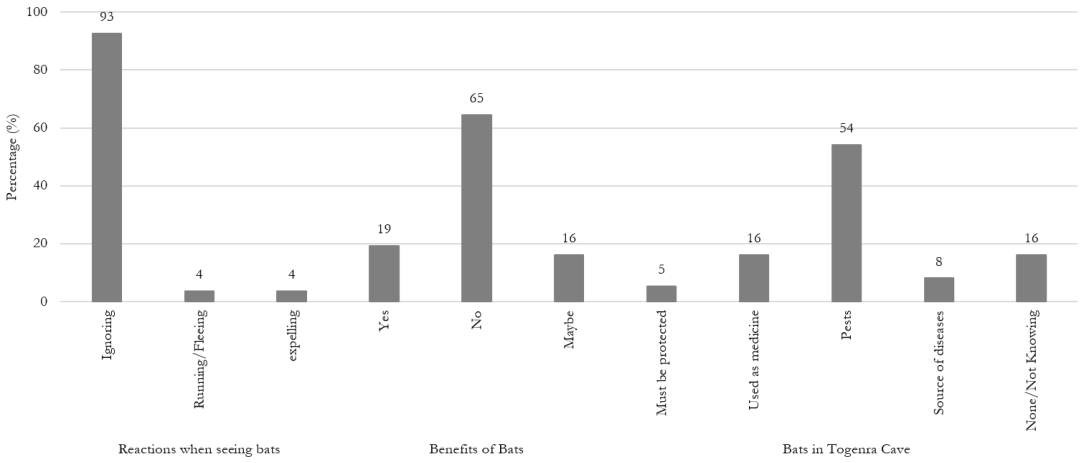

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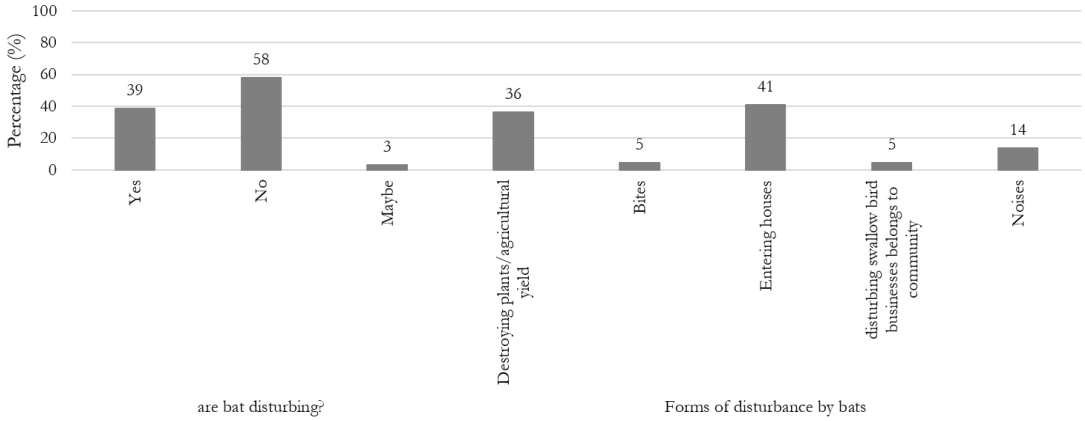

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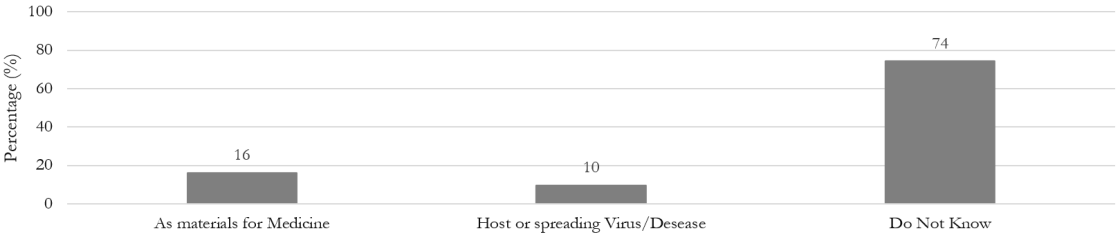

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Figure 4. Responses by locals living close to the Togenra cave, in Barru, assessing (a) their interactions with bats in the Togenra cave; (b) their behavior and attitudes towards bats; (c) kinds of disturbance by bats experienced by respondents; and (d) health-related issues

touching). Moreover, when locals saw the bats in the cave, most of them claimed to ignore the presence of the bats (Figure 4b). Not many respondents realized the benefits of bats for the environment (65%), and only 5% stated that the bats should be protected. Some respondents (42%) reported having experienced disturbance caused by bats, including bats entering their houses (41%), destroying plants or agricultural fields (36%), and making noise (14%). In relation to health issues arising from exposure to bats (including COVID-19), the majority of respondents (74%) did not know these issues.

