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Preliminary checklist of marine invertebrate fauna within the intertidal of Teluk Penyabong and Teluk Gorek, Mersing, Johor, Malaysia

(Senarai Semak Awal Fauna Invertebrat Marin di Kawasan Pasang Surut Teluk Penyabong dan Teluk Gorek, Mersing, Johor, Malaysia)

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ABSTRACT

Study on the biodiversity and distribution of marine invertebrate fauna within the intertidal areas of Teluk Penyabung and Teluk Gorek, Mersing has been conducted from July 4th to 9th, 2010. Field sampling was carried out using a transect line method, during the low tide period. The transect line was laid down along the tidal height, perpendicularly to the shoreline. All marine invertebrates encountered within 1 m areas of the line were recorded. Species that could not be identified on site were taken and preserved in 5% formalin for further analysis and identification. Results showed that mollusk was the most dominant phyla, followed by the crustaceans and other organisms. Among the mollusks, the Littorinidae, Neritidae, Muricidae and Patellidae was the most common and can be found in all stations. Within the crustaceans the fiddler crab (Ocypodidae) and tree climbing crab (Sesarmidae) was the most common. In areas with hard substrates, the acorn barnacles (Chthamalidae) were also found abundant. In this paper the biodiversity and distributional pattern of marine invertebrate fauna within the intertidal areas of the study sites were documented and discussed.

Keywords: Biodiversity, marine invertebrates, intertidal, distribution, mollusk, crustacea

ABSTRAK

Kajian biodiversiti dan taburan fauna invertebrat marin di kawasan pasang surut Teluk Penyabung dan Teluk Gorek, Mersing telah dijalankan dari 4 hingga 9 Julai, 2010. Pensampelan di lapangan telah dijalankan dengan menggunakan kaedah garis transek, semasa tempoh air surut. Garis transek tersebut telah diletakkan merentasi ketinggian kawasan pasang surut, berserenjang dengan garis pantai. Semua invertebrata marin yang dijumpai dalam rangkuman satu (1) m kawasan garis tersebut direkodkan. Spesies yang tidak dapat dikenal pasti di lapangan diambil dan diawet dalam 5% formalin untuk pengenalan dan analisis lanjut. Hasil kajian menunjukkan bahawa moluska adalah filum yang paling dominan, diikuti dengan krustasia dan organisma lain. Dikalangan moluska, Littorinidae, Neritidae, Muricidae dan Patellidae adalah yang paling biasa dijumpai dan hadir di semua stesen. Dikalangan krustasia ketam Uca (Ocypodidae) dan ketam memanjat pokok (Sesarmidae) adalah yang paling biasa dijumpai. Di kawasan yang mempunyai substrat keras, teritip (Chthamalidae) juga dijumpai dengan banyaknya. Dalam penulisan ini, biodiversiti dan corak taburan fauna invertebrat marin di kawasan pasang surut lokasi kajian telah didokumenkan dan dibincangkan.

Katakunci: Biodiversiti, invertebrat marin, pasang-surut, taburan, molluska, krustasia.

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INTRODUCTION

Mersing is a district on the northeastern part of Johor, with an area of 2,836 km^2, and is the third largest district in Johor. The district is bordered by Pahang to the northwest, Segamat District to the west, Kluang District to the southwest, Kota Tinggi District to the south, and the South China Sea to the east. Mersing is traditionally a fishing village, has an extensive coastline with many small offshore islands. The coastal areas have many unique habitats such as mangrove, estuaries, mud flat, sand flat, rocky shores, and seagrass beds. The mangrove forest in Teluk Gorek, Teluk Sari, Teluk Sisek, Tanjung Penyabong, Sg Puchong, Sg Mawar, Sg Sisek, Sg Endau are indeed very rich in biodiversity and should be conserve (Wan-Juliana et al. 2010).

The tides along the Mersing coast are a mixture of semi-diurnal and diurnal tides. Tidal characteristic vary at minimum, with average tidal range of approximately 1.9 m (Anonymous 2010). The coastal current are highly influenced by the prevailing monsoon seasons, similar to other area on east coast of Malaysia, running strongly north along the coast during south-western monsoon and south during north-east monsoon (Morton & Blackmore 2001). Mersing shoreline is however relatively protected by string of small offshore islands such as the Tioman Island and the Seribuat - Besar Islands, which might contribute to the shoreline characteristics and habitat richness along the coast. Initial surveys found that the beach and mudflat area generally has a shallow slope, with vast intertidal zone. There are plentiful of marine resources where locals frequently collecting shells such as the bamboo shell (Solenidae), the venus clam (Veneridae) and other fishery resources during low tides. Studies by Muda et al. (2010) found the coastal waters were very rich in epibenthic marine fauna community such as shrimps, crabs and lobsters. Samat et al. (2010) recorded more than 62 species of marine fishes from the coastal area.

Mersing is the main gateway to many island resorts which attracted tourists from all over the world and now is fast developing. There are many development projects, both from the government as well as private sectors, currently in the pipeline. Among the big project include coastal development and reclamation activities, which unfortunately might have adverse impact on the flora and fauna along the coasts. Currently there is not much scientific or taxonomic information regarding the marine invertebrate community along the Mersing coast available in the literatures. Within the east coast of Peninsular Malaysia studies are more concentrated on the corals and other marine life and habitats of the offshore resort islands. The coastal areas seem to be ignored. The main objective of the present study is to document the biodiversity of macroinvertebrate fauna along the coastline of Mersing. As was mentioned earlier Mersing has an extensive length of coastline, thus more studies will follow suit. This preliminary survey hopefully will entice more detailed scientific study particularly in Mersing, as well as other areas along the east coast of Peninsular Malaysia.

