Journal of Indonesian Tourism and Development Studies

doi: 10.21776/ub.jitode.2018.006.01.01
E-ISSN : 2338-1647
http://jitode.ub.ac.id

Exploration of Herpetofauna Habitat as Tourism Attraction: Ecology, Preferences, and Potentials

Nia Kurniawan[1]*, Alif Aulia Ananda[2], Fatiha Kamilah[1], Ari Ardiantoro[1], Satria Wira Bagaskara[1], Agung Sih Kurnianto[3]

[1]Department of Biology, Faculty of Mathematics and Natural Sciences, University of Brawijaya, Malang, Indonesia
[2]Meru Betiri National Park, East Java, Indonesia
[3]Graduate School, University of Brawijaya, Malang, Indonesia

Abstract

Herpetofauna (Class: Reptilia, Amphibia) has potential value as tourist attraction and its sustainability could be preserved by ecotourism program. We propose a new fauna-based tourism attraction by conducting herpetofauna survey in a few locations inside Sukamade, Meru Betiri National Park (MBNP), and using their habitat as spots for ecotourism potential sites. Visual Encounter Survey method was conducted in 6 locations (200 m transect pathway). We found 166 individuals, belonging to 32 species in 15 families. *Leptobrachium hasselti* has the biggest Important Value Index (16.55%), making this species potentially become one of the potential herpetofauna as a tourist attraction. *Chelonia mydas,* an endangered species, is one of the interesting species to be observed in Sukamade.This species is full migrant and does long migration in its feeding ground in Borneo, Australia, and Pacific, then back to Sukamade to lay eggs. Sumbersari and Glintungan forest became a habitat for amphibians that need clean water, such as *L. Hasselti* and *Leptophryne borbonica,* and potentially become the location of herpetofauna observation. *Occidozyga lima, Fejervarya limnocharis*, and *Limnonectes microdiscus* were found in four survey sites (Sumber Langsep, Glintungan, Estuary, and Jungle Track).

Keywords: Herpetofauna, Sukamade, Tourism.

INTRODUCTION

Herpetofauna (Class: Reptilia, Amphibia) is one of the animal group which able to illustrate the quality of local habitat [1]. This role is associated with its limitation on mobility and its dependency toward certain vegetation, also toward water body [2]. Herpetofauna has been developed for a choice of tourist attraction in Cambodia [3], and South Africa [4]. The endangered frogs also attracted ecotourism business, and this activity has been shown to help preserve its sustainability [5]. Ecotourism is the most relevant and progressive options with huge revenue potential [6].

Meru Betiri National Park (MBNP) is the largest lowland forest protection area in Java. Geographically, this area located at 80 20' 48''-80 33' 48'' S and 1130 38' 48''-1130 58' 30'' E. The presence of society in surrounding and inside the national park, as seen in Sukamade, MBNP, became one of the potential causes of conservation conflict, which related to economic needs [7]. This also threatens herpetofauna and other fauna's diversity which became more isolated inside the Sukamade. On the other hand, Sukamade has a very high international tourist visit. In 2015, there are 2671 foreign tourists and 60,672 domestic tourists visit Meru Betiri National Park. This figure increased 90% from 2014 (MBNP unpublished data). This is a great tourism potential that should be developed. As far, turtle landing and nesting site on Sukamade beach became the only main object for Sukamade. It is important that other forms of exploration of the object as an alternative and diversification of products from the tour.

We propose a new fauna-based tourism object by conducting herpetofauna survey in a few locations inside Sukamade, MBNP, and using their habitat as spots for tourism potential [8]. Through a few analysis of biodiversity, we propose the areas which has potential and should became a priority in terms of tourism.

MATERIALS AND METHOD

Study sites

Survey was done for 6 days (December 14-19th 2016) and was focused on 6 main locations: Sumber Langsep, Glintungan,Sumber Sari, Coastal, Jungle Track, and Estuary (Fig. 1). All of these locations were located within Sukamade Resort, Meru Betiri National Park, Banyuwangi,

*Correspondence address:
Nia Kurnaiawan
Email : wawan@ub.ac.id
Address : Dept. Biology, Faculty of Mathematics and Natural Sciences, University of Brawijaya, Veteran Malang, Malang 65145.

East Java, Indonesia. These locations were chosen because it was able to illustrate different habitat for herpetofauna.