C. Togenra Cave as an Ecotourism Object

Result of the study found that 58% of respondents agreed to appoint Togenra cave as an ecotourism spot, but only 48% considered bats a potential tourism object (Figure 5). Around 61% of the respondents considered that the local government (Barru Regency) should implement conservation efforts in the area, whereas 19% considered that other parties should take conservation measures. Regarding the assistance required to develop ecotourism in the Togenra cave, facilities and infrastructures were the highest answers (48%). There were 23 % of respondents mentioned the need for workers, 20% for advocacy support, 7% for experts, and 2% for government officials related with permit matters.

Respondents living close to the Togenra cave, Barru Regency are quite familiar with the Togenra cave, bats and its conservation, although they know less about its benefits or functions for humans and the environment.

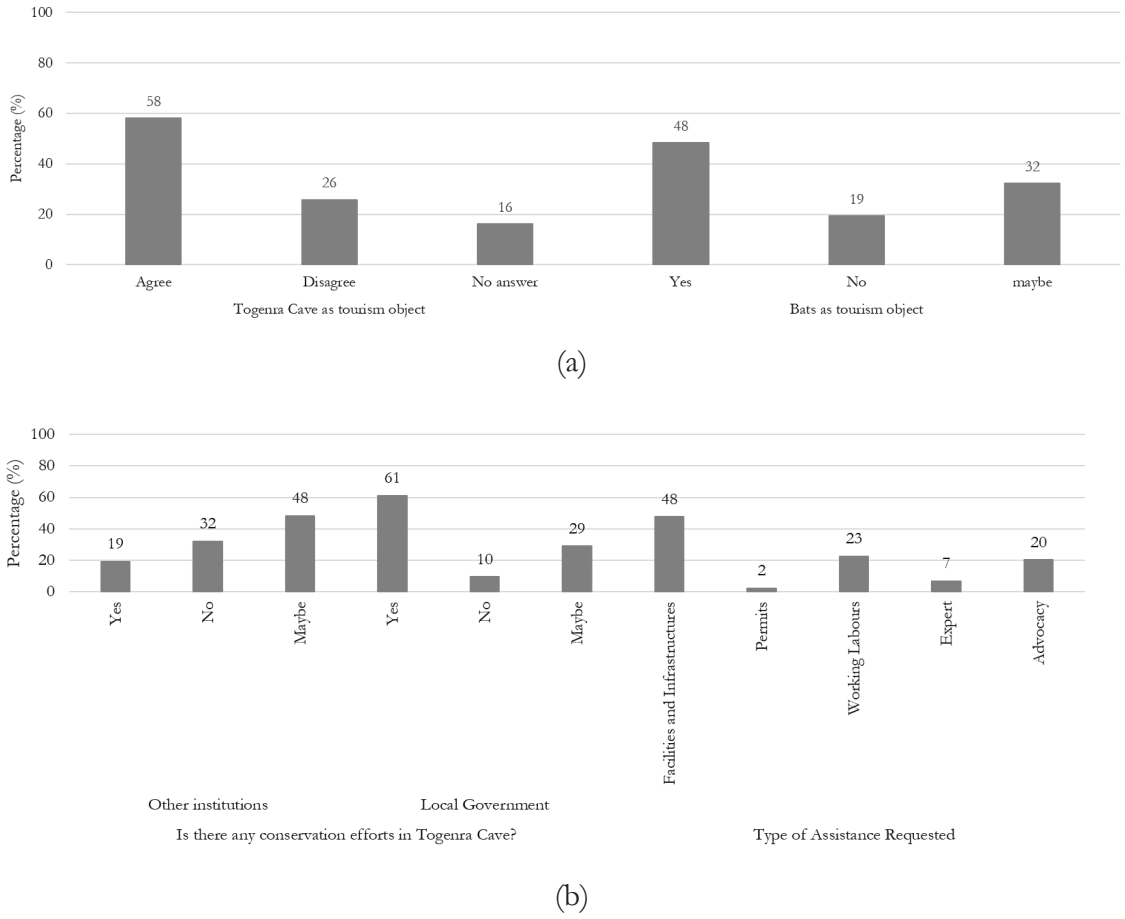

Figure 5. Local perspectives (a) on the use of the Togenra cave and bats as potential tourism objects; and (b) on the need for conservation efforts and the types of assistance required to develop ecotourism

Many respondents considered the cave as a dark, dirty, creepy and/or scary place. In addition, respondents often had negative perceptions about bats and were often considered as pests, and/or mistakenly identified as rodents/ similar to birds. Lack of detailed knowledge of caves and bats likely contributed to their negative perceptions towards caves and bats. These findings are in line with other studies in Philippines and Pakistan where people living in agricultural areas have little awareness about the importance of bats for the environment, with negative consequences for their perceptions towards bats (Mahmood-ul-Hassan et al. 2011; Scheffers et al. 2012; Tanalgo et al. 2016).

