

Checklist of mangrove snails (Mollusca: Gastropoda) in South Coast of Pamekasan, Madura Island, East Java, Indonesia

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Abstract. *Islamy RA, Hasan V. 2020. Checklist of mangrove snails (Mollusca: Gastropoda) in South Coast of Pamekasan, Madura Island, East Java, Indonesia. Biodiversitas 21: 3127-3134.* Mangrove forests are crucial to gastropods providing breeding and nursery grounds, food sources, and shelter from predators. They are useful bioindicators of environmental pollution. Consequently, it is crucial to understand the species richness of gastropods mangrove environments. This study aims to provide information about the species composition of mangrove snails in the South Coast of Pamekasan (Madura Island), East Java, Indonesia. Samplings were performed at low tide from 4 stations in December 2019 using a transect (10m x 10m). All samples were identified using reference books and published journal. We found a total of 10 family consist of Assimineidae, Cerithiidae, Ellobiidae, Littorinidae, Muricidae, Neritidae, Olividae, Planaxidae, Potamididae, and Trochidae with consist of 15 Genus, i.e., *Assimineia*, *Clypeomorus*, *Cerithium*, *Rhinoclavis*, *Laemodonta*, *Littorarina*, *Tenguella*, *Semiricinula*, *Nerita*, *Clithon*, *Oliva*, *Planaxis*, *Pirenella*, *Telescopium*, and *Monodonta*. The most common substrate where mangrove snails were found was rocks, sandy, and around the tree and roots of mangrove. All gastropods in this study found alive during our surveys and predominantly mangrove associated. We assume that there are still many snails that have not been surveyed at the location. We suggest to the future researcher to survey through different sampling efforts and sampling methods such as quantitative or semi-quantitative methods.

Keywords: Checklist mollusca, gastropods, Madura, mangrove snail, Pamekasan Coast

INTRODUCTION

Gastropods are unique from an ecological perspective because they are inhabiting extremely contrasting habitats (Marshall et al. 2015) such as marine, freshwater, and terrestrial environments [although they are predominantly marine] compared to other more abundant metazoans (Dayrat et al. 2011; Webb 2012). Gastropods play a significant ecological role in nutrient dynamics in the mangrove ecosystem because they form an essential link within the food web as predators, herbivores, detritivores, and filter feeders (Pawar 2012; Suresh et al. 2012). They are useful for bioindicators of environmental pollution (El-Sorogy et al. 2013). The diverse group of gastropods plays an important role in the benthic food web (Adams and Crawley 2018).

Ecologically, mangrove forests are important as feeding ground, breeding ground and nursery ground for various types of terrestrial and marine organisms (Igulu et al. 2014; Shing et al. 2014). Mangrove forests are crucial to gastropods providing breeding and nursery grounds, food sources, and shelter from predators (Reid et al. 2010). However, there were several factors causes of the disturbances in the mangrove area, i.e., economic factors and the lack of people understanding the importance of the ecology of mangrove forests, leading to the destruction of mangroves for economic purposes. (Chatarina et al. 2011).

The mangrove ecosystem in the South Coast of Pamekasan, chosen because of its vital role for local communities. Local people harvest shrimp, snail, clam, crab, and several types of fish from this location as a livelihood for household needs. Nevertheless, now the mangrove ecosystem in this location has significant natural and artificial changes. The dynamics of sedimentation, abrasion, and the rate of change of land-use in the South Coast of the Pamekasan Regency are higher compare to the North Coast of Madura. Besides, the geographical position of the South Coast of Pamekasan Regency which is a crossing of Madura from Bangkalan to Sumenep increases the dynamics of population activities including reclamation of coastal land for new settlements, excavation of sand for building materials, felling of mangrove trees for timber and leaves for fodder (Suprakto 2005). It can endanger the life of mangrove biota, especially mangrove snails.

Consequently, it is crucial to understand the species richness and relative abundance of gastropods mangrove environments considering gastropods diversity is declining vastly worldwide (Nützel and Hausmann 2016). Moreover, there has not been much research on gastropods in the Madura region, especially Pamekasan. This study aims to provide information about the species composition of mangrove snails in the South Coast of Pamekasan, East Java, Indonesia.

