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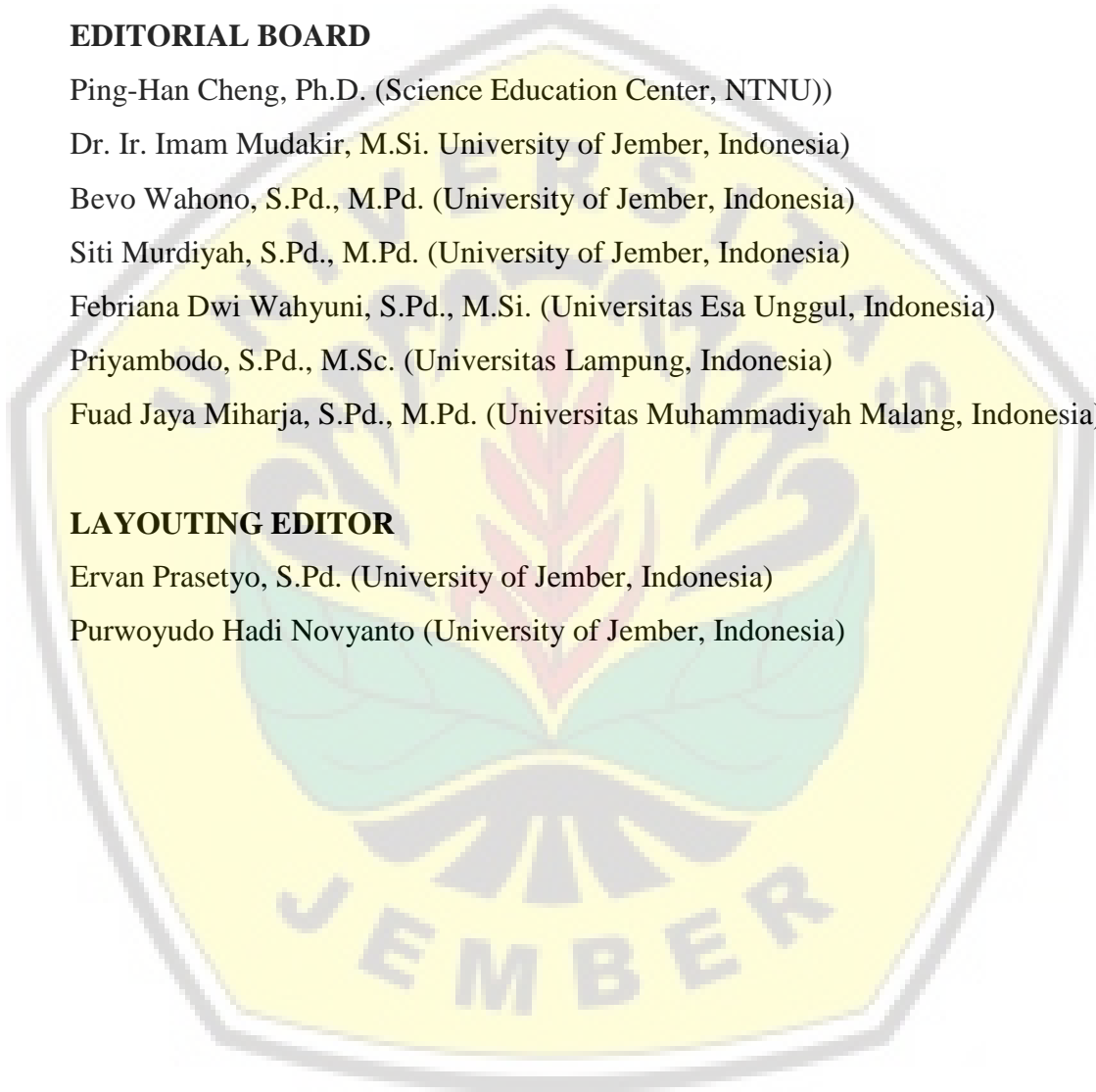
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Abstract