Sumber Langsep and Glintungan

These two blocks were located on the Eastern part of Sukamade Resort. Glintugan is the highest (202 m asl), and is a Dipterocarp forest with two rapid flowing river in it. Sumber Langsep (189 m asl) is a mix of Dipterocarp forest and *Lansium domesticum* plants. There was a river (2-4 m width) and cliffs with 2-3 m height around.

Sumbersari

This location is an open vegetation area, and utilized for agriculture, plantation, and settlement. There was a river, called Sukamade River (6-8 m wide) which quietly flows towards the estuary and the southern sea. These locations become the crossing access for grazing animals and transportation.

Beach, Estuary, and Jungle Track

These three locations were located on one block, i.e. the beach, but it shows different habitat for fauna. Beach consist of vegetation, such as bushes, shrubs, and sea sands. Estuary is the latest region of Sukamade River which flooded in dry season, but it flows to the sea in rainy season. Dominant vegetation in this area are Nipah (*Nypa fruticans*), and Mangrove (*Rhizopora sp.*). Jungle track is an open part of lowland primary forest which consist of typical rainforest plants: Dipterocarp and *Ficus*, as well as more open area near the coast, such as Ketapang (*Terminalia catappa*) and Sage Plant (*Lantana camara*).

Survey

Visual Encounter Survey method was conducted in each location (200 m transect pathway) to assess the diversity of herpetofauna. This method was started from 7 pm untill 11 pm. Time Consctrained Studies (TCS) were not used in this study, while survey was used time variation, and depends on species discovery. Periodically, sample observed between the rocks, litter, foliage, shrubs, and fallen branches, without any disturbed microhabitat [9]. Herpetofauna were counted and collected with barehands, hook, or grabstick, then documented with Canon DSLR 1100D camera. All specimensthen released on the same microhabitat. Then, the images were compared with the reference [10,11,12].

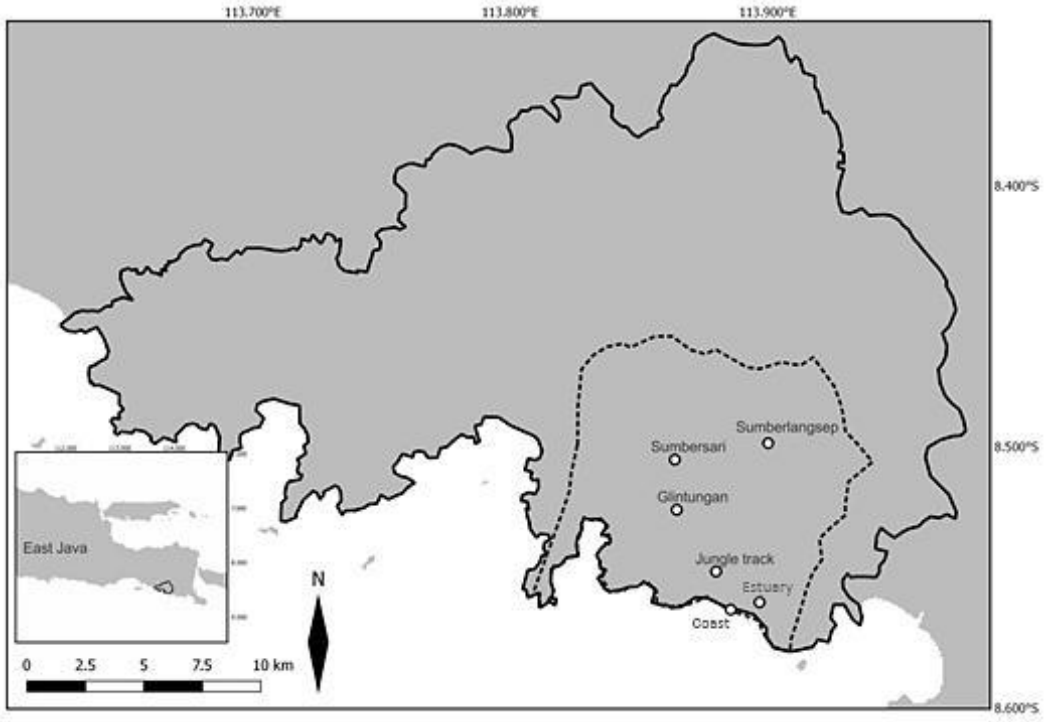

Figure 1. Research map
Description: black line = Meru Betiri National Park Area, dot line = Sukamade Area, survey point: study sites

Data Analysis

Important Value Index (IVI) and Shannon Index (H) were used to estimate herpetofauna diversity in MBNP. Ratio between species and agroforestry habitat were estimated using principal components based on Bi plot analysis. Past software version 3.0.0 was used for data analysis. We used Principal Component Analysis (PCA) to determine the preference of herpetofauna habitat among the studied locality. Status of threatened species was known from IUCN Red List (http://iucnredlist.org).