MATERIALS AND METHODS

Sampling and identification of mangrove snail

Samplings were performed at low tide from 4 stations (Figure 1) every week for one month in December 2019 (the beginning of the rainy season) using a transect (10m x 10m) modification method of the published journal (Isoni et al. 2019). Determination of the observation station based on differences in land use (Figure 1). All gastropod samples placed in the sample box and preserved immediately in 5-7% neutralized formalin. All samples were identified using reference books such as Abbott and Dance (2000); Tapilatu and Pelasula (2012); Arbi (2014); Dolorosa and Gallon (2014); Reid (2014); Reid and Claremont (2014), and Baharuddin and Marshall (2015).

Gastropod identification is made by observing morphological characteristics such as shell shape, shell width, shell length, shell color, apex, whorl, body whorl, siphonal canal, spire, suture, aperture, and columella. After being identified, the sample is measured using a vernier caliper, taken using a digital camera, and then stored again in a collection bottle. The data obtained will be analyzed by describing the morphological characteristics based on the reference book.

Study of area

Determination of the observation station based on differences in land use. A complete description of the sampling station shown in Figure 1 and table 1.

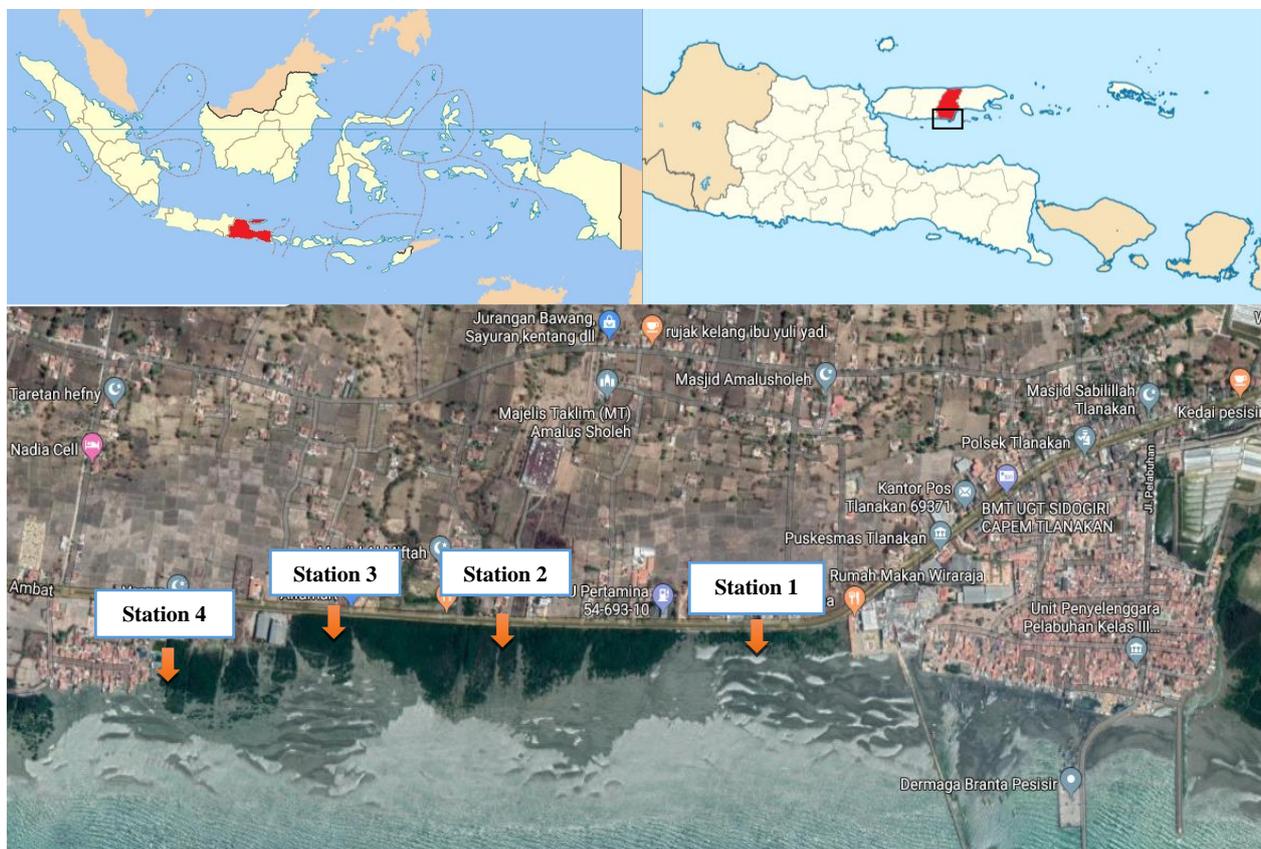


Figure 1. Map of sampling location in Pamekasan District, Madura Island, East Java Province, Indonesia (above); and map of the South Coast of Pamekasan, showing the location of sampling stations (below). Note: Arrows indicated sampling locations.

