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Amphibians (Order Anura) Exploration at Ake Jawi Resort, Aketajawe Lolobata National Park

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ABSTRACT. Amphibians have an important role in maintaining the balance of the ecosystem. Halmahera Island is the largest island in the North Maluku region. Unfortunately, there has not been much research on amphibians. The purpose of this study was to determine the diversity, evenness and to compare the length and density of amphibians found in Ake Jawi Resort, Aketajawe Lolobata National Park. This research was conducted from August to September 2021. Observations were made using the visual encounter surveys (VES) method. Identification is done using field guide books of amphibian in West Jawa, Waigeo Insland, and Halmahera Island. Data analysis was carried out descriptively and statistically to calculate the Shannon-Wiener species diversity index, evenness index and morphometric measurements, body length measurements (SVL - muzzle length) and body weight. Based on the results of the study, there were 91 individuals from five species from four families. The species diversity index of the order Anura at the study site was in the medium category (H'=1.26), while the species evenness index was in the high category (E=0.78). The results of the comparison of the average length and weight of the order Anura showed that the species *Limnonectes grunniens* had the longest size and heaviest weight.

Keywords: Aketajawe Lolobata National Park, Ake Jawi resort, amphibian, Anura, *Limnonectes grunniens*

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1. Introduction

Amphibians are animals that live in humid forest areas, even some species depend on water for their whole life. Amphibians are one of the components that make up the ecosystem that have a very important role in the continuity of ecological processes. Ecologically, amphibians act as predators of primary consumers such as insects or other invertebrate animals (Iskandar, 1998) and can be used as bioindicators of environmental conditions (Stebbins and Cohen, 1997).

There are two orders of amphibians that can be found in Indonesia: Anura and Gymnophiona. The Anura order is generally easily found in Indonesia, while Gymnophiona is considered rare and difficult to identify (Iskandar, 1998). As many as 450 species of Anura can be found in Indonesia, this number is equivalent to 11% of the total number of Anura in the world.

Halmahera Island as the largest island in North Maluku has the Aketajawe Lolobata National Park Area (ALNP) as the only Nature Conservation Area located in this province. This National Park has potential for biodiversity, including amphibians. The results of the fauna diversity survey in ALNP showed that there are 21 species of amphibians in this area and four of them are endemic to Halmahera (RPJP-TNAL, 2016). However, it is necessary to conduct other research related to amphibian species in the ALNP to enrich the ALNP's biodiversity database.

For this reason, this research was carried out with a focus on exploring the species of amphibians of the order Anura for this order is more common in many areas in Indonesia, including in North Maluku. The research location also focuses on the Ake Jawi Resort, Aketajawe Block, ALNP. Therefore, the aims of this study were to describe the diversity of amphibian species (order Anura) and to compare each species of amphibian (order Anura) based on length and weight at Ake Jawi Resort, Aketajawe Lolobata National Park.

2. Materials and Methods

2.1 Study Site

Study site was at Ake Jawi Resort, Aketajawe Block, Aketajawe Lolobata National Park (Fig. 1). Ake Jawi Resort is administratively located in East Halmahera Regency, North Maluku Province. This research was conducted for six months, from February to August 2021.

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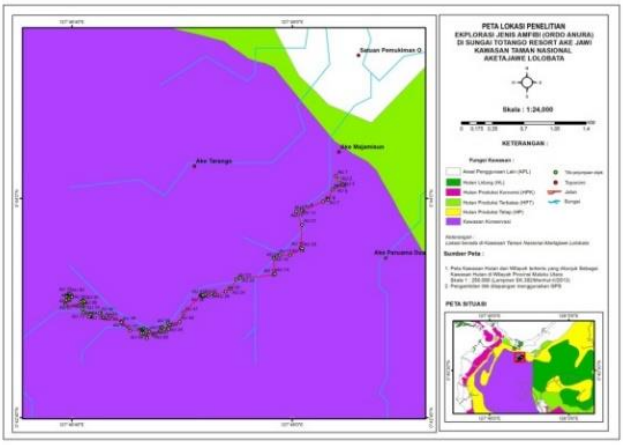

Fig. 1 Research site in Aketajawe Lolobata National Park

2.2 Materials

The materials used in this research were a headlamp, GPS receiver, watch, tagging tape, caliper, digital scales, observation sheets, tracing paper, digital camera, gloves, thermometer, labeled plastic and stationary.

