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The diversity of Gastropoda in grati lake district pasuruan east java

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Abstract: Freshwater gastropods are benthic fauna whose live under the water surface or attached to the bottom rocks of the river, pond, or lake. Ranu Grati is a freshwater lake located in District Pasuruan, East Java. Information on gastropod community from this lake is still scarce. We surveyed Ranu Grati from November 2019 until February 2020 to find out the gastropod's diversity. We found 118 individual gastropoda consist of five families and six species. Gastropod's community in Ranu Grati was classified as moderate ($H' = 1,415$). Morphology of each species will be discussed briefly in this paper.

1. Introduction

Macrobenthos fauna is sometimes dominated the freshwater communities. They can be classified based on their way of life into two forms, namely infauna and epifauna. Infauna is benthic animals that live by immersing themselves in the substrate such as sediment, while epifauna is benthic animals that live on the surface of a substrate, including animals whose way of life is moving [5]. Gastropods are relatively sedentary animals live at the bottoms and substrates that are not fully flooded. The occurrence of gastropod species is highly influenced by physical (temperature, depth) and chemical factors (pH, salinity). If they found in fewer number, this may indicate that their environment has poor water quality [9]. This makes them frequently used as biological indicators (bio-indicators) of water quality [4].

Ranu Grati is natural lake ecosystem located in the District Pasuruan of East Java Province. At present day, the surrounding environment is highly populated. Peoples utilizing the lake for fish culture. They feed fishes with pellets. Pellet residues that drown into the bottom are polluting the water. The presence of fish cages will produce secretions from fish and pellet residue which can have a negative or positive impact on the life of gastropods. However, fish secretion and leftover pellet can provide nutrition for gastropods life. All materials derived from the human activities around the lake will certainly affect the fauna lives in these waters [14].



Information on the gastropod's diversity in Ranu Grati was mainly based on the knowledge of local observers. No available paper discussing the gastropod community in the present day. This scientific hole is can only be fulfilled by observing the lake to obtain the recent data. This study aims to determine the diversity of gastropoda, as well as ecological factors that influenced found in Ranu Grati.

2. Sampling stations and methods

2.1 Time and Place

The observation was conducted in Ranu Grati from November 2019 to February 2020.

2.2 Tools and Materials

The tools used in this research were digital camera, taper, pH meter, thermometer, lux meter, GPS, book, pen, calipers, microscope, container box, jar, aquarium, tracing paper, label paper, and chest board. The materials used for sampling and preserving gastropods were distilled water and alcohol (76%). Identification was mainly based on the book entitled Indonesian Snails and Shells [3].

2.3 Sampling Protocol

Purposive sampling method was applied in this study. Only sites with suitable habitat for gastropod were observed. The observation was made in five plots (5 x 5 m). Physical parameters of the water (pH, temperature, light intensity, and substrate) were measured before taking the gastropod's sample. Followed by road sampling with manual collection attached to the rocks, the edge of the lake and digging the substrate with a maximum depth of 10 cm using a small scope. The collected sample of gastropods was preserved in plastic clips with containing alcohol 76% and labelled. Sample identification was carried out at the Zoology Laboratory of the Biology Education Study Programme at the University of Jember.