Table 1. Coordinates, type of substrates, type of mangrove vegetation and description of the sampling station

Station name	Coordinates	Substrates type	Vegetation	Description
Station 1	7°13'16.2"S 113°26'35.6"E	Sandy mud	<i>Rhizophora</i> (stake)	Close to the salt warehouse, a newly planted mangrove area
Station 2	7°13'15.7"S 113°26'24.0"E	Sandy mud	<i>Rhizophora</i> , <i>Avicennia</i>	It is a river mouth, close to the rest area and gas station
Station 3	7°13'15.9"S 113°26'01.6"E	Mud	<i>Rhizophora</i> , <i>Avicennia</i> , <i>Bruguiera</i>	River mouth
Station 4	7°13'19.2"S 113°25'49.6"E	Sandy mud	<i>Rhizophora</i> (tree)	Close to residential areas

RESULTS AND DISCUSSION

Mangrove snails found at the study site

In this study, we found a total of 10 families (Table 2) consist of Assimineidae, Cerithiidae, Ellobiidae, Littorinidae, Muricidae, Neritidae, Olividae, Planaxidae, Potamididae, and Trochidae with consist of 15 Genera, i.e., *Assimineia*, *Clypeomorus*, *Cerithium*, *Rhinoclavis*, *Laemodonta*, *Littorarina*, *Tenguella*, *Semiricinula*, *Nerita*, *Clithon*, *Oliva*, *Planaxis*, *Pirenella*, *Telescopium*, and *Monodonta*. A total of 7 genera were found in station 1 (*Clypeomorus*, *Littorarina*, *Semiricinula*, *Nerita*, *Clithon*, *Oliva*, and *Telescopium*). Total of 13 Genera found in station 2 (*Assimineia*, *Clypeomorus*, *Cerithium*, *Rhinoclavis*, *Laemodonta*, *Littorarina*, *Tenguella*, *Nerita*, *Clithon*, *Planaxis*, *Pirenella*, *Telescopium*, and *Monodonta*). Total of 13 Genera found in station 3 (*Assimineia*, *Clypeomorus*, *Rhinoclavis*, *Laemodonta*, *Littorarina*, *Semiricinula*, *Tenguella*, *Nerita*, *Clithon*, *Oliva*, *Planaxis*, *Pirenella*, and *Telescopium*). Total of 9 Genera found in station 4 (*Assimineia*, *Clypeomorus*, *Cerithium*, *Littorarina*, *Semiricinula*, *Nerita*, *Clithon*, *Pirenella*, and *Monodonta*).

In this study, species richness of gastropods inhabiting mangrove forest in station 2 (13 genera) and Station 3 (13 genera) is highest and lowest in Station 1 (7 genera).

We found the highest family richness of gastropods from collections on vegetation such as on vegetation of *Rhizophora*, *Bruguiera*, and *Avicennia* in leaves, stem, branches, and roots. In this study, the family of *Neritidae* was found at almost all stations. The second highest is *Cerithiida*.

The checklist

Family of Assimineidae

Assimineia Figure 2.A (Zvonareva and Kantor 2016: 409, Figure 7G-H). *Assimineia* is one of the most abundant and representative benthic invertebrates (Suzuki et al. 2002). They are gastropods in the family Assimineids (Zvonareva and Kantor 2016). In this study, they commonly found on mud bottom of the lower estuarine mangals and also on mud surface under mangrove trees. Average shell length ranged from 4.73 to 5.74 mm, and size structures showed different patterns among the stations (Suzuki et al. 2002). In this study, they commonly found in the coastal mudflat near the mangrove tree of *Avicennia alba*.

Family of Cerithiidae

Clypeomorus 1 Figure 2.C (Zvonareva and Kantor 2016: 409, Figure 7E-F). *Clypeomorus* 2 Figure 2G (Zvonareva and Kantor 2016: 409, Figure 7A-B). *Clypeomorus* are epifaunal species in intertidal, estuarine, mangrove habitats, on the muddy or sandy substrate between pneumatophores of *Avicennia* and bare mud in near of the mangrove fringe. All the recorded *Clypeomorus*

are common in shallow water and intertidal areas, and they are herbivores (Soekendarsi 2019). In this study, this genus found in the mangrove habitat of *Avicennia*. Deposit feeder lives in areas of high organic content. Stomach contents consist of microalgae, filamentous algae, macroalgae, vascular plant material, and diatoms comprising detritus in this habitat (Houbrick 1992).

