Microplastic in mangrove horn snail *Telescopium telescopium* (Linnaeus, 1758) at mangrove ecosystem, Rambut Island, Jakarta Bay, Indonesia

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Abstract. This study was done to identify the type and amount of microplastic particle in the sediment, water and the horn snail *Telescopium telescopium* (soft tissue, respiratory and digestive organs) in the coast of Rambut Island, Jakarta. This research also aimed to know the correlation between the amount of microplastic particles in the sediment and the snail body mass. The result showed that average amount of microplastic were found 764.81 particles/ind in the snail, 31.7 particles/g in sediment and 15.46 particles/mL water samples. The microplastic type of film was dominant in all of the samples, with average amount 368.51 particles/ind in snail, 15 particles/g sediment and 9.46 particles/mL water samples, respectively. The respiratory organ contained higher microplastics (102.33 particles/ind) than the digestive organ (66.85 particles/ind). There were significantly positive correlation (r=0.744) between amount of microplastics in the snail and the snail body mass.

Keywords: Horn snail, mangrove, microplastic, respiratory organ, sediment

1. Introduction
Plastic debris has been an issue for marine ecosystem, the massive amount of plastic waste from Jakarta has contaminated the islands in Jakarta Bay. This resulted in the disturbance of ecosystem stability and the shrinking of the islands’ area [1]. Rambut Island is one of the islands in Jakarta Bay [2]. It is an uninhabited but has a high level of waste contamination and plastic waste is the dominant waste [1].

Plastic in the ocean can be degraded into small sized particles (<5 mm) known as microplastics due to physical, chemical and biological pressure [3]. Microplastics contain toxic constituents and they can bind with toxic chemical compounds from the environment, so the organisms that ingest them will be contaminated and accumulated in their body, mainly the fat tissue and muscle [4].

Invertebrates can be contaminated by microplastics directly and indirectly from the environment [3]. Benthic organisms, especially filter feeder and deposit feeder, are vulnerable towards the microplastic contamination because microplastics can be found massively in sediment and water [5]. Microplastic was found inside filter feeder organisms like shellfish [6] and deposit feeder like sea cucumber [7]. Mangrove horn snail, *Telescopium telescopium* is a deposit feeder gastropods which can be found in large amount at mangrove ecosystem [8]. They are consumed by people and used as asthma medication [9]. Human body can be contaminated by microplastics because of consuming the contaminated this marine biota [10].
The research about the effects of microplastics contamination in environment towards marine biota is a key matrix to determine the contamination of an area [11]. The research about amount of microplastics in *T. telescopium* in mangrove ecosystem at Pulau Rambut has not been done. This research needs to be done to know the amount and type of microplastics in the snail especially respiratory organ and digestive organ, sediment and water in their habitat, and to know the correlation between the amount of microplastics and the snail body mass.

2. Methodology

2.1. Data sampling

The study was carried out in mangrove ecosystem of Rambut Island, Jakarta Bay. There were three sampling stations, located in the East, South, and West of Island. In each station, we collected nine snails *T. telescopium*, ±500 g of sediment and 10 L of water. The sediment sample were taken by scooping 1–2 cm sediment from the surface. The water sample was filtrated by using plankton net with the size 200 μm. Environment parameters namely temperature, pH and salinity were recorded as well with three times repetition.

2.2. Microplastics extraction from *T. telescopium*

2.2.1. Individual. The shell of snail was destroyed using a hammer. After that, the soft tissue was taken then weighed. The soft tissue was placed inside the 100 mL beaker glass then 10 mL of HNO₃ 65 % was added and soaked for 12 h. Dilution of ten times was done using water against the sample. The sample was filtered using filter paper with diameter of 500 μm then 1 mL was pipetted into the counting chamber. Observation was performed on the sample using microscope magnified in 10×10. The number of each type of microplastic were counted. The type of microplastic based on their shape are pellets, film, fiber and fragment.

2.2.2. Organ. The observation of microplastics was also done on the digestive and respiratory organs of *T. telescopium*. There were 5 individuals of snail used. After the shell was destroyed, the digestive and respiratory organs were separated. Each of the organ then was treated using the same method as point 2.2.1 The total amount of microplastic were counted instead of the amount of each type of microplastic.