Although most respondents entered Togenra for tourism or recreational purposes, less intensive interactions occurred between the locals with the Togenra cave and the bats. Most respondents only had visual interactions with bats, although nearly a quarter of cave visitors aimed to collect guanos or fetch water inside the Togenra cave which may pose risks to the cave environment and the bats living inside (IUCN SSC 2014), especially if these activities remain unregulated. Respondents agreed on developing the Togenra cave and the cave bats into an ecotourism object that might open important opportunities for further steps in developing ecotourism in the area.

D. Analysis of the Potency of the Togenra Cave and its Bats as an Ecotourism Spot

To assess the potency of the Togenra cave and its bats as an ecotourism spot, SWOT

Table 2. Scoring internal and external factors for the development of ecotourism in the Togenra cave

	Internal Factors			
	Strengths	Value (V)	Rating (R)	Score (VxR)
S1	Knowledge about the cave	0.1	3	0.3
S2	Having ever visited a cave/caves	0.06	1	0.06
S3	Function of the cave as tourism object	0.1	4	0.4
S4	Knowledge about the existence of the Togenra cave	0.08	2	0.16
S5	Existence of bans/taboos/myths/regulations in the Togenra cave	0.07	2	0.14
S6	Need for regulations/bans on the activities inside the Togenra cave	0.08	3	0.21
S7	Having ever visited the Togenra cave	0.04	1	0.04
S8	Tourism as one activity in the Togenra cave	0.1	3	0.3
S9	Recreation as main reason for conducting activities in the Togenra cave	0.1	3	0.3
S10	Entering/conducting activities in the cave was mostly a self-decision	0.08	1	0.08
S11	No disturbances caused by the existence of bats	0.09	3	0.27
S12	Never heard about or never got involved in hunting or consuming bats	0.1	4	0.4
Total Strengths				2.69
	Weaknesses			
W1	Consider cave as a dark place	0.2	1	0.2
W2	Insufficient knowledge about the functions of caves	0.1	2	0.6
W3	Limited knowledge about benefits of Togenra cave	0.4	2	0.8
W4	The word 'bats' is associated with nocturnal which is considered negative by the locals	0.3	1	0.3
Total Weaknesses				1.3
	Total (S-W)			**1.39**
	External Factors			
	Opportunities			
O1	Cave and bats as tourism objects	0.14	4	0.56
O2	General interactions are mostly visual interactions.	0.12	3	0.36
O3	Interest as the main reason for interactions	0.12	4	0.48
O4	Recreational purposes as the main reason for interactions	0.12	3	0.36
O5	Willingness of the local community to develop the Togenra cave as an ecotourism destination	0.14	4	0.56
O6	Involvement of other institutions in conserving bats and developing ecotourism in the Togenra cave	0.12	3	0.36
O7	Involvement of the local government in conserving bats and developing ecotourism in the Togenra cave	0.12	3	0.36
O8	Facilities and infrastructures are required by the local community to develop ecotourism	0.12	4	0.48
Total Opportunities				3.52
	Threats			
T1	Negative description of the bats in the Togenra cave	0.16	2	0.32
T2	Ignoring the presence of bats when encountering them	0.16	1	0.16
T3	Assuming that bats have no benefits	0.32	2	0.64
T4	Assuming that bats can host viruses/diseases, including the Covid-19 virus	0.16	2	0.32
T5	Beliefs on bat meat as medicine	0.2	2	0.4
Total Threats				1.84
	Total (O-T)			**1.68**

analysis were done to identify some internal and external factors as strengths, weaknesses, opportunities, and threats by covering several aspects related to the Togenra cave, bats and conservation. There were 12 strengths and 4 weaknesses identified in the internal factors, and 8 opportunities and 5 threats found in the external factors. To determine priority strategies

for developing ecotourism in the Togenra cave, both internal and external factors were given values, rated and scored then analyzed further by using the Analysis Hierarchy Process (AHP). The total score gained for strengths and weaknesses (S-W) was 1.39, whereas for opportunities and threats (O-T) was 1.68 (Table 2). Then, to portray the position of total scores of all factors, the final score is laid in quadrant I (score: 1.68) between internal strengths and external opportunities (Figure 6). These results suggest a growth strategy through optimizing the existing opportunities and strengths to develop ecotourism in the Togenra cave.