RESULT AND DISCUSSION

We found 166 individuals, belonging to 32 species in 15 family (Table 1). The most common species found are *Leptobrachium hasselti* (Anura: Megophryidae, n:21), *Cyrtodactylus marmoratus* (Squamata: Gekkonidae, n:15), *Hylarana chalconata* (Anura: Ranidae, n:14), *Occidozyga lyma* (Anura: Dicroglossidae, n:13), *Leptophryne* sp. (Anura: Bufonidae, n:13), *Microhyla* sp. (Anura: Microhylidae, n:12), *Polypedates leucomystax* (Anura: Rhacophoridae, n:11), *Takydromus sexlineatus* (Squamata: Lacertidae, n:8) and *Phrynoidis asper* (Anura: Bufonidae, n:8). Two species are categorized into IUCN Red List, those are *Chelonia mydas* (Endangered) and *Leptophryne cruentata* (Critically Endangered). Species which categorized into Appendix II CITES: *Varanus salvator* and *Chelonia mydas*. Shannon-Wiener index value shows a medium diversity (0.394).

Leptobrachium hasselti

Leptobrachium hasselti has the biggest IVI value (16.55%). *Leptobrachium* habitats was in the forest floor and its tadpole commonly found in river stream or creek around the forest. This species will come to the river when they are about to lay their eggs. It tadpoles has ability to maintain water quality by eating algae, prevent it from Algae blooming [13]. That was much portrayed with it's existence at lush forests, such as Glintungan. This frog was found among the rapids covered by tight canopy.

Leptobrachium hasselti has distinct body character: large head that is wider than its body, and; eyes tend to be large and glared. Tips of digits round, webbed at the base. Smooth skin, supratimpanic folds up to the base of the hindlimbs. Male are smaller (60 mm) than females (70 mm). It has scarlet coloured iris, dorsal with black plattern circles (darker circles), white ventral surfaces with black blotches. Juveniles is bluish in color [14]. Skin patterns variation in *Leptobrachium haseltii* provides remarkable camouflage in tropical rain forest. Open lowland forest were not provide any habitat which fraught of leaf litter, as seen that this frog were not found in other habitat.

Table 1. Complete Checklist of Herpetofauna in Sukamade

Species	IVI	Location					
		SL	G	SS	M	P	JT
Hylarana chalconota	16.13		√	√	√		√
Cyrtodactylus marmoratus	14.81		√	√	√		
Polypedates leucomystax	12.40	√	√				
Microhyla sp.	11.08		√				√
Takydromus sexlineatus	10.59	√		√			√
Phrynoidis asper	10.59		√		√		√
Occidozyga lima	9.75		√				
Hemidactylus sp.	7.58		√		√		√
Fejervarya limnocharis	7.46	√			√		
Kaloula baleata	5.65				√		√
Gekko gecko	5.05	√			√		
Eutropis multifasciata	5.05		√				√
Microhyla achatina	4.94				√		
Limnonectes microdiscus	4.94						√
*Cheloniamydas** **En**	3.73					√	
Odorrana hosii	3,73						√
Ramphotyphlops braminus	3,73						√
Leptobrachium hasseltii	17.93		√	√			
Boiga cynodon	3.13				√		
Leptophryne borbonica	3.13		√	√			√
Dandrelaphis pictus	2.53				√		
*Varanus salvator**	2.53				√		
Xenochrophis piscator	2.53						√
Xenochropis trianguligerus	2.53						√
Bungarus fasciatus	2.53						√
Ahaetulla prasina	2.53						√
Dasia olivacea	2.53						√
Eutropis rudis	2.53						√
Lygosoma bowringii	2.53						√
Draco volans	2.53						√

Notes: SL=Sumber Langsep, G=Glintungan, SS=Sumber Sari, M=Muara, P=Pantai, JT=Jungle Track.
En=Endangered, *=Appendix II CITES

Limnonectes microdiscus* and *Microhyla

Microhabitat conditions in Sumber Langsep and Glintungan also provide environmental composition which is appropiate with the needs of other species, such as *Limnonectes microdiscus* and *Microhyla.* Both live on the forest floor. Furthermore, *Odorrana hosii* was one species that commonly found on the rapids at Glintungan. We've also found this frog above the rocks or behind the rapid flows of Sumber Langsep Waterfall.