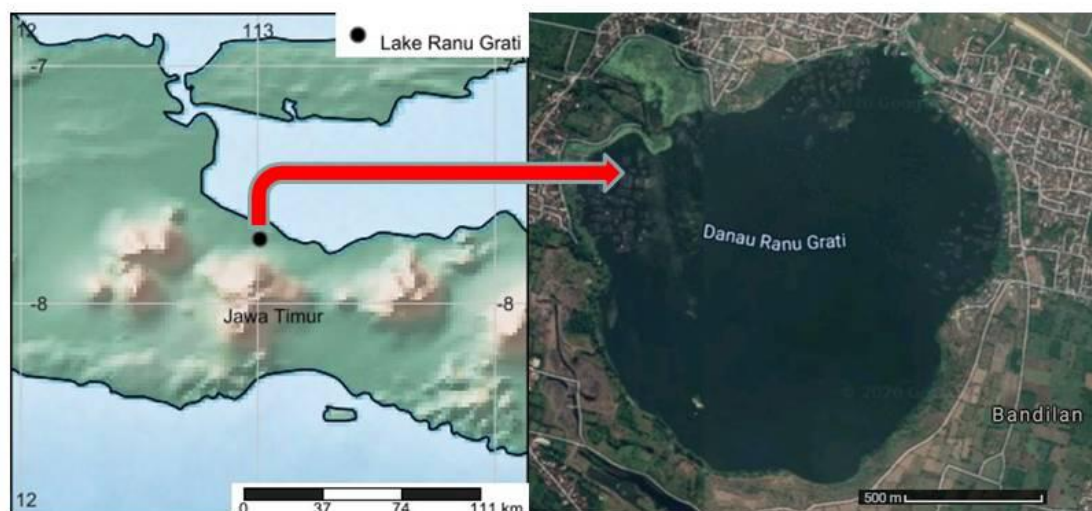


Figure 1. Location and aerial photograph of Ranu Grati. Source: www.simplemappr.net and <https://www.google.co.id/maps>.

Gastropod diversity was analysed by Shannon's diversity index [$H' = -\sum (n_i/n) \ln (n_i/n)$]. Low (<1), medium (1-3), high (>3). Degree of equality of species in a certain environment was analysed by Pielou's evenness index ($J = H' / \ln S$). Low (< 0,4), medium (0,4-0,6), high (> 0,6). Probability of two randomly sampled individuals belong to the

same species was analysed using Simpson's dominance index [$D = \sum (n_i/n)^2$]. Low (0,0-0,5), medium (0,50-0,75), high (0,75-1,00). Note: S (number of species), n_i (number of individual of species i), n (number of individual) [15]. All analyses were running in PAST 2.17c package [16].

3. Results and Discussion

3.1. Results

We collected 118 individu gastropoda consist of five families and six species.

Table 1. Gastropod's species from Ranu Grati.

No	Order	Family	Species
1.	Caenogastropoda	Thiaridae	<i>Tarebia granifera</i> (Lamarck, 1816)
2.	Caenogastropoda	Thiaridae	<i>Mienplotia scabra</i> (O. F. Muller, 1774)
3.	Architaenioglossa	Ampullariidae	<i>Pomacea canaliculata</i> (Lamarck, 1822)
4.	Architaenioglossa	Viviparidae	<i>Filopaludina javanica</i> (Von Dem Busch, 1844)
5.	Cycloneritida	Neritidae	<i>Clithon bicolor</i> (Recluz, 1843)
6.	Caenogastropoda	Pachychillidae	<i>Sulcospira testudinaria</i> (Busch, 1842)

1). *Tarebia granifera*

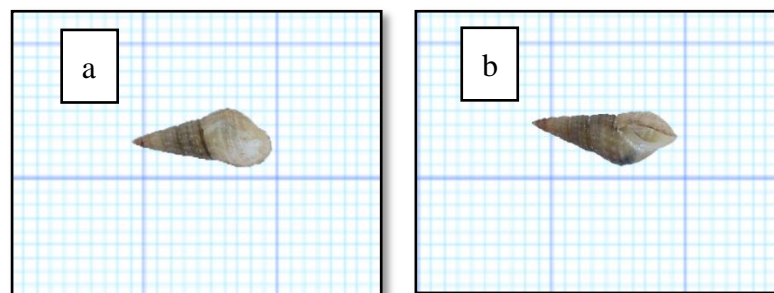


Figure 2. Shell's morphology of *Tarebia granifera*: (a) the dorsal part; (b) the ventral part

Classification

Kingdom : Animalia
 Phylum : Mollusca
 Class : Gastropoda
 Order : Caenogastropoda
 Family : Thiaridae
 Genus : *Tarebia*
 Species : *Tarebia granifera* (Lamarck, 1816)

(Source : <http://www.molluscabase.org/aphia.php?p=taxdetails&id=397189>)

Description

Dextral rotation, shell's length 2 cm and width 1 cm. The shell's surface is rough by numerous nodules, whitish brown. Apex is pointed with a narrow and pointed indentation. Inner and outerlip are thin. Aperture oval. *Tarebia granifera* is in station 1, station 2, and station 3 around the mud and sandy substrate.