Finally, six experts were involved to give ranking for the AHP process. The variables generated were ranked and were examined to be further translated into priority strategies in developing Togenra cave as an ecotourism spot. Based on the SWOT and AHP analyses, there were five strategies formulated to support the development of cave ecotourism in Togenra. The first priority strategy required is ***1) to improve the community's knowledge and attitudes and raise awareness of the values and benefits of the cave, bats, conservation and ecotourism***. Failure to understand the benefits of caves and cave bats for the environment, will likely contribute to the emergence of negative perceptions toward both the cave and the bats (Pennisi & Confer 2005; Trewhella et al. 2005; Mickleburgh et al. 2009; Kingston 2016; Garcia-Cegarra & Pacheco 2017). In the Philippines and Slovakia, for example, bats are mostly viewed as uncharismatic, frightening animals, and often considered pests (Prokop et al. 2009; Tanalgo et al. 2016). Only few people realize the valuable ecosystem services that bats can provide to human communities (Mildenstein et al. 2016). Therefore, there is a need to increase awareness of the people concerning the ecosystem services that might be provided by caves and cave bats (Madden 2004).

The local community close to Togenra knows about the cave's existence and the cave bats, but they have insufficient knowledge about it. Even though knowledge is not the only factor positively affecting community behavior in biodiversity conservation (Guagnano et al. 1995; Stern 2000), it often has a positive impact on conservation efforts (Keller et al. 1996; Hoffmaster et al. 2016). In some efforts, for instance, providing sufficient knowledge to schools and local communities has effectively increased people's concerns on bats and its conservation (Tanshi et al. 2013; Mildenstein

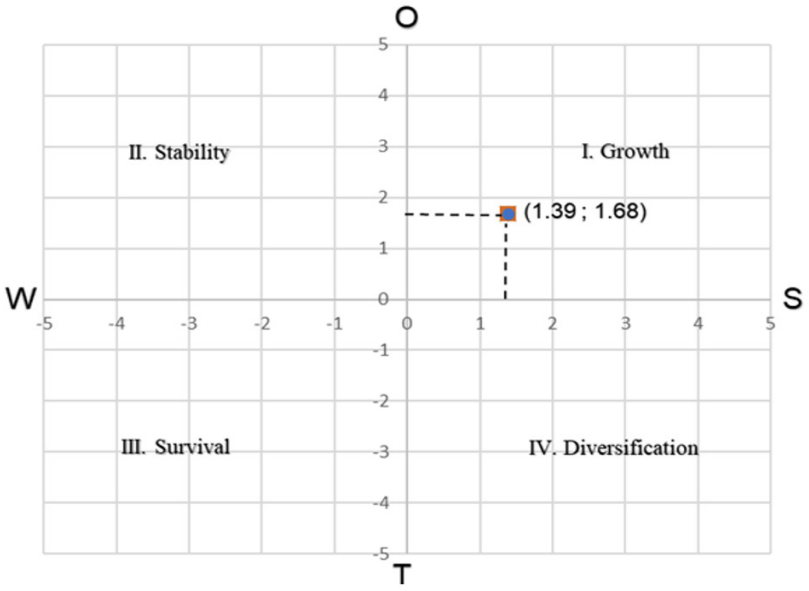

Figure 6. SWOT matrix of ecotourism development in the Togenra cave

et al. 2016). Therefore, educating the local community is an important step to improving people's understanding of the environmental importance of caves and bats, and thus their attitudes towards bats and their support for conservation efforts (Kingston 2016).

A second strategy to support the development of cave and bat ecotourism from the perspective of the local community is ***2) to encourage the active involvement of the local community and relevant stakeholders in the process of ecotourism development***. Experience is crucial to improve public attitudes, as it can influence people's attitudes and behaviors towards the object (Smith et al. 2011). The local people close to the Togenra cave mostly had indirect contact with the bats, even when they visit the cave. Past and current experiences with bats might interfere with the ability of locals to change their attitudes towards these animals. In his studies, Kellert described several factors that may shape human attitudes, including experience and knowledge (Kellert 1979, 1980; Kellert and Berry 1980; Kellert and Westervelt 1981, 1983). Therefore, direct involvement of the community in ecotourism development may provide new experiences related to cave protection and bat conservation. These experiences may increase local knowledge and improve people's attitudes. Relevant stakeholders also need to be actively involved in developing ecotourism to reduce the negative impacts generated through the initiation of collaborative management (Hikmah et al. 2020).

To implement cave protection and bat conservation through ecotourism, another important strategy based on the SWOT and AHP analyses is ***3) establishing local management bodies and formulate local rules/regulations to protect the cave and regulate its use, especially for ecotourism purposes***. Currently, the access and use of the Togenra cave are not regulated, and this has caused the cave became the target for activities like guano collection and water fetching. Therefore, establishing a local management body is crucial to implement ecotourism. In particular, the body could initiate the development of ecotourism, including planning, identification of potential tourism objects, mapping, the establishment of proper regulations, identification of local people's needs, required facilities and infrastructures, regular monitoring of the impacts generated by ecotourism activities, and establishment of integrated marketing and networks (Wood, 2002). Regarding cave utilization, protection and bat conservation, local regulations will need to be implemented by the management unit to guarantee the preservation of nature and avoid environmental problems (Bokov et al. 2019). This has been proven as one strategy to provide protection and increase a sense of value towards bats in Soppeng, in South Sulawesi, where regulation together with beliefs could together form the perception and behavior of the locals and positively contributed to bat's conservation (Maulany et al. 2021).