Hylarana chalconota

Hylarana chalconota commonly found at puddles, pool, or along small lowland forests stream [15]. Striking color of this species (green, yellow or cream colored) shows that this species is not camouflaged well on its surrounding vegetation. *Hylarana chalconota* are common

species that commonly found at secondary forest or highly disturbed area. Artificial pond, bushes, and paddy fields becomes the habitat of this species, especially at settlements or residential area [16].

Cyrtodactylus marmoratus

The presence of *C. marmoratus* also used as an indicator of conserved tropical rain forest [17]. This species are commonly found at the high or big tree in the forest, but sometimes it climbs down to the ground and rocks, so it is better known as forest geckos or stone geckos. An attractive and varietifely patterns make this species as cryptic species and continously studied in genetic relationship, ecology, distribution, and its behaviour. *Cyrtodactylus marmoratus,* as one of member of the most widespread genus, commonly found at tropical rain forestand open land areawhich contiguous with tropical rain forest [17]. In Indonesia, *C. marmoratus* can be found on the Island of Nias, Sumatra, Lombok, Borneo, Sulawesi, and Aru Archipelago. Its stable population may soon be threatened by the transition of land functions [8].

Chelonia mydas

Chelonia mydas (Green turtle) is one of the interesting species to be found in Sukamade. This species is full migrant and does long migration in its feeding ground in Borneo, Australia and Pacific, then back to Sukamade to lay eggs [18]. Green turtles became very common to find in Sukamade, and its management included in MBNP conservation program [19]. Local officers also revealed that this species becomes the most famous tourist attraction in Sukamade beach. However, its populatian will be threatened by eggs and adult overexploitation in the nesting sites all over the world [20]. Decreased population of this species also derived from climate change that affect hatchery temperature naturally [21].

Ecology, Preferences, and Potentials

Sukamade herpetofaunas consisting of many types of amphibians that depend on lowland rainforest. Rapids, waterfall, and closed rivers located far beneath the Sumbersari and Glintungan forest became a habitat for amphibians that needs clean water, such as *Leptobrachium* and *Leptophryne.* Herpetofauna becomes a potential in the development of economy, such as ecotourism [22]. Ecotourism is the only meeting point of conservation and economic needs, where the people of Sukamade are no longer perceived as a threat but as potential conservationist, having seen the benefits of such biodiversity [23].

The herpetofauna observation results show that the spatial distribution of all species found in the six locations is illustrated by a dot (Fig.2). These results illustrate a particular habitat selection trend. The Dicroglossidae family is one of 14 other families that prefer habitat all across the survey sites. Three members of this family: *Occidozyga lima, Fejervarya limnocharis*, and *Limnonectes microdiscus* were found in four survey sites (Sumber Langsep, Glintungan, Estuary, and Jungle Track) with varying amounts. Glintungan is an ideal habitat for *Occidozyga lima*, since it has the highest elevation among other sites (202 m asl), as well as the existence of puddles and rapids that make it possible for this species to breed. The species is able to survive at a maximum elevation of 750 m above sea level, and has the capability to adapt to different habitats (grasses, dry forests, and lowlands that have aquatic vegetation)[15].