Cerithium Figure 2.L (Zvonareva and Kantor 2016: 409, Figure 7I-J). Published study (Sun and Zhang 2014) describes that this snail has an elongated shell, turreted, comprising about 11 straight-sided whorls. Shell up to 25.82 mm in length and 9.42 mm in width. Protoconch and sharp apex commonly eroded. Early teleoconch elongate, sculptured with two spiral cords gradually becoming bearded. Adult teleoconch whorls sculptured with three major distinct beaded spiral cords. Beads on spirals aligned with axial ribs. Former varices randomly distributed. Axial ribs are usually indistinct. Suture clear, impressed. Body whorl sculptured with six or seven spiral cords, and the three posteriors beaded. Distinct varix opposite outer lip of aperture. Aperture fusiform, narrow. Columella concave with moderate callus and columellar lip. Anterior siphonal canal short, broad, slightly reflected. Anal canal clear, flanked by distinct parietal columella callus and tooth. Outer lip thick at the edge, crenulate, and with inner elongate denticles and a wide posterior sinus. Shell color black to light grey, sometimes with whitish stripes. Outer lip sometimes white. Operculum light brown, thin, corneous, and ovate with an eccentric nucleus.

In studied sites, it was found on mud under mangrove trees. They commonly found on intertidal mudflats from mid to low tide level, and beneath mangrove trees in non-drying puddles, in coastal estuarine mangroves (Zvonareva and Kantor 2016). Often co-occurs with *Pirenella cingulate* (Reid and Ozawa 2016). Development with the planktonic phase of 10 to 12 days (Ozawa et al. 2015).

Table 2. This type of mangrove snail was found at four research stations

Family	Genus	Station			
		1	2	3	4
Assimineidae	<i>Assimineia</i>	-	+	+	+
Cerithiidae	<i>Clypeomorus</i> 1	+	+	+	+
	<i>Clypeomorus</i> 2	+	+	+	+
	<i>Cerithium</i>	-	+	-	+
	<i>Parvanachis</i>	-	+	+	-
Ellobiidae	<i>Laemodonta</i>	-	+	+	-
Littorinidae	<i>Littoraria</i>	+	+	+	+
Muricidae	<i>Tenguella</i>	+	-	+	+
	<i>Semiricinula</i>	-	+	+	-
Neritidae	<i>Nerita</i>	+	+	+	+
	<i>Clithon</i>	+	+	+	+
Olividae	<i>Oliva</i>	+	-	+	-
Planaxidae	<i>Planaxis</i>	-	+	+	-
Potamididae	<i>Pirenella</i>	-	+	+	+
	<i>Telescopium</i>	+	+	+	-
Trochidae	<i>Monodonta</i>	-	+	-	+