2.3. Microplastics extraction from water and sediment

Drying process was performed on the sediment sample in an oven for 72 h at 60 °C. The dried sample was sifted using 5 mm filter then soaked into concentrate of NaCl 26 % in the ratio of 1:3. Stirring was conducted on the sample for 2 min, next, by using a pipette, 1 mL sample was transferred into the counting chamber. The sample was studied using a microscope, magnified in 10×10. The amount of each type of microplastic were counted. The water sample was processed in the same manner to the sample of sediment, initiating by mixing the sample with the concentrate NaCl.

3. Results and discussion

The average amount of microplastic particles contained in the sediment was 31.7 particles/g. We found film, fragment and fiber type of microplastics. The average amount of microplastic particles contained in the water, was 15.46 particles/mL. The type of microplastics were film, and fiber. Film was the most common type with 15 particles/g sediment and 9.46 particles/mL seawater. Based, on the result, microplastic particles were found more abundant in the sediment than in water. The microplastic is known to bind strongly with every sediment type, so it is hard to separate and can be well-accumulated [12]. The microplastic with lower density tends to float on the surface of water, where else the higher
one tend to sink and accumulate on the sediment [12]. The most common type found was film, because it has low density so it is easier to be transported to the mangrove ecosystem [13].

*Telescopium telescopium* samples have an average mass of 12.13 gr, length of 9 cm, and diameter of 3 cm. In the snail sample, we recorded fiber, fragment, and film type of microplastics [14]. Average amount of microplastic particles were 68.22 particles/g. Based on figure 1, film type Microplastic was the most common found with the amount 32.8 particles/individual.

Microplastic contamination in the snail during the ingestion is caused by the size of microplastics that is small makes them hard to be separated from the food, so they are easier to be eaten [3]. Bioaccumulation can happen if the amount of ingestion is higher than the amount of egestion [14]. The vulnerability of each species towards microplastic contamination is different, based on their eating mechanism [15]. Non selective deposit feeder is more vulnerable than the selective deposit feeder, because they are more selective with what they ingest to their body [14].

Each individual of *T. telescopium* has different mass and different amount of microplastic, so correlation test was conducted to know the relation among the body mass increment and the microplastics amount. The test result shows that there was a positive correlation (r = 0.744) between them. It is assumed that microplastic can be accumulated in the muscle and fat tissue [16], so the increment of mass is related with the amount of microplastic inside the snail body.

The respiratory organ of *T. telescopium* used has the average weight of 2.8 g, while the digestive organ used has the average weight of 5.8 g. Microplastic can be found in both organs. The comparison of the amount of microplastic found can be seen in figure 2. The graph reveals that the respiratory organ has more microplastic particles content than digestive organ. The numbers of microplastic particles contained in the respiratory organ are 102.33 particles/g, while the numbers of microplastic particles contained in the digestive organ are 66.85 particles/g. The high amount of microplastic particles in the respiratory organ indicates that there is an accumulation of microplastic due to the organ exposure to the environment [14].

![Figure 1](image1.png)

*Figure 1.* Types and amounts of Microplastic in *T. telescopium.*

![Figure 2](image2.png)

*Figure 2.* Types and amounts of microplastic in *T. telescopium* organ.
Mangrove ecosystem of Rambut Island can be contaminated because of tidal current process [1]. The microplastics found contaminating the mangrove ecosystem of Rambut Island were fiber, film, and fragment. The film type is commonly employed by humans to assist their everyday life needs namely food/drink packages, soap/detergent packages, plastic bags, etc [14]. This was found commonly at the coast of Rambut Island [17].

Fiber is the microplastic type comes from rope or hawser, and weathered synthetic fiber (clothes) [14]. Our clothes commonly are composed by acrylic polyester synthetic fiber, if the clothes are washed using the washing machine, the fiber will be released and washed through the washing water into the environment. The fiber can be carried to the river then accumulated in the ocean [18]. Fragment is secondary microplastic particles comes from strong polymer of plastic with high density [14]. Waste from household equipment, which are made from plastic, were found stranded on the coast of Rambut Island. The plastic waste due to physical, chemical and biological pressure can be changed into fragment type and can be easily distributed by seawater current [16].

4. Conclusion
The microplastics type that has been discovered in the snail samples were film, fragment, and fiber. The respiratory organ of snail has more microplastic particles content than digestive organ. The microplastic is also found in the sediment and water in mangrove ecosystem of Rambut Island. Film type microplastic was the most common found. There was a positive relation among the body mass and the microplastics amount.

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