The species also habits open forest areas, as well as forest edges with temporary water accumulation (puddles and moats)[24]. Unlike the *Occidozyga lima*, almost all individuals of *Fejervarya limnocharis* are found in the estuaries. Estuaries in Meru Betiri National Park area is full of Mangrove plants (*Rhizopora* sp.), where this plant lives well in the brackish waters. This is consistent with Iskandars statement [14], in which *Fejervarya limnocharis* is a species that tends to choose habitats in areas with low elevation, and has a high tolerance to salinity (up to 2.8%). The abundance of *F. limnocharis* in the estuaries is also influenced by the availability of its food in large quantities, such as crabs or other small invertebrates [25]. Another member of the Dicroglossidae family, *Limnonectes microdiscus*, is a species that tends to choose habitat in undisturbed forest. Tadpoles of this species can be found in the region of the river with a clear flow of water [26]. The abundance of *L. microdiscus* found indicates that this species has a wide range of home range, in which adult species can be found in leaf litter and forest floor of enclosed primary forest, but not found in more open coastal forests. Meanwhile, tadpole or juvenile from *L. microdiscus* is distributed along the rim of the jungle track area.

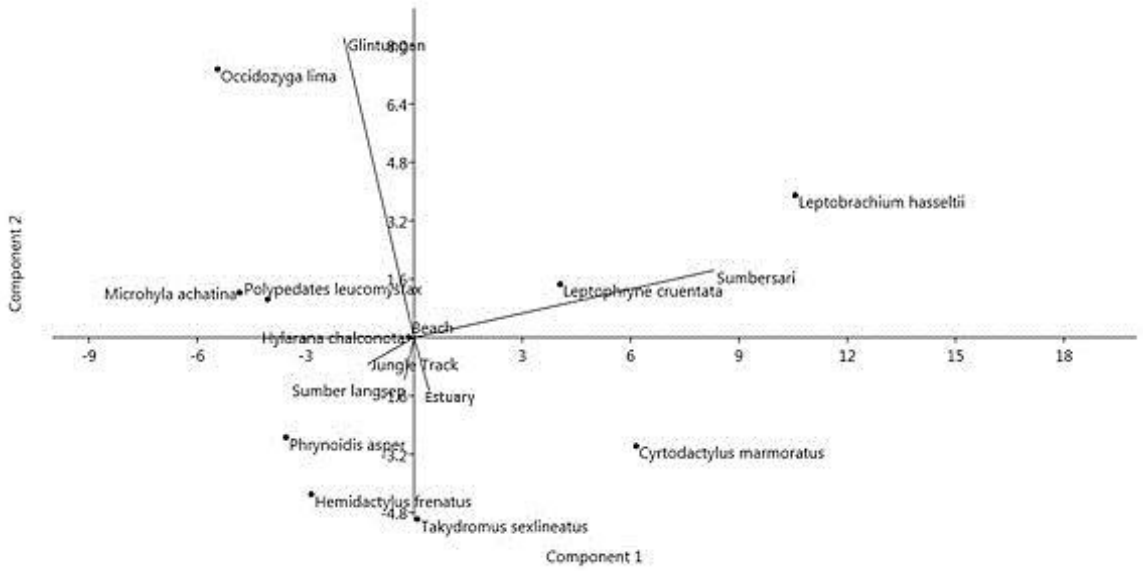

Figure 2. The Distribution of the Ten-Highest IVI of Herpetofauna in Sukamade

Different habitat preferences are also shared by species from the Microhylidae family, where all species found from this family tend to select habitat with a balanced terrestrial and aquatic composition. Sopyan [27] said that frogs of the genus *Microhyla* have ecological spreads vertically or horizontally. Glintungan and jungle tracks are two sites where two species of *Microhyla* genus (*Microhyla achatina* and *Microhyla* sp.) was found, both of which have small pools along the edge of the rapids (vertical pattern), and litter composition in the terrestrial area (horizontal pattern).

The pools around the rapid stream is an ideal place for *Microhyla* to breed, due to the presence of organisms or organic matter above the surface of the pond water, which is the main food source for the juvenile *Microhyla* [26]. Adult species prefer terrestrial habitat that tend to be moist, between litter and shrub bushes, where the whole component is present on Glintungan and jungle track. Other genera with two different habitat preferences is *Leptobrachium* sp. (Glintungan dan Sumbersari). Both of these locations are closed primary forest areas.

However, some areas in Sumbersari have been relocated to human activities (settlements, agriculture, and plantations). Both Glintungan and Sumbersari both have rapids with pool ponds along with a quiet stream of water. The condition is very potential to the growth of *Leptobrachium* tadpole in large quantities to grow and develop. The flow of rafting water and calm ponds facilitates the movement of juvenile frog to other habitat. As adult, *Leptobrachium* tends to choose the habitat on both forest and lowland rainforest and bushland forests [28]. In addition, primary forest areas that have never experienced logging (Glintungan and Sumbersari), both have abundant *Leptobrachium* (threats to this species are agricultural land and large exploited populations).