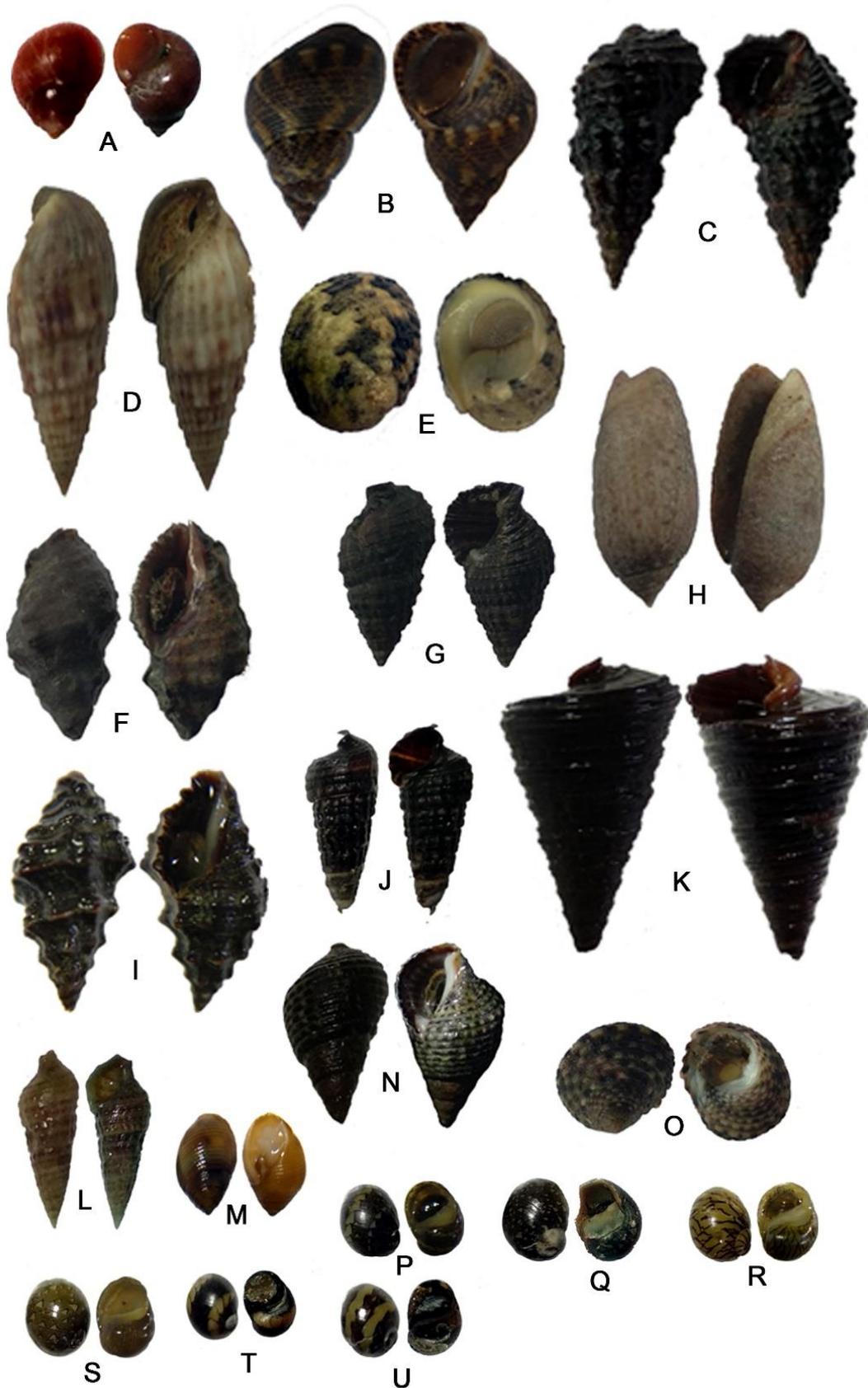


Figure 2. Mangrove snail in South Coast of Pamekasan-East Java. A. *Assiminea* (3mm); B. *Littoraria* (17mm); C. *Clypeomorus 1* (26mm); D. *Parvanachis* (29mm); E. *Nerita*; F. *Tenguella* (19mm); G. *Clypeomorus 2* (14mm); H. *Oliva* (23mm); I. *Semiricinula* (24mm); J. *Pirenella* (13mm); K. *Telescopium* (43mm); L. *Cerithium* (12mm); M. *Laemodonta* (3mm); N. *Planaxis* (16mm); O. *Monodonta* (12mm); P-U. *Clithon* (3mm)

Rhinoclavis Figure 2.D (Okutani 2000: 120-121, Figure 36; Zvonareva and Kantor 2016: 409, Figure 7K-L). *Rhinoclavis* are deposit-feeding gastropods in coral-reef-flat sediments. According to a published article (Janssen et al. 2011), the habitat of *Rhinoclavis* is Sand between coral patches and sand with seagrass, from 1 to 20 m, mostly below 10 m. Some specimens colonized by solitary corals. The Conservative position of corals on the backside of the shells may suggest that the coral colonized the gastropods during the lifetime. Cerithiid gastropods of the genus *Rhinoclavis* are among the most abundant mollusks in sediments at One Tree Reef, on the southern Great Barrier Reef. They herbivores snail (Soekendarsi 2019). Despite being microphages deposit-feeders, these snails reach their greatest abundances in coarse, sandy sediments on a shallow, subtidal sandflat, a habitat usually considered to be a typical for deposit-feeding infauna.

Family of Ellobiidae

Laemodonta Figure 2.M (Okutani 2000: 816-819, figure 11; Poppe 2010: 452, figure 5; Zvonareva and Kantor 2016: 409, figure 8W-X). This snail commonly found in estuaries in mangrove areas and under rotting wood in salt marshes (both in the tidal zone and above usual high tide mark) (Zvonareva and Kantor, 2016). In the study, it was found on mud surface under mangrove trees. All of the Ellobiidae are air-breathing and hermaphroditic snails. The shell of one species (*Laemodonta punctatostriata*, 5 mm) is distinctive in having spiral rows of tiny pits on the shell (hence its Latin name); They can be seen grazing algae on dead logs and stiff mud on the mangrove floor during daytime low tides; Its close relative, *L. siamensis*, is a slightly larger species (7-8 mm) that is common on soft wet mud (Ng and Sivasothi 2002).