Together with providing education and increase awareness in the local community, another strategy that needs to be employed is ***4) to improve community capacity in conservation and ecotourism aspects***. Further support to the local community of Togenra is required to enhance people's capacities in the form of various relevant trainings. This will not only boost their knowledge, awareness and attitudes, but also provide the locals with hands-on experience. For example, in the Philippines, local protected area rangers are involved in the training of bat identification and monitoring techniques (Mildenstein 2011; Mildenstein and Mills 2013).

Lastly, another important strategy to develop ecotourism and the community's perspectives is 5) establishing ***a stakeholders' forum***. The success of ecotourism development and implementation is highly dependent on good coordination and communication among stakeholders (Wood 2002). This forum can be formed by relevant stakeholders that might jointly acquire funds to establish basic infrastructures required for developing

ecotourism in the area. This platform could also be used to exchange information and expand networks between stakeholders, to develop social capital, increase coordination and effectively contribute to conservation programs (Kingston et al. 2016). Apart from that, having a forum will provide channeling for the community to share their thoughts and ideas as well as difficulties and problems related to cave management. Eventually, this will indirectly encourage the local community to positively change their mindsets towards caves, bats, conservation and ecotourism.

It has been realized that this research has been drawn from a limited sample size and therefore, it is challenging to give a broad conclusion from this study. However, at the same time, this presents an opportunity for more comprehensive research not only to the wider community but also to different groups and context of community with different socio-cultural-economic backgrounds (Tanalgo and Hughes 2020). A larger window for research gaps in the future is still widely opened in particular in assessing the impact of cave-bat ecotourism on the conservation of both cave and bats. Future in-depth research on challenges and risks posed in developing this type of tourism in relation with zoonotic transmission of diseases including Covid-19 by bats (Nash 2022; Sánchez et al. 2022), were also required for further examination and will therefore generate strategies and mitigation for the tourism as well as to achieve conservation of bat species in the region.

IV. CONCLUSION

In conclusion, based on our preliminary study the local community close to the Togenra cave (Barru-South Sulawesi) has limited knowledge and negative perceptions toward caves, bats and conservation. However, the local community also considered the cave and the bats as potential objects for the development of non-consumptive use of resources namely ecotourism. Several strategies can be used to increase people's knowledge and improve their attitudes, highlighting all the strengths, weaknesses, threats and opportunities linked to these processes. These strategies include educational projects, the active involvement of local communities, the establishment of local management initiatives and regulations, capacity enhancement, and implementing a stakeholders' forum.

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REFERENCES

Admasu, S. (2020). Ecotourism as a Tool to Substantially Funding Conservation Endeavors in Ethiopia. *Journal of Tourims & Hospitality*, *9*(3):432, 1-5. doi: //10.35248/2167-0269.20.9.432.

Ansharullah, A.S. (2021). Populasi Kelelawar Genus Hipposideros dan Ancaman terhadap keberadaannya di Gua Togenra, Desa Madello, Kecamatan Balusu, Kabupaten Barru (Population of Bats Genus Hipposideros and Threats to Its Presence in Togenra Cave, Madello Village, Balusu District, Barru Regency). *Undergraduate Thesis*. Forestry Faculty, Hasanuddin University, Makassar.

Arfib, B., De Marsily, G. and Ganoulis, J. (2000). Pollution by seawater intrusion into a karst system: new research in the case of the Almyros source. *Acta Carsologica*, *29*, 15–31.

Asrijaya, A.A.A. (2021). Studi Karakteristik habitat dan keanekaragaman jenis kelelawar di

gua Togenra, Desa Madello, Kecamatan Balusu, Kabupaten Barru (Study on Habitat Characteristic and Diversity of Cave-dwelling Bats in Togenra Cave, Madello Village, Balusu District, Barru Regency). *Undergraduate Thesis*. Forestry Faculty, Hasanuddin University, Makassar.

Bagstad, K. J., and Wiederholt, R. (2013). Tourism Values for Mexican Free-Tailed Bat Viewing. *Human Dimensions of Wildlife*, *18*, 307–311. doi://10.1080/10871209.2013.789573.

Baker A., and Genty, D. (1998). Environmental pressures on conserving cave speleothems: effects of changing surface land use and increased cave tourism. *Journal of Environmental Management*, *58*, 165–176. doi://10.1006/jema.1998.0208.