Some types of Anura have a narrow range of environmental parameters. They can't survive in environments where natural conditions change dramatically. Therefore, Anura has the potential to be a good environmental bioindicator. The purpose of this research was to identify the types of Anura found at Jember University. This research is included in the survey research using direct observation method VES (Visual Encounter Survey). Observations were made of adult members of the Anura Order. Data taken includes species characteristics, abiotic factors such as temperature and humidity, and activity when found. The results showed at Jember University there were four species from 3 family members of the Anura order, namely *Duttaphrynus melanostictus* Schneider, 1799 (Bufonidae), *Polypedates leucomystax* Gravenhorst, 1829 (Rhacophoridae), *Fejervarya limnocharis* Gravenhorst, 1829 (Dicroglossidae), and *Occidozyga sumatrana* Peters, 1877 (Dicroglossidae). The species most commonly found was *Duttaphrynus melanostictus* in almost every observed location. Environmental factors that support the existence of Anura members are temperature and humidity.

Keywords: Identification, Anura, University of Jember

1. INTRODUCTION

The Anura order is an amphibian that is most known to the broader community and found in almost all parts of the world. Most amphibians in Indonesia commonly belong to this group. Members of this order are referred to as frogs and toads (Kusrini, 2013). There are around 4,100 types of frogs and toads. As much as 450 species are found throughout Indonesia from Sumatra, Kalimantan, Java to Papua (Iskandar, 1998). It favors humid places, although some are adapted to live in dry habitats (Menzies, 2006).

Anura depends on his environment for the sake of its body temperature. Due to this limitation, Anura generally found in specific habitats and must remain in the environment with the appropriate temperature limit (Adiaramanti, 2016). Therefore, Anura is vulnerable to changes in environmental conditions, even though some species of Anura can adapt well to disturbed environmental conditions. The sensitivity to environmental changes makes Anura potents to be a bioindicator (Zug, 1993). Not only interacts with other living organisms, but Anura also interacts with its abiotic environment. Ashley and Robinson (1996), found that highways built near Anura's habitat significantly affected Anura's mortality.

The existing road is a factor that causes the isolation of Anura habitat and population

(Mader, 1984; Fahrig *et al.*, 1995). Roads also change soil density, temperature, groundwater content, light intensity, surface water, salt content, and organic molecules (Trombulak and Frissel, 2000). Habitat characteristics such as the hydrological cycle also affect Anura, because the spawning season depends on the presence or absence of water (Rowe and Dunson, 1995; Calhoun *et al.*, 2003; Egan and Paton, 2004; Burne and Griffin, 2005).

Temperature and humidity are factors that influence the environment. Appropriate temperature and humidity are essential for Anura's life. Some species of cold climates Anura bask to raise body temperature (Cogger, 1999). Most Anuras are nocturnal and are only active when the environmental conditions are damp enough to reduce dehydration in the body (Cogger and Zweifel, 2003). Moisture is needed to make Anura's skin dry because the skin functions as a respiratory tool (Cogger, 1999). Anura mostly lives close to water except for several species, such as tree frogs (Iskandar, 1998). Anura's habitat varies from rice fields, swamps, ponds, and around rivers in the lowlands to high (Fitri, 2002 & Iskandar, 1998).

Campus provides a unique environment for Anura because its location and spatial layout include several artificial habitats such as ditches or gutters, ponds, and experimental gardens. One campus that provides a complete

habitat is Jember University (UNEJ). This Green Campus provides various large and shady trees that cover most of the area, ensuring a moist environment suitable for Anura.

Limited information or database on herpetofauna, especially the order of Anura at the University of Jember, requires special attention. It encourages the researcher to find out Anura on the campus. The data on Anura biodiversity can be used as a conservation on its natural habitat.

2. MATERIALS AND METHODS

Types of Research

This study is a survey conducted at the University of Jember using the VES (Visual Encounter Survey) method. The VES method collects animal species based on direct encounters on the track both in terrestrial, arboreal, and aquatic areas.

Place and Time of Research

The research was conducted at the University of Jember from April to July 2019. Sampling was carried out at 18.30 - 22.00.