Family of Littorinidae

Littoraria Figure 2.B (Zvonareva et al. 2015: 8, Figure 4C; Zvonareva and Kantor 2016: 409, Figure 6W-X). The previous study describes that *Littoraria* includes to ovoviviparous animal base on the reproductive apparatus, between the size of the oviduct and prostate concerning the shell height is a positive correlation (Zeidan et al. 2019). In studied sites, it was found on trunks and roots of mature *Rhizophora* trees. *Littoraria* predominantly mangrove-associated and typically life on trunks and roots throughout *Rhizophora* forest, occasionally on other trees (0.3-2 m above the ground) (Zvonareva and Kantor 2016). Rather common on sheltered rocks (Reid and Ozawa 2016). The general distribution of this genus is throughout the tropical and subtropical Indo-Pacific (Reid and Ozawa 2016). The external morphology of the shell presented typical turbinate shape, with fine texture, but robust and with a sharp vertex. Color polymorphism was observed, including beige, brown, yellow-orange, and purple, with dark brown predominating (Zeidan et al. 2019).

Family of Muricidae

Tenguella Figure 2.F (Zvonareva et al. 2015: 9; Zvonareva and Kantor 2016: 409, Figure 8C-D). The

muricid whelk *Tenguella* is common on the low and mid intertidal rocky shores (Wright et al. 2018). The distribution and abundance of this genus are patchy and variable within and among shores. Significant influences on its distribution and abundance include emersion, wave exposure, competitor abundance, and the availability of suitable prey species. *Tenguella marginalba* has been found on areas of the shore with strong wave exposure, and favor the edges of rock pools and crevices (Coulson et al. 2011). Muricidae dwells on bare mud bottom associated with outer to mid estuarine mangroves (Lozouet and Plaziat 2008). Appears to be generally rare over its wide range (Reid and Ozawa 2016). In studied sites, it was found on the mud surface under mangrove trees and roots.

Semiricinula Figure 2.I (Tan and Liu 2001: 1279, Figure 1E-F). *Semiricinula* snail belongs to the neogastropod family Muricidae includes a diverse set of radular bauplan, including a beaked, three-dimensional form, a flattened-pentacusped form, and a third "dagger" type in which the central rachidian cusp is massive and elongate (Herbert et al. 2007). The published study about describes that *Semiricinula* neither pose bisulcate transverse groove nor the revolving raised ridges of small nodules equidistantly on the body whorl; Spire made up of 4-5 angulated whorls, body whorls with two spiral rows of compressed tubercles (9-11 in numbers), and two rows of indistinct ridges, anal sulcus broad inverted 'U' shape margined by a ridge; Inside of outer lip with 4-8 strong ridges, generally, six, arranged in pairs. Anterior canal short and broadly open; Colour: Light brown, interior white, dark blotches on columella; A deep 'V' shape notch between inner lateral denticle and the central cusp of radula; The central cusp pointed and slightly curved towards the right side; Six small pointed denticles between marginal and lateral cusp (Kumar et al. 2017). They commonly found in Intertidal rocky bottom or coral reef because they are Scavenger (Okutani 2000). In studied sites, it was found on rocks in the lowest part of the intertidal zone.

Family of Neritidae

Nerita Figure 2.E (Tan and Clements 2008:484, Fig. 2.11-12; Vermeij et al. 2009: 65, fig 7-8). *Nerita* included to family Neritidae. They are small to medium-sized euryhaline gastropods widely distributed from marine to freshwater habitats (Tudu et al. 2017). They are herbivores inhabiting in the middle to upper intertidal zones. Shells are low spired with a swollen last whorl and D-shaped calcareous operculum. The heavy shell is to resist desiccation and to protect from predators. *Nerita* snail grows up to 10 mm and ecological notes that they developed with free-swimming veliger (Fukumori and Kano 2014). They found in estuaries, which does not extend to low salinity estuarine upper reach (Fukumori and Kano 2014). In this study, we found this snail on the sediment surface in the upper intertidal zone.

