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.](image)

Gastropod diversity was analysed by Shannon’s diversity index \[H'=\Sigma(ni/n) \ln (ni/n)\]. 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 \[D = \Sigma (ni/n)^2\]. Low (0.0-0.5), medium (0.50-0.75), high (0.75-1.00). Note: S (number of species), ni (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     | *Tarebia granifera* (Lamarck, 1816)    |
| 2. | Caenogastropoda | Thiaridae     | *Mieniplotia scabra* (O. F. Muller, 1774) |
| 3. | Architaenioglossa| Ampullariidae | *Pomacea canaliculata* (Lamarck, 1822) |
| 4. | Architaenioglossa| Viviparidae   | *Filopaludina javanica* (Von Dem Busch, 1844) |
| 5. | Cycloneritida    | Neritidae     | *Clithon bicolor* (Recluz, 1843)       |
| 6. | Caenogastropoda | Pachychillidae| *Sulcospira testudinaria* (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](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](image_url)

**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](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](image_url)

**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](image)

**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 : Thiaridae  
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. Innerlip and outerlip are thin. Aperture oval. Mieniplotia scabra is only found in station 2 around muddy substrate.

5). Clithon bicolor

![Figure 6](image)

**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  | Tarebia granifera        | 10   | 17   | 5    | 5    | 37  |
| 2  | Pomacea canaliculata     | 7    | 11   | 4    | 1    | 23  |
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-Wienner 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, Tylomeliana neritiformis, Tylomeliana kuli, Tylomeliana paticolarum, Tylomeliana bakara, Tylomeliana sp1, Tylomeliana 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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