2). *Pomacea canaliculata*

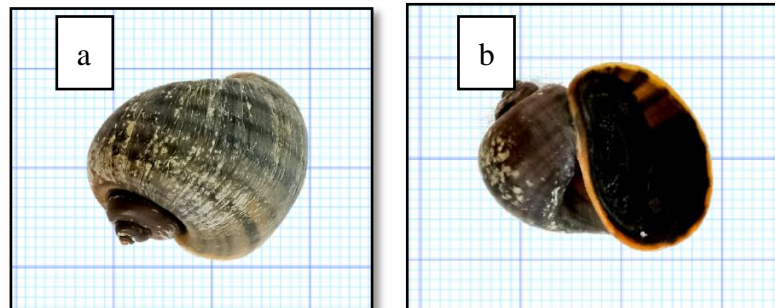


Figure 3. Shell's morphology of *Pomacea canaliculata*: (a) the *dorsal* part; (b) the *ventral* part

Classification

Kingdom : Animalia
 Phylum : Mollusca
 Class : Gastropoda
 Order : Architaenioglossa
 Family : Ampullariidae
 Genus : *Pomacea*
 Species : *Pomacea canaliculata* (Lamarck, 1822)
 (Source : <http://www.molluscabase.org/aphia.php?p=taxdetails&id=741113>)

Description

Dextral rotation, shell's length 3 cm and width 2 cm. The shell's surface is rough, yellowish brown with black round bands. Apex is shortened. The inner and outerlip are thin. Aperture oval with rounded body whorl. *Pomacea canaliculata* is found in all stations around the mud and sandy substrate.

3). *Filopaludina javanica*

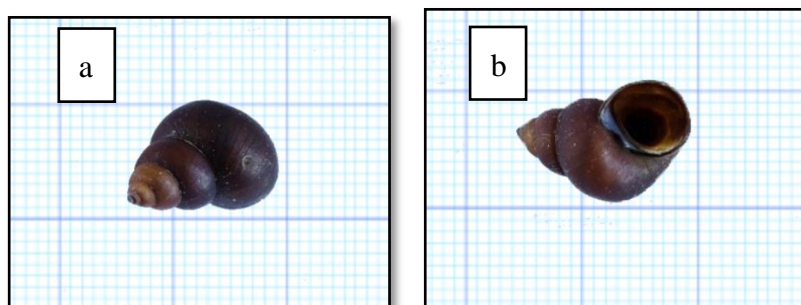


Figure 4. Shell's morphology of *Filopaludina javanica*: (a) the *dorsal* part; (b) the *ventral* part

Classification

Kingdom : Animalia
 Phylum : Mollusca
 Class : Gastropoda
 Order : Caenogastropoda

Family : Viviparidae
 Genus : *Filopaludina*
 Species : *Filopaludina javanica* (von Dem Busch, 1844)
 (Source : <http://www.molluscabase.org/aphia.php?p=taxdetails&id=827342>)

Description

Dextral rotation, shell's length 1,5 cm and width 1 cm. The shell's surface is smooth and dark brown. Apex is slightly tapered. Inner and outerlip are thin. Aperture is rounded with rounded body whorl. *Filopaludina javanica* is found in all stations around mud and sandy substrate.

4). *Mieniplotia scabra*

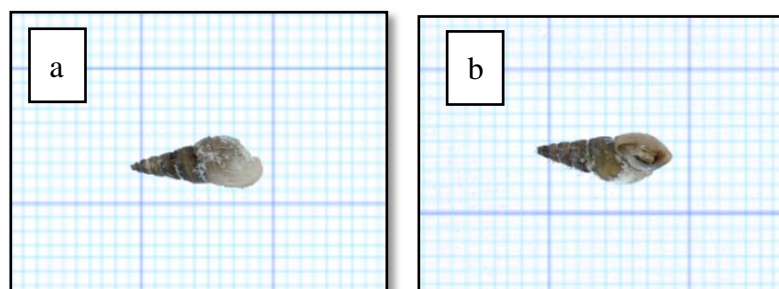


Figure 5. Shell's morphology of *Mieniplotia scabra*: (a) the dorsal part; (b) the ventral part

Classification

Kingdom: Animalia
 Phylum : Mollusca
 Class : Gastropoda
 Order : Caenogastropoda
 Family : Thiariidae
 Genus : *Mieniplotia*
 Species : *Mieniplotia scabra* (O. F. Muller, 1774)
 (Source : <http://www.molluscabase.org/aphia.php?p=taxdetails&id=828967>)

Description

Dextral rotation, shell's length 1 cm and width 0,5 cm. The shell's surface is rough, thin and whitish brown. Apex is pointed with a narrow and pointed indentation. Inner and outerlip are thin. Aperture oval. *Mieniplotia scabra* is only found in station 2 around muddy substrate.