Clithon 1 Figure 2.P-U (Zvonareva et al. 2015: 8, Figure 3(6); Zvonareva and Kantor 2016: 409, Figure 3M-N; Baharuddin et al. 2019: 1148, Figure 3(22)). These

snails are euryhaline; the genus *Clithon* prefers to live in estuarine and tasteless waters. They have a geographical distribution in Indo-Pacific waters (Abdou et al. 2015). At present, it is known that as many as 11 types of *Clithon* are found in Java (Mujiono 2016). Most of its members (6 types) do not have thorns on the shell and have a serrated groove on the column, whereas in group 2, all members have spines on the shell and do not have a groove on the column. All members have a slanted crescent-shaped mouth. Meanwhile, all members of group 2 have the last threads that are bulging and have shoulder shells. One function of the thorn in the conch shell is for the defense system. With thorns in the shell, it can make it difficult for snail predators such as fish to eat it. *Clithon* found in several habitats such as large rocky substrates, sandy, and soil that have a water temperature of 26°C, a water pH of 7.4 (Suratno et al. 2020). *Clithon bicolor* is a type of snail that has the most extensive distribution, which can be found in 4 of 6 provinces in Java, and Banten Province has the highest number of snail species, 10 species, and then West Java has 9 species (Suratno et al. 2020). Young snails that live in calm waters, sometimes their shells have thorns, whereas, in adult snails that live in fast-flowing waters, these thorns can reduce or disappear. The absence of thorns, in this case, is related to defense against the water flow, the loss of thorns on the shell can reduce the power of water flow so that the chance of being carried away by the water is getting smaller.

Family of Olividae

Oliva Figure 2.H (Voskuil 2018: 40, Figure 50). *Oliva* shell is subcylindrical, convolute, smooth; spire short, sutures channeled. Aperture narrow, longitudinal, and notched at the base. The columella is obliquely striated. No operculum. *Oliva* is very smooth shells, shining, and prettily colored, and have no epidermis. They are distinguished from several characters, i.e., the cylindrical cone, a channel which separated the whorls of the spire, and the striae on the columella; from volute and Mitra, by the spiral whorls of those shells being separated by simple unchanneled suture. The *Oliva* is further distinguished by a prominent callus at the upper extremity of the columellar lip, which assist in forming the channel of the spire. At the base of the columella, some vestiges of the very oblique callus of the Ancillariae appear, but those shells never have their suture channeled, nor a striated columella. Species of the Olividae genus *Agaronia*, are characterized by their smooth elongate fusiform shell with a broad, glossy fasciola band at the anterior part of the body whorl that usually extends to over half the aperture height (Tan et al. 2019).

The shells of the olive are rolled around the longitudinal axis, leaving a void space at the place of the axis, and the last whorl so envelopes the rest, that only their upper portion is visible, and consequently the spire is concise. The shell appears to be formed of two separated layers of testaceous matter, like that of the *Cypaea*, for if we remove the exterior layer, we generally find the one beneath of a different color. Some 20 living species and subspecies are

distributed in tropical and subtropical regions worldwide (Cilia 2012).

Family of Planaxidae

Planaxis Figure 2.N (Zvonareva et al. 2015: 8; Zvonareva and Kantor 2016: 409, Figure 4Q-R). *Planaxis* are epifaunal species in intertidal, estuarine, mangrove habitats, on muddy or sandy substratum between pneumatophores of *Avicennia* and on bare mud in front of the mangrove fringe. They are deposit feeder, lives in areas of high organic content. *Planaxis* usually live on the beach, where muddy rock substrates are an ideal habitat for *Planaxis*, so that these species can live in groups in large numbers (Pratama et al. 2011). A published study describes that the stomach of *Planaxis* contents consists of microalgae, filamentous algae, macroalgae, vascular plant material, and diatoms comprising detritus in this habitat (Houbrick 1992). The presence of mangroves is a critical factor in the distribution of this species. In studied sites, this genus was found on mud surface between pneumatophores of *Avicennia* and *Rhizophora* as well and on the sandbanks in mangrove stands.