Tools and Materials

The tools used are stationery, latex gloves, jars, DSLR cameras, Thermo

hygrometers, GPS, hand net, and identification books. The ingredients used are chloroform and 70% alcohol.

Sampling Method

The sampling method used is the VES (Visual Encounter Survey) method by determining 18 points of the study area bounded by asphalt roads. Searches are carried out at locations close to water sources or locations with lush vegetation. Sampling using a hand-net, then the samples obtained are stored in a jar.

Anura Identification

Specimen samples were observed morphology with the aid from identification keys in the book Amfibi Jawa dan Bali (Iskandar, 1998), and Panduan Bergambar Identifikasi Amfibi Jawa Barat (Kusrini, 2013).

3. RESULTS AND DISCUSSION

There are four species of 3 families found (Table 1). The existence of species found scattered in almost all locations of observation.

Table 1. Results of identification of the order Anura at the University of Jember

Family	Genus	Species
Bufonidae	<i>Duttaphrynus</i>	<i>Duttaphrynus melanostictus</i> Schneider, 1799
Rhacophoridae	<i>Polypedates</i>	<i>Polypedates leucomystax</i> Gravenhorst, 1829
Dicroglossidae	<i>Fejervarya</i>	<i>Fejervarya limnocharis</i> Gravenhorst, 1829
Dicroglossidae	<i>Occidozyga</i>	<i>Occidozyga sumatrana</i> Peters, 1877

Descriptions of each species found are as follows :

***Duttaphrynus melanostictus* (Schneider, 1799)**

Duttaphrynus melanostictus was found in almost all observations, except at the Faculty of Agriculture, Faculty of Humanities, dan Faculty of Computer Science. *Duttaphrynus melanostictus* has a size of SVL 60-80 mm with a black-nipple skin surface on the body surface. There is a supraorbital groove that integrates with the parietal groove above the muzzle. There are also oval-shaped parotoid

glands. *D. melanostictus* has blunt toes with black tips.

Determination key :

- (1b-2a-1a-2b-3b)
- 1b The body has four legs, the head is clear .
- 2
- 2a Rough skin, covered by large warts".....
- **Bufonidae**
- 1a Relatively large body, reaching 120 mm, very wrinkled/wrinkled skin, generally has a pair of "parotoid glands".....**Bufo** (2)
- 2b Grayish or reddish-brown color 3

3b Head without a pair of parietal embankments, reddish, brownish, and gray with black "warts", Body around 50-80 mm .
..... **Bufo melanostictus**



Fig 1. *Duttaphrynus melanostictus*

***Polypedates leucomystax* (Gravenhorst, 1829)**

Polypedates leucomystax was found at Faculty of Pharmacy, Faculty of Mathematics and Sciences, Faculty of Teacher Training and Education building 1, Rector's building, Faculty of Teacher Training and Education building 3, LP2M, Faculty of Social and Political Science, Faculty of Law, dan Faculty of Economics and Business. *Polypedates leucomystax* has a size of SVL 70-85mm. Smooth skin texture without nodules. Brownish skin color, lines are extending or with dark spots from the head to the end of the body. The toes are almost entirely webbed with the tips wide and flat.

Determination key :

- (1b-2b-3b-5a-6b-9a-1b-4a)
- 1b The body has four legs, the head is clear ..
.....2
- 2b The skin is mostly wrinkled, generally slippery.....3
- 3b Relatively long limbs.....5
- 5a Slim body, the fingertips are generally broad and flat with a thin circular curve separating the top from the bottom of the disc
.....6
- 6b Slim body, relatively large eyes, short snout, front and back limbs with flat and wide fingertips, without "dorsolateral" folds, and "arboreal"9
- 9a Pectoral girdle firmisternal
..... **Rachoporidae**
- 1b Size more than 50mm.....4
- 4a The colors are generally dull, up to 85mm in size, dorsum yellowish-brown with small