5). *Clithon bicolor*

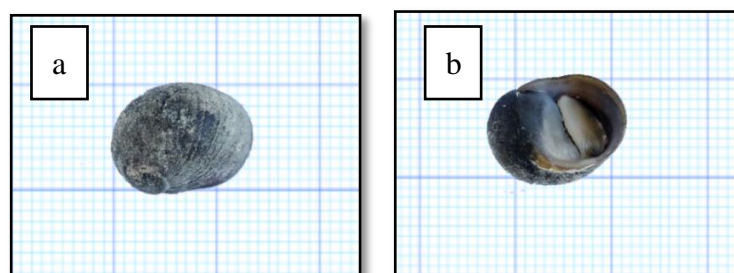


Figure 6. Shell's morphology of *Clithon bicolor*: (a) the dorsal part; (b) the ventral part

Classification

Kingdom: Animalia

Phylum : Mollusca

Class : Gastropoda

Order : Cycloneritida

Family : Neritidae

Genus : *Clithon*

Species : *Clithon bicolor* (Recluz, 1843)

(Source : <http://www.molluscabase.org/aphia.php?p=taxdetails&id=737509>)

Description

Dextral rotation, shell's length 1,5 cm and width 1 cm. The shell's surface is rough and black. Apex is rounded. Inner and outerlip are thick. Aperture and operculum are semicircular. *Clithon bicolor* is only found in station 2 around muddy substrate.

6). *Sulcospira testudinaria*

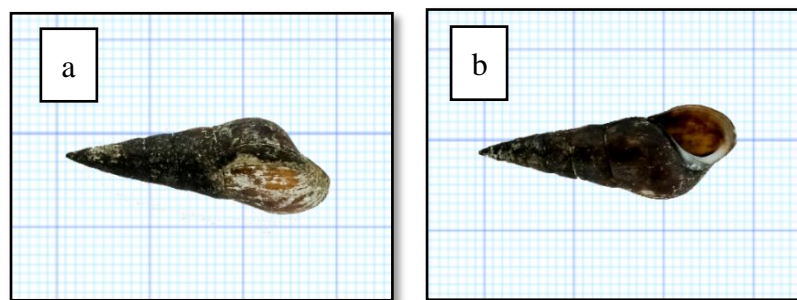


Figure 7. Shell's morphology of *Sulcospira testudinaria*: (a) the dorsal part; (b) the ventral part

Classification

Kingdom : Animalia

Phylum : Mollusca

Class : Gastropoda

Order : Caenogastropoda

Family : Pachychilidae

Genus : *Sulcospira*

Species : *Sulcospira testudinaria* (von dem Busch, 1842)

(Source : <http://www.molluscabase.org/aphia.php?p=taxdetails&id=716910>)

Description

Dextral rotation, shell's length 3 cm and width 1 cm. The shell's surface is smooth, black, pointed and decorated with spiral grooves. Apex is pointed. Inner and outerlip are thick. Aperture rounded. *Sulcospira testudinaria* is only found in station 2 around muddy substrate.

Table 2. Occurrence of Gastropoda in each sampling station

No	Species	St.1	St.2	St.3	St.4	All
1	<i>Tarebia granifera</i>	10	17	5	5	37
2	<i>Pomacea canaliculata</i>	7	11	4	1	23

3	<i>Filolopaludina javanica</i>	0	1	0	0	1
4	<i>Mieniplotia scabra</i>	0	3	0	0	3
5	<i>Clithon bicolor</i>	10	25	6	0	41
6	<i>Sulcospira testudinaria</i>	0	13	0	0	13
Shannon's diversity index		1,09	1,51	1,09	0,45	1,43
Pielou's evenness index		0,99	0,75	0,99	0,78	0,69
Simpson's dominance index		0,34	0,25	0,34	0,72	0,27

Diversity index (H') (Shannon-Wiener) of Gastropod in Ranu Grati is 1,415 and classified as medium because the value ranges from 1 to 2.