Bokov, Y., Davydova, M., Zolotovskiy, V. and Abezin, D. (2019). Legal restrictions in Ecotourism. *Advances in Engineering Research*, *191*, 46-50. doi://10.2991/aer.k.200202.010.

Calò, F., and Parise, M. (2006). Evaluating The Human Disturbance to Karst Environments In Southern Italy. *Acta Carsologica*, *35*(2), 47–56. doi://10.3986/ac.v35i2-3.227.

Ceballos-Lascuráin, H. (1996). *Tourism, ecotourism and protected areas*. Gland, Switzerland: IUCN.

Cigna A.A., and Forti, P. (2013). Caves: The most important geotouristic feature in the World. Tour. *Karst Areas*, *6*(1), 9–26.

Clements, R., Aziz, S.A., Bulan, R., Giam, X., Bentrupperbaumer, J., Goosem, M., Laurance, S. and Laurance, W.F. (2018). Not everyone wants roads: assessing indigenous people's support for roads in a globally important tiger conservation landscape. human. *Ecology*, *46*, 909-915. doi://10.1007/s10745-018-0029-4.

Clottes, J. (2005): What did ice age people do in the deep caves?. *Expedition: Penn Museum Journal*, *47*, 20–24.

Constantin, S., Ionut, C.M., Petculescu, A., Arghir, R.A., Măntoiu, D. S., Kenesz, M., Robu, M. and Moldovan, O.T. (2021). Monitoring human impact in show caves. A study of four romanian caves. *Sustainability*, *13*, 1619. doi://10.3390/su13041619.

Das, M., and Chatterjee, B. 2015. Ecotourism: A panacea or a predicament? *Tourism Management Perspectives*, *14*, 3-16. doi://10.1016/j.tmp.2015.01.002.

Eshoo, P.F., Johnson, A., Duangdala, S. and Hansel, T. (2018). Design, monitoring and evaluation of a direct payments approach for an ecotourism strategy to reduce illegal hunting and trade of wildlife in Lao PDR. *PloS ONE*, *13*(2), p.e0186133.

García-Cegarra, A.M. and Pacheco, A.S. (2017). Whale-watching trips in Peru lead to increases in tourist knowledge, pro-conservation intentions and tourist concern for the impacts of whale-watching on humpback whales. *Aquatic Conservation: Marine and Freshwater Ecosystems*, *27*, 1011-1020. doi://10.1002/aqc.2754.

Gössling, S. (1999). Ecotourism: a means to safeguard biodiversity and ecosystem functions? *Ecological Economics*, *29*(2), 303-320. doi://10.1016/S0921-8009(99)00012-9.

Government of Barru Regency. (2021). Laporan akhir rencana program investasi infrastruktur jangka menengah Kabupaten Barru – RPI2JM (Final Report of Mid-term Infrastructure Investment Planning Program of Barru Regency). https://sippa.ciptakarya.pu.go.id/sippa_online/ws_file/dokumen/rpi2jm/DOCRPIJM_15012300573__BAB_III_RTRW_Sebagai_Arahan_Spasial_Bidang_Cipta_Karya.pdf. Cited 27 May 2021.

Hikmah, N., Larasati, E., Purnaweni, H. and Yuniningsih, T. (2020). Identification and Role of Stakeholders in Ecotourism Development in Indonesia. *Proceedings of the 6th International Conference on Social and Political Sciences (ICOSAPS) 2020*. doi://10.2991/assehr.k.201219.039.

John, F.A.V.S., Keane, A.M., and Milner-Gulland, E.J. (2013). Effective conservation depends upon understanding human behaviour. Key Topics in Conservation Biology 2, John Wiley & Sons, Ltd, 344-361.

Kellert, S.R, and Westervelt, M.O. (1981). Phase IV: Trends in animal use and perception in twentieth century America. United States Department of the Interior Fish and Wildlife Service.

Kellert, S.R. (1979). Phase I: Public attitudes toward critical wildlife and natural habitat issues. United States Department of the Interior Fish and Wildlife Service.

Kellert, S.R. (1980). Phase II: Activities of the American public relating to animals. United States Department of the Interior Fish and Wildlife Service.

Kellert, S.R., and Berry, J.K. (1980). Phase III: Knowledge, affection and basic attitudes

toward animals in American society. United States Department of the Interior Fish and Wildlife Service.

Kellert, S.R., and Westervelt, M.O. (1983). Phase V: Children's attitudes, knowledge and behaviors toward animals. United States Department of the Interior Fish and Wildlife Service.

Kellert, S.R., Black, M., Rush, C.R. and Bath, A.J. (1996). Human culture and large carnivore conservation in north America. *Conservation. Biology*, *10*, 977–990. doi://10.1046/j.1523-1739.1996.10040977.x.