bits or four to six black lines.....
..... ***Polypedates leucomystax***

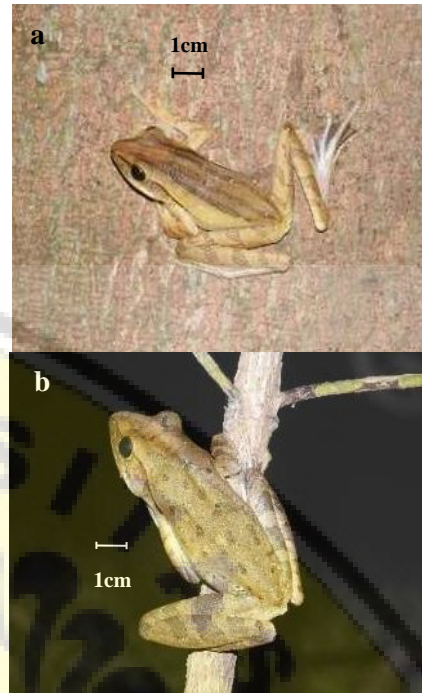


Fig 2. *Polypedates leucomystax* stiped (a)
Polypedates leucomystax spotted (b)

***Fejervarya limnocharis* (Gravenhorst, 1829)**

Fejervarya limnocharis was found at two locations, namely at Nursing Faculty, dan Faculty of Mathematics and Sciences. *Fejervarya limnocharis* has a size of SVL 50 mm with a wrinkled skin covered with elongated nodules, parallel to the axis of the body. Brownish skin with dark patches. Front toes are blunt and do not widen, while the back toes are pointed and do not widen with an incomplete membrane.

Determination key :

- (1b-2b-3b-5b-7a-1b-7b-10b-12b-13a)
- 1b The body has four legs, the head is apparent 2
- 2b The skin is mostly wrinkled, generally slippery 3
- 3b Relatively long limbs..... 5
- 5b Fat body, the tips of the fingers do not expand or if they are spread out unevenly and without thin, curved curves..... 7
- 7a The head is generally uneven, the tips of the toes end without claws, but may extend but not flat **Ranidae (Dicroglossinae)**
- 1b Fingers with or without extended fingertips, but without thin circular curves
..... **Dicroglossidae** (7)

- 7b The body exceeds 70 mm, with or without "fangs" in the lower jaw 10
- 10b The skin is covered with elongated warts, the skin is relatively slippery, the fingers are endless, the pair of folds in the neck of the male, without "fangs" in the lower jaw *Fejervarya* (12)
- 12b The body is generally no more than 70 mm, the membrane is generally not full in the last segment of the fourth finger, the metatarsal with one wart, the head is shorter 13
- 13a Body in medium size, male around 50 mm, female reaching 60 mm, greenish with dark spots *Fejervarya limnocharis*



Fig 3. *Fejervarya limnocharis*

***Occidozyga sumatrana* (Peters, 1877)**

Occidozyga sumatrana only found at the Faculty of Teacher Training and Education building 3 with the position in the gutter.

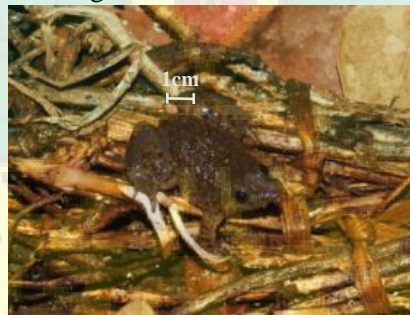


Fig 4. *Occidozyga sumatrana*

Occidozyga sumatrana has a size of SVL 30-40mm with a brownish color. Nipple skin texture on the back, while on the abdomen and delicate legs. *O. sumatrana* has completely webbed toes.