Table 3. Abiotic parameters of sampling station

Parameter	St. 1	St. 2	St. 3	St. 4
pH	8,7	8,7	8,7	8,7
Temperature (°C)	34	34	34	34
Light (lux)	3930	3470	3800	4100
Substrate	Mud and sand	Leaves and mud	Mud and rubbish	Mud

Based on Table 3. The abiotic parameters of Ranu Grati have a water pH of 8,7. The lowest temperature in Ranu Grati is 33°C and the highest temperature is 34°C. The light intensity at Ranu Grati is approximately between 3470 lux to 4100 lux. The type of substrate in Ranu Grati is dominated by the type of mud substrate, but there are also types of substrate for sand, leaves, and gravel.

3.2. Discussions

The calculation of species diversity in this study uses the Shannon-Wiener index [5]. The results of the calculations in Table 2. obtained a Gastropod diversity index of 1,415. Diversity index can be used to measure community stability, namely the ability of the community to maintain stable conditions even though there are disturbances to its components [1].

Gastropod diversity in Ranu Grati is classified as moderate ($1 < H' < 3$). This can be caused by several factors that affect the life of Gastropods. Among them are the cages in Ranu Grati. The existence of fish cages in Ranu Grati has a positive impact and a negative impact on the habitat of Gastropods. The positive impact of the cage is that the secretion from fish and fish food waste can be a food source that contains a lot of nutrients needed by gastropods, while for the negative impact, namely the sedimentation of fish secretions and fish food residue from the cage so that there will be deposition and secretion of fish and waste. feed will also increase water turbidity and changes in the properties of the bottom substrate waters. This is in accordance with [7] which states that gastropod diversity is influenced by several factors including contaminated substrate, sedimentation, availability of food sources, competition between species, disturbance and conditions of the surrounding environment. So that species that have high tolerance will be stable and even increase while species that have low tolerance will decrease.

Based on the results of the exploration of Gatropoda in Ranu Grati, when compared with the trend of gastropod research in lakes in other locations, the same results were obtained, namely having a trend of diversity in the moderate category because the number of species and evenness of individuals in one community was uneven. This can be due to different abiotic

factors in each environment so that it can affect the diversity of species found in Ranu Grati. Measurements of environmental factors that affect the diversity of gastropods in Ranu Grati were carried out. The degree of acidity (pH) had an average value of 8,7; temperature has an average value of 33°C-34°C; Light intensity has an average of 3470 lux - 4100 lux with the substrate type of mud, sand, leaves, and garbage. This situation resulted in the 6 species of Gastropods in Ranu Grati being able to adapt to each research station. It was proven that not all types of Gastropods can be found in all research locations, but they are spread unevenly by adjusting to existing environmental conditions, causing the distribution of freshwater gastropods in Ranu Grati.

There are 62 recorded freshwater gastropods in Java, which spread from West Java, Central Java to East Java. However, the results of monitoring and expeditions carried out in the last 20 years recorded 70 species [8]. The types of gastropods found in Ranu or Lake in Indonesia have a number of species that are not much different, including 7 species in Lake Poso, namely: *Tylomelania toradjarum*, *Tylomelania patriarchalis*, *Tylomelania neritiformis*, *Tylomelania kuli*, *Tylomelania palicularum*, *Tylomelania bakara*, *Tylomelania* sp1, *Tylomelania* sp2 [3]. Whereas in the East Java region, namely Gastropod Diversity in Ranu Kumbolo Bromo National Park, 5 species of Gastropods were found, namely *Tarebia granifera*, *Semisulcospira testudinaria*, *Sulcospira testudinaria*, *Sulcospira hainanensis*, and *Tubifex* sp. [12]. Types of gastropods found in Ranu Grati are *Sulcospira testudinaria*, *Pomacea canaliculate*, *Filopaludina javanica*, *Clithon bicolor*, *Tarebia granifera*, and *Mieniplotia scabra*.

4. Conclusion

Gastropod diversity in Ranu Grati found 6 species from 5 families (Pachychilidae, Ampullariidae, Viviparidae, Neritidae, Thiaridae). There is 1 species in the Pachychilidae family, namely *Sulcospira testudinaria*. There is 1 species in the Ampullariidae family, namely *Pomacea canaliculate*. The Viviparidae family contains 1 species, namely *Filopaludina javanica*. There is 1 species in the Neritidae family, namely *Clithon bicolor*. There are 2 species of the Thiaridae family, namely *Tarebia granifera*, and *Mieniplotia scabra*.

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