Kim, S.S., Kim, M., Park, J. and Guo, Y. (2008). Cave tourism: Tourists' characteristics, motivations to visit, and the segmentation of their behaviour. *Asia Pacific Journal of Tourism Research*, *13* (3). doi://10.1080/10941660802280448.

Kingston, T. (2016). Cute, Creepy, or Crispy—How values, attitudes, and norms shape human behavior toward bats. in C.C. Voigt and T. Kingston (eds). 2016. Bats in the Anthropocene: Conservation of Bats in a Changing World.

Kingston, T., Aguirre, L., Armstrong, K., Mies, R., Racey, P.A., Rodríguez-Herrera, B. and Waldien, D. (2016). Networking Networks for Global Bat Conservation in C.C. Voigt and T. Kingston (eds.). 2016. Bats in the Anthropocene: Conservation of Bats in a Changing World.

Krüger, O. (2005). The role of ecotourism in conservation: panacea or Pandora's box? *Biodiversity & Conservation*, *14*, 579–600. doi://10.1007/s10531-004-3917-4.

Lim, T., Cappelle, J., Hoem, T. and Furey, N., (2018). Insectivorous bat reproduction and human cave visitation in Cambodia: A perfect conservation storm?. *PloS ONE*, *13*(4), p.e0196554. doi://10.1371/journal.pone.0196554.

Madden, F. M. (2004). Creating Coexistence between Humans and Wildlife: Global Perspectives on Local Efforts to Address Human–Wildlife Conflict. *Human Dimensions of Wildlife*, *9*(4), 247-257. doi://10.1080/10871200490505675.

Mahmood-ul-Hassan, M.M., Rehman, F., and Salim, M. (2011). Public perceptions about the fruit bats in two horticulturally important districts of Pakistan. *The Journal of Animal & Plant Sciences*, *21*, 1018-7081.

Maulany, R.I., Gautama, R.D., Dassir, M., and Nasri, N. (2021). Capturing community behavior towards fruit bats conservation in South Sulawesi. *IOP Conf. Series: Earth and Environmental Science*, *807* (022029). doi://10.1088/1755-1315/807/2/022029.

Mickleburgh, S.P., Waylen, K. and Racey, P.A. (2009). Bats as bushmeat: a global review. *Oryx*, *43*, 217-234. doi://10.1017/S0030605308000938.

Mildenstein, T., Tanshi, I., and Racey, P.A. (2016). Exploitation of bats for bushmeat and medicine in C.C. Voigt and T. Kingston (Eds). 2016. Bats in the Anthropocene: Conservation of bats in a changing world.

Mildenstein, T.L. (2011). Bat count Philippines, final report to the conservation leadership program.http://www.conservationleadershipprogramme.org/media/2014/11/00170F_Philippines_FinalReport_Bat-Count-Philippines_21stJune2011.pdf. Cited 27 May 2021

Mildenstein, T.L. and Mills, L.S. (2013). Mariana fruit bat conservation through research and local capacity building. Final Report for Cooperative Agreement Number: N40192-11-2-8005, prepared for NAVFAC Marianas.

Nash, C. (2022). Fear-Responses to bat-originating coronavirus pandemics with respect to quarantines gauged in relation to postmodern thought—implications and recommendations. COVID, 2, 1303-1328. https://doi.org/10.3390/covid2100096

Noh, A.N.M., Razzaq, A.R.A., Mustafa, M.Z., Nordin, M.N., and Ibrahim, B. (2021). Sustainable Community Based Ecotourism Development. PalArch's Journal of Archaeology of Egypt / Egyptology, 17(9), 5049-5061. Retrieved from https://archives.palarch.nl/index.php/jae/article/view/4740

Okonkwo, E. E., Afoma, E. and Martha, I. (2017). Cave Tourism and its Implications to Tourism Development in Nigeria: A Case Study of Agu-Owuru Cave in Ezeagu. *International Journal of Research in Tourism and Hospitality*, *3*(3): 16-24.doi://10.20431/2455-0043.0303003.

Ommani, A.R. (2011). Strengths, weaknesses, opportunities and threats (SWOT) analysis for farming system businesses management: Case of wheat farmers of Shadervan District, Shoushtar Township, Iran. *Africa Journal of Business and Management*, *5* (22). 9448-9454.

Parise, M., and Pascali, V. (2003). Surface and subsurface environmental degradation in the

karst of Apulia (southern Italy). *Environmental Geology*, *44*, 247-256. doi://10.1007/s00254-003-0773-6.

Pennisi, L. A., Holland, S. M., and Stein, T.V. (2004). Achieving bat conservation through tourism. *Journal of Ecotourism*, *3*(3), 195–207. doi://10.1080/14664200508668432.