Determination key :

(1b-2b-3b-5b-7a-1b-7a-8b-9b)

- 1b The body has four legs, the head is apparent 2
- 2b The skin is mostly wrinkled, generally slippery 3
- 3b Relatively long limbs 5
- 5b Fat body, the tips of the fingers do not expand or if they are spread out unevenly and without thin, curved curves 7
- 7a The head is generally uneven, the tips of the toes end without claws, but may extend but not flat **Ranidae (Dicroglossinae)**
- 1b Fingers with or without extended fingertips, but without thin circular curves **Dicroglossidae (7)**
- 7a Small body, no more than 65 mm, lower jaw without "fangs" 8
- 8b Small body, not exceeding 35 mm, full webbed rear limbs 9
- 9b Small body, no clear marks, dark brown, no spots on the chest or stomach ***Occidozyga sumatrana***

Table 2. Number of species found

Location	Species found	Amount
Faculty of Nursing	<i>Duttaphrynus melanostictus</i>	2
	<i>Fejervarya limnocharis</i>	1
Faculty of Dentistry	<i>Duttaphrynus melanostictus</i>	2
Faculty of Medicines	<i>Duttaphrynus melanostictus</i>	2
Faculty of Engineering	<i>Duttaphrynus melanostictus</i>	3
Faculty of Agricultural Technology	<i>Duttaphrynus melanostictus</i>	3
Faculty of Public Health	<i>Duttaphrynus melanostictus</i>	2
Faculty of Pharmacy	<i>Duttaphrynus melanostictus</i>	4
	<i>Polypedates leucomystax</i>	5
Faculty of Agricultural	-	-

Faculty of Mathematics and Science	<i>Duttaphrynus melanostictus</i>	3
	<i>Polypedates leucomystax</i>	2
	<i>Fejervarya limnocharis</i>	2
Faculty of Teacher Training and Education building 1 Rector's building	<i>Duttaphrynus melanostictus</i>	4
	<i>Polypedates leucomystax</i>	2
	<i>Duttaphrynus melanostictus</i>	3
	<i>Polypedates leucomystax</i>	2
Faculty of Computer Science	-	-
Faculty of Teacher Training and Education building 3	<i>Duttaphrynus melanostictus</i>	5
	<i>Polypedates leucomystax</i>	4
	<i>Occidozyga sumatrana</i>	2
Research and Community Service Institutions	<i>Duttaphrynus melanostictus</i>	1
	<i>Polypedates leucomystax</i>	2
Faculty of Social and Political Sciences	<i>Duttaphrynus melanostictus</i>	1
	<i>Polypedates leucomystax</i>	3
Faculty of Law	<i>Duttaphrynus melanostictus</i>	2
	<i>Polypedates leucomystax</i>	3
Faculty of Economics and Business	<i>Duttaphrynus melanostictus</i>	3
	<i>Polypedates leucomystax</i>	2
Faculty of Humanities	-	-
Total		70

The species found at the University of Jember were 70, with the most species being *Duttaphrynus melanostictus* as many as 40 individuals. The existence of these species at the observation site is influenced by abiotic environmental factors. Abiotic factor data are presented in the following table:

Table 3. Abiotic factors and the location where Anura was found

Location	Species found	Air	Air	Place found
		temperature (°C)	humidity (%)	
Faculty of Nursing	<i>Duttaphrynus melanostictus</i>	27,6 ± 0,57	78,3 ± 0,57	Grass
	<i>Fejervarya limnocharis</i>			Grass
Faculty of Dentistry	<i>Duttaphrynus melanostictus</i>	27,6 ± 0,57	77,3 ± 0,57	Grass
Faculty of Medicines	<i>Duttaphrynus melanostictus</i>	27,3 ± 0,57	77 ± 0	Grass
Faculty of Engineering	<i>Duttaphrynus melanostictus</i>	28 ± 1	77,3 ± 0,57	Ground
Faculty of Agricultural Technology	<i>Duttaphrynus melanostictus</i>	27,6 ± 1,15	78 ± 1	Grass
Faculty of Public Health	<i>Duttaphrynus melanostictus</i>	27,6 ± 0,57	76,6 ± 0,57	Grass
Faculty of Pharmacy	<i>Duttaphrynus melanostictus</i>	27,6 ± 1,15	77 ± 1	Ground, grass, paving floor
	<i>Polypedates leucomystax</i>			Grass, tree trunk
Faculty of Agricultural	-	27,3 ± 0,57	77,6 ± 0,57	-
Faculty of Mathematics and Science	<i>Duttaphrynus melanostictus</i>	27,6 ± 1,15	78 ± 0	Grass
	<i>Polypedates leucomystax</i>			Rumput, tree trunk