In other side, economic value of amphibians and reptiles induce over-exploitation of its population (poaching), which can lead to extinction. More detail, Whitten explains that the preservation of species richness in Indonesia is threatened by commercial exploitation and habitat loss [29]. This condition is gradually worsen by the effect of climate change.Beyond these findings, Green Turtle (*C. mydas*) is a uniqueness of Sukamade. Nesting site beach on Meru Betiri National Park belongs to the government under the auspices of the Ministry of Environment and Forestry and is appointed as one of the specific Green Turtle conservation sites. This is because of the turtle lands every day. Sukamade beach is the largest nesting site for Green Turtle in Indonesia. There are four species of Sea Turtles which uses this nesting site, Green Turtle (*Chelonia mydas*), Hawksbill Turtle (*Eretmochelys imbricata*), Olive Ridley (*Lepidochelys olivacea*), and Leatherback Sea Turtle (*Dermochelys coriaceae*) [30].

The beginning of conservation management of sea turtles in Banyuwangi dates back to 1983, which back then consist Marengan Beach, Pancur, ParangIreng, Bantenan, and Pondok Waru. Meanwhile back then the other nesting site have not yet managed [31].

Figure 3. Some of herpetofauna of Sukamade. a. *Cyrtodactylus marmoratus,* b. *Leptobrachium hasseltii,* c. *Polypedates leucomsytax,* d. *Chelonia mydas*

Management in the area of Bantenan and Pondok waru in the form of semi-natural hatching only runs for one year of budget (1983/1984). Management in Bantenan and Pondok Waru areas is not long lasting due to: remote location, difficulty of transportation (land vehicle cannot be used), lack of adequate facilities, difficulty in finding fresh water source, lack of fund, and the nesting season often arrives at the same time as wet season, giving rise to malaria [32]. The capacity of these captive breeding site is limited and its facilities isn't adequate or has been damaged, which gave rise to predator entering the site.

The management carried out at Ngagelan post at this time in the form of transporting eggs from natural nest to semi-natural hatcheries, enlarging hatchlings hatching in tubs, releasing hatchlings, and safeguarding habitat of turtle nesting along the coast. Semi-natural hatching sites were made with 3x4 m size and 2x3.5 meters, bordered by 60 cm bamboo fence. Meanwhile the development tub (porcelain tub) was made with 6x3 meters in size and was separated into 5 small tubes, each containing up to 300 hatchlings [33]. Sukamade visitor is showing an increasing trends in the past 5 years (2012-2016) (Table 2). Sea turtle and its hatching process observation became the main attraction. The observation of the turtle and its hatchling process is of particular interest to the tourism activities. The high interest from the visitor becomes an excellent base for tourism development.

Table 2. Annual Visits in Sukamade, MBNP

Year	International	Domestic
2012	584	2,758
2013	1,118	7,937
2014	2,152	57,940
2015	2,410	86,661
2016	2,671	60,672

Source: MBNP Unpublished Data

Sukamade tourist preferences for turtle observation tours are very high, compared to other tourist objects, such as bird watching, mammals, or nature explorations (MBNP unpublished data). This adversely affects the sustainability of the tourism business, where the product diversification becomes one of its supporters [34]. This study shows that Sukamade has potential locations in the development of nature exploration. MBNP as tourism stakeholders can make a selection of interest, preferences, and build a tourist location to continue to develop this tour and at the same time maintain its sustainability [5,35,36].

Herpetofauna habitat locations became an important spot for the basis of alternative tourism development. However, the access toward these locations is important for observation and research. Subsequent research is expected to make approaches on classifying the access and tourist preferences toward herpetofauna and its habitat observation-based tourism.