2.3 Procedure

Amphibian data was collected through field observations, species identification, and morphometric measurements. The explanation is as follows:

a. Data Collection with Visual Encounter Survey method
   The method used in data collection for the order Anura was visual encounter surveys (VES), where the observer walked in a predetermined area along the river and collected data on all amphibian species (Ordo Anura) encountered. The search for amphibians using the VES method is limited by time (time-constrained search). Therefore, in the VES method, it was necessary to record the search effort of each observer involved (search effort in man-hours) who moved through the forest randomly and observed all the microhabitats encountered. The time used during the search for amphibians was two hours per person measured using a stopwatch and was done at night (20.00 – 22.00 East Indonesia Time). Amphibians found in the location of the observation were captured and then put in plastic labeled for morphometric measurement.
b. Species identification
   Amphibian species from order Anura was identified using field guide books: "Panduan Bergambar Identifikasi Amfibi Jawa Barat" (Kusrini, 2013), "Metode Survei dan Penelitian Herpetofauna" (Kusrini 2019), "(LIPI) Hertpertofauna di Pulau Waigeo" (Amir Hamidy dan Mulyadi 2007), and "Jenis-jenis Hertpertofauna di Pulau Halmahera" (M.Iqbal Setiadi, Amir Hamidy 2006).
c. Morphometric measurements
   Amphibians found must be alive when measured in length and weighed. Body length was measured from the mouth to the most posterior opening of the cloacal slit (snout-vent length – SVL) using calipers. Then the amphibians were placed on a tissue to reduce excess water in their bodies and then their weight was measured using a digital pocket scale with an accuracy of 0.01 grams.

2.4 Data Analysis

Data of species, number of individuals, length, and weight were analyzed by:

a. Species Diversity Index
   The Shannon-Wiener diversity index was used to calculate the diversity of the order Anura (Odum, 1993):

$$H' = - \Sigma \, pi \ln pi$$

   Where:
   H' is species diversity index
   Pi is proportion of important values
   Ln is natural logarithm
b. Evenness index
   The evenness index was used to calculate the abundance proportion of order Anura (Odum, 1993). The formula used is as follows:

$$E = H'/\ln S$$

   Where:
   E is evenness index
   H' is species diversity index
   S is the number of species
   Ln is natural logarithm
c. Morphometric measurement
   The results of the morphometric measurements were analyzed descriptively and then a comparison of each species on length and weight was made.

3. Results and Discussion

3.1 Environmental Conditions

The presence of amphibian species of Order Anura is influenced by environmental factors such as air temperature, humidity and weather. The condition of environmental factors at the time of the study is presented in Table 1.

Table 1
Environmental factors in study site: temperature, humidity and weather

Day	Humidity		Temperature		Weather
	H^{o} (%)	H^{1} (%)	T° (°C)	T^{1} (°C)	
1	79	94	27,6	24,6	No rain, no wind
2	97	99	26,9°	26,1	No rain, no wind
3	89	99	27,3	25,1	Drizzle, little windy
4	96	98	27,5	25,5	Quiet heavy rain
5	99	99	25,9	25,8	Drizzle
6	98	99	26,1	24,6	Little windy
7	96	99	27,6	26,1	Drizzle

Notes : H°: initial humidity; H^{1}: final humidity;
T°: initial temperature; T^{1}: final temperature

Aketajawe Lolobata NP is located at an altitude of 0-1,200 masl. This area in general has flat to wavy topography. Most of the contours of this area are very tight and show irregular undulating surface or relief shapes. There are no volcanoes in the ALNP area, both active and non-active. ALNP area has various grades of slope, from 0 – 8% to above 45% (Drafting team for RPJP-TNAL, 2016).

3.2 Diversity of Order Anura at Ake Jawi Resort

The total number of Order Anura found during observations at Resort Ake Jawi was 91 individuals from 5 species and 4 families. Species of the Order Anura found at Resort Ake Jawi are presented in Table 2.