				Grass
Faculty of Teacher Training and Education building 1 Rector's building	<i>Fejervarya limnocharis</i>			
	<i>Duttaphrynus melanostictus</i>	27,6 ± 0,57	76,6 ± 1,15	Tanah, trash bin Tree trunk
	<i>Polypedates leucomystax</i>			
Faculty of Computer Science	<i>Duttaphrynus melanostictus</i>	27,3 ± 0,57	78,6 ± 0,57	Grass Grass, wall gutter
	<i>Polypedates leucomystax</i>			
	-	28 ± 0	75 ± 1	-
Faculty of Teacher Training and Education building 3	<i>Duttaphrynus melanostictus</i>	28 ± 1	78,3 ± 0,57	Grass, paving floor Grass, tree trunk Gutter
	<i>Polypedates leucomystax</i>			
	<i>Occidozyga sumatrana</i>			
Research and Community Service Institutions	<i>Duttaphrynus melanostictus</i>	27 ± 0	77,6 ± 1,15	Grass Grass
	<i>Polypedates leucomystax</i>			
	<i>Duttaphrynus melanostictus</i>	27,6 ± 0,57	78 ± 0	Grass, paving floor Grass, iron pole, tree trunk
Faculty of Social and Political Sciences	<i>Duttaphrynus melanostictus</i>	27,6 ± 0,57	78 ± 0	Grass, paving floor Grass, iron pole, tree trunk
	<i>Polypedates leucomystax</i>			
	<i>Duttaphrynus melanostictus</i>	27,3 ± 0,57	77,3 ± 0,57	Paving floor, Grass Grass, tree trunk
Faculty of Law	<i>Polypedates leucomystax</i>			
	<i>Duttaphrynus melanostictus</i>	27,3 ± 0,57	77,3 ± 0,57	Paving floor, Grass Grass, tree trunk
	<i>Polypedates leucomystax</i>			
Faculty of Economics and Business	<i>Duttaphrynus melanostictus</i>	27,6 ± 0,57	78,3 ± 0,57	Grass, ground Grass
	<i>Polypedates leucomystax</i>			
	<i>Duttaphrynus melanostictus</i>	27,6 ± 0,57	78,3 ± 0,57	Grass, ground Grass
Faculty of Humanities	<i>Polypedates leucomystax</i>	28,3 ± 0,57	77,3 ± 0,57	-

Based on the results of this research, *Duttaphrynus melanostictus* can be found in 15 of 18 total sampling locations. That is because *Duttaphrynus melanostictus* has a wide tolerance range. It can be seen from the data above that *Duttaphrynus melanostictus* was found alive at temperatures of 27°C - 29°C, with an air humidity of 76% - 79%. When compared with the results of research conducted by Hanifa (2016), *Duttaphrynus melanostictus* was found at 20°C-24°C, with a humidity of 90% - 100%. From these two results, it can be concluded that *Duttaphrynus melanostictus* has a reasonably wide temperature and humidity tolerance range, which is at a temperature of 20°C-29°C, and a humidity of 76% - 100%.

Not much different from *Duttaphrynus melanostictus*, *Polypedates leucomystax* can be found in 9 locations out of a total of 18 observation sites, and live at temperatures of

27°C - 29°C, with air humidity of 76% - 79%. When compared with research conducted by Hanifa (2016) *Polypedates leucomystax* was found at a temperature of 20°C - 23°C with humidity of 90% - 100%, so it can be concluded from these two data that this species has a fairly wide tolerance range, namely at a temperature of 20°C - 29°C, with a humidity of 76% - 100%. Besides, this species is also found in a location with *Duttaphrynus melanostictus*. Still, there will be no competition between the two species because *Polypedates leucomystax* has widening on its fingertips, which allows this species to climb trees, walls, iron poles, and other vertical surfaces so that species it has a broader home range.

An organism's habitat is where the organism lives, or where one must go to find it. Habitat can also indicate the place occupied by the whole community (Odum, 1998).