Family of Potamididae

Pirenella Figure 2.J (Reid and Ozawa 2016: 30-35, Figures 1, 2G, H, 4I, 10, 11A; Zvonareva and Kantor 2016: 413, Fig. 5C-D). Members of the genus *Pirenella* are abundant inhabitants of intertidal sedimentary shores, often found in association with mangroves, on the continental margins of the western Pacific and Indian Oceans, and the eastern Mediterranean Sea. *Pirenella* has attracted some attention as an inhabitant of extreme environments, from brackish estuaries to hypersaline lagoons and inland lakes. Shell: moderate size (to 54 mm); elongate; conical, fusiform, or pupiform. Sculpture of 3 spiral cords on spire whorls (another partly visible in suture) and numerous axial ribs; varices may be present on spire whorls; no columella fold; ventrolateral varix usually present (occasionally absent); aperture slightly to strongly flared and thickened, peristome weakly sinuous or planar, weak or strong basal projection of outer lip defining anterior canal, posterior canal sometimes forming wing-like projection; Radula: rachidian tooth broad, with 7-13 pointed cusps; lateral tooth with a delicate lateral extension (Reid and Ozawa. 2016). *Pirenella* was found on mud and sandstones with algal associations in the upper intertidal and mid-intertidal zones in mangrove plantation as well as in natural mangroves (Solanki et al. 2017). They like to prefer muddy habitat generally, but, during and summer, the monsoon mud was restricted to mangrove roots, so these snails were observed at the base of the mangroves (Shukla 2014).

Telescopium Figure 2.K (Strong et al. 2011: 46, figure 1L). Mangrove snails (*Telescopium*) live in brackish water on a muddy base substrate and are affected by tides (Radjasa et al. 2012). *Telescopium* has a thick, cone-shaped and striped shell; a blackish shell color, murky brown and there is also a purplish-brown; It has a range of 75-110 mm in length and 17-47 mm in width; the conch shell is conical, long, slender, and somewhat horizontal at the bottom (Adriman et al. 2020). The color of the shell is

murky brown, purplish brown, and blackish brown, the outer layer of the shell is equipped with a very tight spiral line and has a curved inward path. The length of the shell ranges from 7.5-11 cm. The size of a standard adult shell can reach 90-100 mm in size, but according to (Houbrick, 1992), the conch shell can reach 130 mm.

This organism is generally found under mangrove trees with mud substrate and found in groups. Currents and tidal waves do not readily carry this organism. *T. telescopium* has a thick shell structure that is useful for reducing evaporation so that it can adapt to high temperatures and is not quickly carried by currents and tidal waves.

Family of Trochidae

Monodonta Figure 2.O (Zvonareva et al. 2015: 8; Zvonareva and Kantor 2016: 409, Figure 2B-C). Morphologically, this species is characterized by a highly pointed apex and prominent granules on the spiral ribs. Shell color is highly variable, with a typically yellowish brown, greenish, or reddish background (Zhao et al. 2019). Found on sediment surface in the mid intertidal zone. *Monodonta* (Gastropoda: Trochidae) is a herbivorous snail that grazes on microalgae. Published study (Periyasamy et al. 2012) describes that *Monodonta* snail has the size of the shell varies between 15 mm and 43 mm; Generally, it is heavy and thick and has an elongate-conical shape. It is whitish, tinged with grey, yellowish or greenish, spirally traversed by bands composed of alternating white and black purplish or red spots. The aperture is very oblique. The thick, smooth outer lip is beveled to an edge. It is pearly and iridescent within. The *Columella* is flattened on the face, bluntly lobed within, pearly, backed by an opaque white layer (Donald et al. 2012).

Discussion

Based on the diversity of genera found at the study site, we assume that the study site has rich mangrove snail even though the area of studied mangroves is small. For relative species diversity evaluation, we attempt to compare with published data. Comparison of relative richness and abundance of mollusks with other regional faunas is complicated due to several factors, some of which are difficult to evaluate. The most challenging factor in assessing was the completeness of the mangrove snail survey. We assume that there are still many snails that have not been surveyed at the location. Completeness surveys depending both on sampling effort and sampling methods such as quantitative and semi-quantitative methods (Sri-roon et al. 2005). Sampling methods are designed to match the aim of a given study. Thus it is inappropriate to compare species numbers from faunistic studies with numbers obtained (Hong 2004). Unfortunately, the published accounts do not always describe the methods of collecting in detail, thus complicating direct comparison.

In this study, we found a total of 10 families (Table 2) consist of Assimineidae, Cerithiidae, Ellobiidae, Littorinidae, Muricidae, Neritidae, Olividae, Planaxidae, Potamididae, and Trochidae with consist of 15 genus, i.e., *Assimineae*, *Clypeomorus*, *Cerithium*, *Rhinoclavis*, *Laemodonta*, *Littorarina*, *Tenguella*, *Semiricinula*, *Nerita*,

Clithon, *Oliva*, *Planaxis*, *Pirenella*, *Telescopium*, and *Monodonta*. The most common substrate where mangrove snails were found was rocks, sandy, and around the tree and roots of mangrove. All gastropods in this study found alive during our surveys and predominantly mangrove associated.

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