Table 2
Amphibian species of Order Anura found at Ake Jawi Resort

Species	Family	Number of individuals
Duttaphrynus melanostictus	*Bufonidae*	13
Litoria infrafrenata	*Hylidae*	1
Rana papua lesson	*Ranidae*	8
Limnonectes grunniens	*Dicroglossidae*	27
Rana grisea	*Ranidae*	42

The species of Anura with the highest number of individuals was Rana grisea (42 individuals) from the family Ranidae, while the least was *Litoria infrafrenata* (1 individual) from the family Hylidae. The Anura order found during observation were generally in terestrial areas such as soil, rocks on river bodies, dry leaves, and under tree roots on the edge of Ake Jawi Resort. Exploration of the Anura order was carried out at night (20.00 – 22.00 WIT) and the activities of Anura at that time were to stay silent and jumped from one point to another.

The observation location is in the lowland area. Amphibian species are found at an altitude range of 38 - 168 masl. The initial and final observation points, altitude range and the dominant species are listed in the Table 3.

Table 3
Coordinates of Anura found in Ake Jawi Resort, ALNP

Sample No.	Coordinates		Altitude (masl)	Dominant Species
	Latitude (N)	Longitude (E)		
1-21	00°44.086'	127°48.309'	38-68	*D. melanostictus*
	00°43.839'	128°47.062'		
12-26	00°43.442'	127°47.893'	61-85	*R. papua lesson*
	00°43.414'	127°47.536,		
13	00°43.535'	127°47.890'	69	*L. infrafrenata*
22-91	00°43.516'	127°47.689'	42-168	*R. grisea*
	00°43.372'	127°46.748'		
25-90	00°43.433'	127°47.600'	98-162	*L. grunniens*
	00°43.376'	127°46.736'		
	00°43.376'	127°46.736'		

Data on the number of individuals of each Anura species was used to analyze the diversity and evenness index of Anura species at the study site. These two indices are commonly used to describe species diversity in a particular area. The results of the analysis that have been carried out show that the diversity of Anura at the study site is in the medium category (H'=1.26), while the evenness index value is high (E=0.78).

3.3 Amphibian of Order Anura Morphometric

All Anura found at the study site were measured for SVL and body weight. Morphometric size is also an important component to measure in amphibian research because each species has its own general size and weight. The results of the SVL and body weight measurements are presented in Table 4.

Table 4
Average SVL and weight of the Order of Anura at Ake Jawi Resort

Species	SVL (cm)	Weight (g)
Rana grisea	5,87	19,10
Limnonectes grunniens	8,41	73,40
Duttaphrynus melanostictus	5,78	20,72
Rana papua lesson	5,65	13,72
Litoria infrafrenata	7,59	42,16

The Table 4 shows that the SVL range of amphibians of the order Anura found ranges from 5.65 cm - 8.41 cm and the weight ranged from 13.72 gram - 73.40 gram. *Limnonectes grunniens* has the longest SVL and heaviest weight, which is 8.41 cm and 73.40 gram. While the shortest body length and lightest weight are owned by *Rana papua lesson* with a value of 5.65 cm and 13.73 gram, respectively.

3.4 Species Account

Order Anura is the most common group of amphibians and is known as frogs or toads. The differences in body shape, skin texture, colour pattern, substrate type, and foot type of various Anura species are important characteristics in identifying an Anura species. The following are pictures, classifications and descriptions of the Anura Order species found at Ake Jawi Resort Ake Jawi Resort Aketajawe Lolobata National Park Area:

a. *Duttaphrynus Kmelanostictus*

Scientific Classification:
Kingdom : Animalia
Phylum : Chordata
Class : Amphibia
Order : Anura
Family : Bufonidae
Genus : *Duttaphrynus*
Species : *Duttaphrynus melanostictus*
Binomial nomenclature:
Duttaphrynus melanostictus (Schneider 1799)

Fig.2 *Duttaphrynus melanostictus*
Source: taken by researcher, 2021

The Bufonidae family has a very wide distribution in Indonesia. Medium body size, has black bumps scattered on the top of the body with a pointed snout. The toes and fingers are almost the same and both have blunt ends. There is a prominent black line above the eyes to the mouth. This species is the most common Anura found in various places including villages, urban areas, gardens, on the side of the road and located on dry land, on grass, rocky, above felt, and on the banks of rivers/river areas. At Resort Ake Jawi, the *Duttaphrynus melanostictus* species can be found from an altitude of 38 – 68 masl with a temperature of 27.6°C – 24.6°C and humidity of 79% – 94%. The average length is 5.78 cm and the average weight is 20.71 g.