According to Heyer (1994), amphibians can be found in terrestrial and aquatic habitats. Amphibians inhabit a variety of habitats ranging from trees in tropical rain forests, courtyards around residential areas, in rice fields, ponds, until the cracks of rock in a river that flowed swiftly. So is the case with the Anura order.

Observations at the University of Jember show that Anura species are found to have diverse habitats. *Duttaphrynus melanostictus* has terrestrial habitats, *Polypedates leucomystax* has arboreal habitats, *Fejervarya limnocharis* dan *Occidozyga sumatrana* has semi-aquatic habitat. *Duttaphrynus melanostictus* is said to have a particular habitat because it is often found on the ground, grass, even near settlements far from water sources except during the mating season. *Polypedates leucomystax* is said to have an arboreal habitat because it matches the name of the region, i.e., the striped tree frog. This species is usually found in the tree. But it is also not uncommon for this species to be found at ground level. *Fejervarya limnocharis* and *Occidozyga sumatrana* are included in semi-aquatic habitat because both species are usually found in areas close to water sources, not infrequently found in water.

The water source is one of the factors that influence the presence of Anura in a location. As is well known that Anura is one of the orders of the Amphibian class that is known to live in two habitats during his lifetime, namely land and water. Although not all Anura lay their eggs in water, the larvae or tadpoles of Anura need water as a place to live. Each Anura species has a different way to breed. *Duttaphrynus melanostictus* mating in the water and the resulting egg is wrapped in double gelatin and hooked to vegetation in calm water. This species usually breeds in rivers with slow flow and ponds or pools of water (Khangarot, 1982). *Polypedates leucomystax* live among plants, and sometimes also in the grass. This species mates in a tree branch with a height of 1.7 m above water, and eggs are stored in foam (Feng, 1991). *Fejervarya limnocharis* usually breed in freshwater and rice fields, and amplexus occurs after midnight, followed by spawning at dawn (Jin, 2016). *Occidozyga sumatrana* lay their eggs in wet soil near water as much as 30-40 eggs at fertilization, and are divided into

several egg masses containing 8-14 eggs (Eto, 2012).

4. CONCLUSION

Based on the results, the order Anura in the University of Jember has four species from 3 different families, with the following details: *Duttaphrynus melanostictus* Schneider, 1799 from the family Bufonidae, *Polypedates leucomystax* Gravenhorst, 1829 from the family of Rhacophoridae, *Fejervarya limnocharis* Gravenhorst, 1829 from the Ranidae family, and *Occidozyga sumatrana* Peters, 1877 from the family of Rhacophoridae. Supporting factors for members of the Anura found were environmental conditions, temperature, and humidity.

5. REFERENCES

- Adhiaramanti, T., 2016. Keanekaragaman Ordo Anura di Lingkungan Universitas Negeri Yogyakarta. *Journal of Biology*. 05(06).
- Ashley, P.E., and J.T. Robinson. 1996. Road mortality of amphibians, reptiles, and other wildlife on the Long Point Causeway, Lake Erie, Ontario. *Canadian Field-Naturalist*. 110 (3): 403-412.
- Cogger, H.G., 1999. *The Little Guide Reptiles and Amphibians*. San Francisco. USA: Fog City Press.
- Cogger, H.G., Zweifel, R. 2003. *Encyclopedia of Reptiles & Amphibians: A Comprehensive Illustrated Guide by International Experts (Third Edition)*. San Francisco. USA: Fog City Press.
- Cooke, A.S., 1975. Spawn Site Selection and Colony Size of The Frog (*Rana temporaria*) and The Toad (*Bufo bufo*). *Journal of Zoology*. 175 (1): 29-38.
- Duellman, W. E., Trueb, L., 1986. *Biology of Amphibians*. New York: Mc Graw-Hill Book Company.
- Egan, R.S., Paton, P.W.C., 2004. Within-pond Parameters Affecting Oviposition by Wood Frogs and Spotted Salamanders. *Wetlands*. 24 (1): 1-13.
- Eto, K., Matsui, M. 2012. Field Observation of Egg-laying Behavior of a Puddle Frog