CONCLUSION

Sumbersari and Glintungan provide a suitable habitat for some interest herpetofauna: *Leptrobrachium hasselti, Leptophryne borbonica,* and *Cyrtodactylus marmoratus.* Beach and Jungle track provide suitable habitat for almost all herpetofauna, and an endangered species: *Chelonia mydas.*

ACKNOWLEDGEMENTS

Authors acknowledges the support of PEER-USAID for herpetofauna studies in Java and Sumatra (2016). Authors acknowledge the work of NK research team: A.M. Kadafi, M. Alif Fauzi, A.S. Firdaus, and B. Priambodo. We thank also to Mr.Rohman and Mr Reindra for their assitance in field, and for valuable information. We thank to A.E. Wardana and Junaidi for their assistance on field planning. We also thank to senior officers in Sukamade : Mr. Puji Firmansyah, Mr Hasyim Fikri, Mr. Bc. Hartono and Mr.Pratono Puroso for providing valuable permission, photos, and feedback on our questions about herpetofauna.

REFERENCES

[1] Stebbins, R. C. and N. W. Cohen. 1997. A natural history of amphibians. Princeton University Press. New Jersey.

[2] Iskandar, D.T. and W.R. Erdelen. 2006. Conservation of amphibians and reptiles in Indonesia: issues and problems. Amphibian and Reptile Conservation 4(1), 60-87.

[3] Neth, B. 2008. Ecotourism as a tool for sustainable rural community development and natural resources management in the Tonle Sap Biosphere Reserve. Uniderckei, University of Kassel. Germany.

[4] Moor, R. 2012. Volunteers and ecotourism find their way to South Africa. Tourism review online magazine 3/2012. Available at: http://www.tourism-review.com/travel-tourism-magazine-ecotourism-in-south-africa-volunteer-projects-and-frog-safari-article1777.

[5] Morrison, C., C. Simpkins, J. G. Castley and R. C. Buckley. 2012. Tourism and the conservation of critically endangered frogs. PLoS ONE 7(9), e43757.

[6] Isaacs, J. C. 2000. The limited potential of ecotourism to contribute to wildlife conservation. Wildlife Society Bulletin 28(1), 61-69.

[7] Irandu, E.M. 2003. Wildlife tourism and local communities in Kenya. ATLAS-Africa Conference. Arusha, Tanzania.

[8] Subarudi. 2001. Upaya penyelamatan Taman Nasional Kutai. Info Sosial Ekonomi 2(1), 29-35.

[9] Pradhan, S., D. Mishra, and K. R. Sahu. 2014. An inventory and assessment of snake diversity of Gandhamardan hills range of Western Oriissa, India. International Journal of Pure and Applied Zoology 2(3), 241-245.

[10] Whitaker, R. and A. Captain. 2008. Snakes of India: the field guide, 1st Ed. Draco Books. Chengalpet.

[11] Dutta, S.K., M. V. Nair, P.P. Mohaptra and A. K. Mohaptra. 2009. Amphibians and Reptiles of Similipal Biosphere Reserve. Regional Plant Resource Center. Bhubaneswar.

[12] Das, I. 2015. A field guide to the reptiles of South-East Asia. Bloomsbury Publishing Plc. London.

[13] Ranvestel, A. W., K. R. Lips, C. M. Pringle, M. R. Whiles and R. J. Bixby. 2004. Neotropical tadpoles influence stream benthos: evidence for the ecological consequences of decline in amphibian populations. Freshwater Biology 49, 274-285.

[14] Iskandar, D. T. 1998. Amfibi Jawa dan Bali – seri panduan lapangan. Research and Development Center, Indonesian Institute of Sciences. Bogor.

[15] Van Dijk, P., D.T. Iskandar, M. W. N. Lau, Z. Ermi, G. Baorong, S. Haitao, S. Dutta, S. Sengupta and S. U. Sarker. 2004. *Occidozyga lima*. The IUCN Red List of Threatened Species. e.T58411A86626569.

[16] Inger, R. F., B. L. Stuart, and D. T. Iskandar.2009. Systematics of a widespread Southeast Asian frog, *Rana chalconota* (Amphibia: Anura: Ranidae). Zoological Journal of the Linnean Society 155, 123-147.

[17] Kurniati, H. 2003. Amphibians and reptiles of Gunung Halimun National Park West Java Indonesia. Research Center for Biology, Indonesian Institute of Sciences. Bogor.

[18] Moritz, C., D. Broderick, K.E.M. Dethmers, N. N. FitzSion, and C.J. Limpus. 2002. Population genetics of Southeast Asian and Western Pasific green turtles, *Chelonia mydas*. Australian Government, Department of the Environment and Water Resources. 1-42.