Pennisi, L., and Confer, J.C. (2005). Attitudes of urban bat watchers. In Eleventh Canadian Congress on Leisure Research (eds T. Delamere, C. Randall & D. Robinson). Department of Recreation and Tourism Management, Malaspina University College, Nanaimo, Canada, 469-471.

Pipan, T., and Culver, D.C. (2013). Forty years of epikarst: what biology have we learned? International *Journal of Speleology*, *42*(3), 215–223. doi://10.5038/1827-806X.42.3.5.

Prokop, P., Fanˇcoviˇcová, J., and Kubiatko, M. (2009). Vampires are still alive: Slovakian students' attitudes toward bats. *Anthrozoös*, *22*, 19-30. doi://10.2752/175303708X390446.

Rindam, M. (2014). Cave Tourism: The Potentials of Ascar Cave as a Natural Tourism Asset at Lenggong Valley, Perak. SHS of Conferences Centre for Distance Education, University Sains Malaysia. Online: http://www.shs.conferences.org. Cited 12 June 2016.

Sánchez, C.A., Li, H., Phelps, K.L. et al. (2022). A strategy to assess spillover risk of bat SARS-related coronaviruses in Southeast Asia. *Nat Commun.*, *13*, 4380 doi://10.1038/s41467-022-31860-w.

Scheffers, B.R., Corlett, R.T., Diesmos, A., and Laurence, W.F. (2012). Local demand drives a bushmeat industry in a Philippine Forest Reserve. *Tropical Conservation Science*, *5*, 133-141. doi://10.1177/194008291200500203.

Sherwood, S., and Simek, J. (Eds.). (2001). Cave Archaeology in the Eastern woodlands. Midcontinental Journal of Archaeology, special issue.

Singh, T., Slitkin, M.H., and Vamosi, A.R. (2007). Attitude towards ecotourism and environmental advocacy: Profiling the dimensions of sustainability. *Journal of Vacation Marketing*, *13*(32). doi://10.1177/1356766707074736.

Smith, L.D.G., Ham, S.H. and Weiler, B.V. (2011). The impacts of profound wildlife experiences. Anthrozoös. 24 (1), 51-64. https://doi.org/10.2752/175303711X12923300467366

Suhardjono R.Y., Marwoto, R.M., Achmadi, A.S., Isnaningsih, N.R., Lupiyaningdyah, P., Suyanto, S., Rahmadi, C., Wiantoro, S., Nugroho, H., Wowor, D., and Kurnianingsih, K. (2012). Fauna karst dan Gua Maros. Sulawesi Selatan. LIPI Press, Jakarta.

Tambunan, T.S. 2020. (2020). SWOT Analysis for Tourism Development Strategy of Samosir Regency. TIJAB (The International Journal of Applied Business), Vol. 4 (2), 90-105.

Tanalgo, K.C, and Hughes, A. (2021). The potential of bat-watching tourism in raising public awareness towards bat conservation in the Philippines. Environmental Challenges, 4. doi://10.1016/j.envc.2021.100140.

Tanalgo, K.C., Teves, R.D., Salvaña, F.R.P., Baleva, R.E. and Tabora, J.A.G. (2016). Human-bat interactions in caves of South Central Mindanao, Philippines. *Wildlife Biology in Practice*, *12*(1), 1-14.

Tanshi, I., Labiran, A.J., Chukwuyem, S.F. et al. (2013). Bat conservation in Nigeria: volunteer contribution to bat population survey and public awareness. in S.E. Olajuyigbe, O.M. Coker, F. Olaleru (Eds) Proceedings of the 4th annual biodiversity conference. Lagos, Nigeria.

Trewhella, W.J., Rodriguez-Clark, K.M., Corp, N., Entwistle, A., Garrett, S.R.T. and Granek, E. (2005). Environmental education as a component of multidisciplinary conservation programs: lessons from the conservation initiatives for Critically Endangered fruit bats in the Western Indian *Ocean. Conservation Biology*, *19*, 75-85. http://www.jstor.org/stable/3591011.

Ullman, M., Hovers, E., Goren-Inbar, N. & Frumkin, A. (2013): Levantine cave dwellers: Geographic and environmental aspects of early humans use of caves, case study from Wadi Amud, northern Israel. *Proceedings of the 2013 ICS, International Congress of Speleology*, 169–174.

Uomini, N.T. (2016). Archaelogy in karst areas. Zeitschrift für *Geomorphologie Supplementary*, *60*(2),129-138. doi://10.1127/zfg_suppl/2016/00318.

Van Beynen P.E. and Van Beynen, K.M. (2011). Human disturbance of karst environments. *In: van Beynen P. (eds) Karst Management*. Springer, Dordrecht. doi://10.1007/978-94-007-1207-2_17.

Wood, M.E. (2002). *Ecotourism: Principles, Practices, & policies for sustainability*. United Nations Environment Programme (UNEP) Division of Technology, Industry and Economics, Paris, France.