- Occidozyga sumatrana from Bali, Indonesia (Anura: Dicroglossidae). *Current herpetology*. 31(2): 121-124.
- Feng, A. S., Narinis, P, M. 1991. Unusual Mating Behavior of Malaysian Treefrogs, *Polypedates leucomystax*. *Naturwissenschaften*. 78 : 362-365.
- Fitri, A., Kusriani, M.D., Priyono, A., 2003. *Keanekaragaman Jenis Amfibi (Ordo Anura) di Kebun Raya Bogor*. Bogor: Prosiding Seminar Hasil Penelitian Konservasi Amfibi dan Reptil di Indonesia.
- Gusman, Endri, Nopiansyah. (2010). *Herpetofauna: Mengenal Reptil dan Amfibia di Taman Nasional Siberut*. Balai Taman Nasional Siberut. Kabupaten Kepulauan Mentawai Sumatra Barat
- Iskandar, D.T., 1998. *Amfibi Jawa dan Bali – Seri Panduan Lapangan*. Bogor: Puslitbang LIPI.
- IUCN, Conservation International, and Nature Serve. 2008. Red List Category [online] 2008. Available from: URL: <https://www.globalamphibians.org>. Accessed November 2018.
- Jin, L., Yang, S, N., Liao, W, B., Lupold, S. 2016. Altitude underlies variation in the mating system, somatic condition, and investment in reproductive traits in male Asian grass frogs (*Fejervarya limnocharis*). *Behav Ecol Sociobiol*.
- Khan, M. S., 1982. Collection, preservation, and identification of amphibian eggs from the plains of Pakistan. *Pakistan Journal of Zoology* 14:241–243.
- Kusriani, M.D., 2013. *Panduan Bergambar Identifikasi Amfibi Jawa Barat*. Bogor: Fakultas Kehutanan IPB.
- Kusriani, M.D., 2009. *Pedoman Penelitian dan Survey Amfibi di Alam*. Bogor: Fakultas Pertanian Bogor.
- Mader, H.J. 1984. Animal Habitat Isolation by Road and Agriculture Fields. *Biological Conservation*. 29 (1): 81-96.
- Menzies, J. 2006. *The Frogs of The New Guinea and The Solomon Island*. Bulgaria : Pensoft Publishers.
- Mistar. 2003. *Panduan Lapangan Amfibi Kawasan Ekosistem Leuser*. Bogor : The Gibbon Foundation dan PILI-NGO Movement.
- Pavignano, I., Giacoma, C., Castellano, S. 1990. A Multivariate Analysis of Amphibian Habitat Determinants in North-Western Italy. *Amphibian-Reptilia*. 11 (4): 311-324.
- Purnama, B.M., 2003. *Rekalkulasi Sumber Daya Hutan Indonesia Tahun 2003*. Jakarta: Badan Planologi Kehutanan.
- Rowe, C.L., Dunson, W.A., 1995. Impacts of Hydroperiod on Growth & Survival of Larval Amphibians in Temporary Ponds of Central Pennsylvania, USA. *Oecologia*. 102 (4): 397–403.
- Strijbosth, H., 1979. Habitat Selection of Amphibians During Their Aquatic Phase. *Oikos*. 33(3): 363-372.
- Suhardjono, Y. R. 1999. *Buku Pegangan Pengelolaan Koleksi Spesimen Zoologi*. Puslitbang Biologi LIPI. CV. Riza Graha Jaya. Bogor.
- Tim UNEJ. 2011. *Pedoman Kemahasiswaan dan Pengenalan Kehidupan Kampus Universitas Jember*. Jember : Jember University Press.
- UNEJ. 2015. *Sejarah Singkat UNEJ*. www.unej.ac.id. Accessed November, 2018.
- Yanuarefa, M.F., Hariyanto, G., Utami, J. 2012. *Panduan Lapangan Herpetofauna (Amfibi dan Reptil) Taman Nasional Alas Purwo*. Banyuwangi : Balai Taman Nasional Alas Purwo.
- Zug, G.R. 1993. *An Introduction Biology of Amphibians and Reptiles*. San Diego. California : Academic Press.