[19] Godfrey, M. H., and N. Mrosovsky. 2006. Pivotal temperature for green sea turtle, *Chelonia mydas*, nesting in Suriname. Herpetological Journal 16(1), 55-61.

[20] Seminoff, J., A. Resendiz and W. Nichols. 2002. Home range of green turtles *Chelonia mydas* at a coastal for aging area in the Gulf of California, Mexico. Marine Ecology Progress Series 242, 253-265.

[21] Klom-In, W. 2002. Nesting location of the green sea turtle (*Chelonia mydas*) at the Huyong Island: Biology and Conservation. Naval War College, Institute of Advanced Naval Studies. Nakhon Pathom.

[22] Darusman, D. and Widada. 2004. Konservasi dalam perspektif ekonomi pembangunan. Directorate General of Forest Protection and Nature Conservation Collaborate with Japan International Cooperation Agency (JICA) and Laboratory of Politic, Social and Economy of Forestry, Bogor Agricultural University. Bogor.

[23] Basuni, S. and N. Kosmaryandi. 2008. Pengembangan ekowisata pada kawasan hutan konservasi. CV Tamita Perdana Nias. Nias.

[24] Khan, M. A. R. 2001. A report on the puddle (bleating) frog *Occidozyga lima* (gravenhorst) from the Teknaf Peninsula, Bangladesh, with notes on the presence of other vertebrates. Journal of Zoology 16(9), 583-587.

[25] Kurniati, H. 1998. Kebiasaan makan empat jenis katak *Rana* asal Kelila, Kabupaten Jayawijaya, Irian Jaya. Biota 3(2), 58-62.

[26] Iskandar, D.T. and Mumpuni. 2004. *Microhyla achatina*. The IUCN Red List of Threatened Species: e.T57873A11696337.

[27] Sopyan, M. H., Moerfiah and I. D. Rouland. 2006. Karakteristik dan kepadatan populasi genus *Microhyla* di wilayah Cagar Alam dan Taman Wisata Alam (CA-TWA) Telaga Warna. Jurnal Zoologi, 1-8.

[28] Diesmos, A., A. Alcala, R. Brown, L. Afuang, G. Gee, J. Sukumaran, N. Yaakob, L.T. Ming, Y. Chuaynkern, K. Thirakhupt, I. Das, D. Iskandar, Mumpuni, R. Inger, R. Stuebing, P. Yambun, M. Lakim and M. Kusrini. 2009. *Leptobrachium hasseltii*. The IUCN Red List of Threatened Species. e.T57554A11657884

[29] Whitten, A. J., M. Mustafa and G. S. Henderson. 1987. Ekologi Sulawesi. Gadjah Mada University Press. Yogyakarta.

[30] Putera, A. A. R., L. Sulmartiwi, and W. Tjahjaningsih. 2015. Effect of nesting site depth of green turtle (*Chelonia mydas*) on the incubation period and hatching success percentage in Sukamade beach, Meru Betiri Nasional Park, Banyuwangi in East Java. Jurnal Ilmiah Perikanan dan Kelautan 7(2), 195-198.

[31] Limpus, C. J. 1995. Marine turtle biology. Briefing Book CAMP and PHVA Workshop for Marine turtle in Indonesia. Bogor.

[32] Priyono, A. 1985. Studi reproduksi penyu daging, *Chelonia mydas* L., di Pantai Sukamade, Kabupaten Banyuwangi. Paper. Faculty of Fisheries, Bogor Agricultural University. Bogor.

[33] Nuitja, I. N. S. 1992 Biologi dan pelestarian penyu laut. Bogor Agricultural University Press. Bogor.

[34] Putri, S. D., Soemarno and L. Hakim. 2015. Strategic management of nature-based tourism in Ijen Crater in the context of sustainable tourism development. Journal of Indonesian Tourism and Development Studies 3(3), 123-129.

[35] Krűger, O. 2005. The role of ecotourism in conservation: panacea or Pandora's Box? Biodiversity and Conservation 14, 579-600.

[36] Haryati, J. R., J. F. Putri, N. Chairiyah, A. Harris, H. A. Putri and R. N. Pamungkas. 2016. Action plan in developing sea turtle conservation as ecotourism attraction in Sukamade, Meru Betiri National Park. Journal of Indonesian Tourism and Development Studies 4(2), 67-74.