b. *Litoria infrafrenata*

Scientific Classification:
Kingdom : Animalia
Phylum : Chordata
Class : Amphibia
Order : Anura
Family : Hylidae
Genus : *Litoria*
Species : *Litoria infrafrenata*
Binomial nomenclature:
Litoria infrafrenata (Guenther, 1867)

Fig. 3 *Litoria infrafrenata*
Source: taken by researcher, 2021

Litoria infrafrenata has a bright green back and a white belly. The lower lip has a clear white line that extends to the shoulder. The lower leg is white. It has foot pads that help it to climb. This Anura species was found in trees at a height of more than 2.5 m from the ground, located on the edge of the Ake Jawi Resort. The average body length is 7.59 cm and the average weight is 42.16 g. This anura was found at altitude 69 masl with a temperature of 27.6 – 25.1°C and humidity of 79% – 99%.

c. *Rana papua*

Scientific Classification:
Kingdom : Animalia
Phylum : Chordata
Class : Amphibia
Order : Anura
Family : Ranidae
Genus : *Rana*
Species : *Rana papua*
Binomial nomenclature: *Rana papua* (lesson, 1830)

Fig.4 *Rana papua*
Source: taken by researcher, 2021

This Anura is small to medium in size, has a slender body and long legs with strep stripes of striking color. The color of the upper body is light brown to dark, while the color of the lower skin is yellowish white. The skin texture is smooth without any spots or bumps. The upper side has a straight line protruding from the mouth to the groin of the thigh. The average length value is 5.65 cm with an average weight of 13.72. Found at an altitude of 53 – 135 masl at Ake Jawi Resort with temperatures from 27.3°C – 25.1°C and humidity 89 – 99%.

d. *Limnonectes grunniens*

Scientific Classification
Kingdom : Animalia
Phylum : Chordata
Class : Amphibia
Order : Anura
Family : Dicroglossidae
Genus : *Limnonectes*
Species : *L. grunniens*
Binomial nomenclature:
Limnonectes grunniens (Latreille, 1801)

Fig.5 *Limnonectes grunniens*
Source: taken by researcher, 2021

This species of order Anura is commonly found in Halamahera. Generally found at a distance of 0 m – 3 m from the river bank. The upper body has light brown to dark color, while the lower body skin is white. The body size is larger than the other frogs found. It has small spots scattered on the upper part of the body, while the abdomen and legs are smooth. The arms and legs are long and have dark brown stripes. This Anura is found at an altitude of 81 - 173 masl at a temperature of 27.6 °C - 25.9 °C and humidity of 96% - 99%. The average length is 8.41 cm with an average weight of 73.40 g.

e. *Rana grisea*

Scientific Classification:
Kingdom : Animalia
Phylum : Chordata
Class : Amphibia
Order : Anura
Family : Ranidae
Genus : *Rana*
Species : *Rana grisea*
Binomial nomenclature: *Rana grisea* (Van kampen, 1913)

Fig.6 *Rana grisea*
Source: taken by researcher, 2021

The color of the upper body is light brown to dark, while the skin color of the lower body is white with a pattern. The skin texture is rather smooth and has black spots or bumps on the upper part of the body. Small to medium in size, slender build with slightly prominent stripes on the arms and legs with striking colored stripes. The upper side has a straight line protruding from the snout to the groin of the thigh. The average length is 5.87 cm with an average weight of 19.10 g. This species is found at an altitude of 42 – 174 masl at Resort Ake Jawi, with a temperature of 26.1 °C – 24.6°C and humidity of 98% – 99%.

Conclusion

A total of 91 individuals from 5 species and 4 families of the Order Anura were found at Resort Ake Jawi. The species found were *Rana grisea*, *Limnonectes grunniens*, *Duttaphrynus melanostictus*, *Rana papua lesson*, and *Litoria infrafrenata*. Species diversity index in the medium category (H'=1.26) and the species evenness index in the high category (0.78). *Limnonectes grunniens* has the longest SVL and the heaviest weight compared to the other four species of Anura.

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