MATERIALS AND METHODS

The field sampling was conducted at two main sites along the Mersing coast, namely Tanjung Penyabong and Teluk Gorek (Figure 1). Both areas were characterized by patches of mangroves and areas of rocky shores and sand flat. Field sampling was carried out using a transect line method, during the low tide period. The transect line was laid down along the

tidal height, perpendicularly to the shoreline. Sampling was conducted for 6 days, from 3 to 9 July, 2010, during the EKOMAR (Marine Ecosystem Research Center, Universiti Kebangsaan Malaysia) Scientific Expedition. The macroinvertebrates within the mangrove floor, rocky shores and other habitats were collected. All invertebrates encountered were identified and sample specimens were brought back to the Ecology Laboratory in Universiti Kebangsaan Malaysia to facilitate further taxonomic identification and analysis.

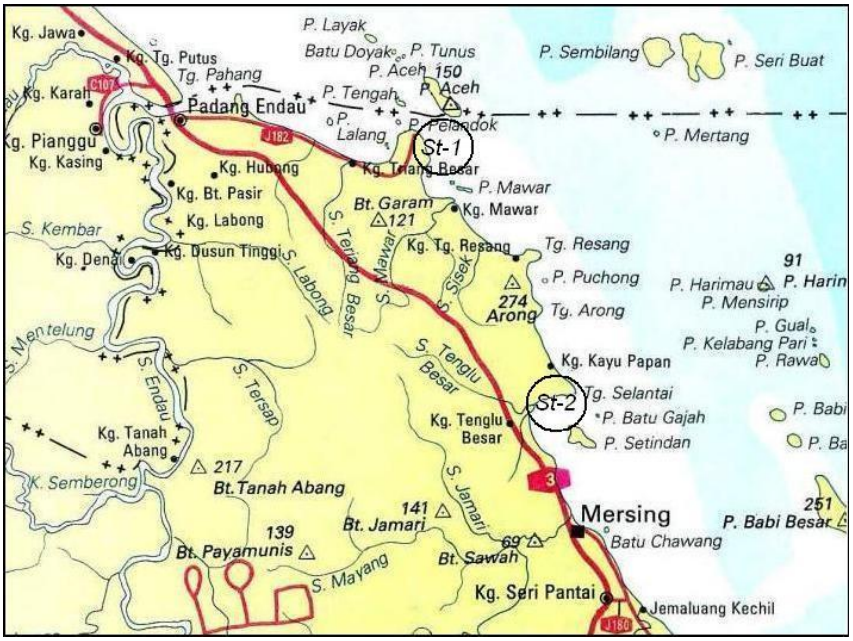

Figure 1. The study sites: Teluk Penyabong (St-1) and Teluk Gorek (St-2).

RESULTS AND DISCUSSION

A total of 62 macroinvertebrate species has been sampled and identified during the survey. Mollusk was the most abundant phyla (76%), followed by the marine arthropods (24%). Within the mollusk, the class Gastropoda was more dominant where 35 species have been sampled, followed by the bivalves with 12 species. Most of the macroinvertebrates were sampled from the mangroves compared with rocky shores and other coastal habitat, and gastropods were very dominant in this habitat. Indeed, gastropods are among the most dominant macroinvertebrate fauna in many Malaysian mangrove ecosystems (Sasekumar 1974, 1999, Saberi et al. 1993, Cob et al. 2004). The number of gastropod species sampled during the survey was considerably high when compared with other studies in Malaysian mangroves. For example Cob et al. (2004) recorded a total of 38 gastropod species from 12 different families in their survey at Sungai Pulai mangrove, only slightly higher than the present study. Study by Sasekumar (1999) on the other hand recorded only 20 gastropods species from the same Sungai Pulai mangrove, and only 18 species from the Benut mangrove, and overall 28 species from the Johor mangroves combined. In his other study at Kapar mangrove, Selangor, 26 gastropod species has been sampled (Sasekumar 1974). Saberi et al. (1993) reported only 14 gastropod species from Sepang mangrove, Selangor.

The Gastropods

Among the gastropods, the littorinid mollusks were one of the most diverse and most common groups. Littorinid comprised of small marine gastropod mollusks from the family Littorinidae, which was generally known as the winkles or periwinkles. These air breathing snails live in the tidal zone of rocky shores, actively grazing on the mat of algae and bacterial film on the substratum surfaces. Other important group sampled from the study area is the Neogastropoda, from the family Muricidae. They are a group of very efficient predatory mollusks that preyed on barnacles, mollusks and other small organisms. They are euryhaline species and can be found in most of the intertidal environment, which include the mangroves, the rocky shores, and in mud flat and sandy areas. Five muricid species has been sampled in this study, which consists of common muricid species present in Malaysian coastal areas.

Other gastropod sampled was the cerith snails. This is a group of deposit feeders and grazers that live on the sand and mud bottom (e.g. *Cerithidea djadjariensis*, *Rhinoclavis sordidula* and *Cerithium lifuense*), and can also be found up on the mangrove trees (e.g. *Cerithidea cingulata* and *Clypeomorus bifasciata*). They often occured in large numbers along the tidal creeks and streams within the mangroves, sometimes together with the batillarid snail, *Batillaria zonalis*. A total of five different cerith species have been sampled from the study area, and all were from the mangrove habitat. The economically important cerith snail such as the *Cerithidea obtusa* or locally known as 'siput sedut' was not found in the study area.

Nerita is other common and abundant macroinvertebrates of the intertidal areas of Malaysian waters. There are about 19 different *Nerita* species reported from Malaysia and Singapore waters (Tan & Clements 2008). In this study five species of *Nerita* snails have successfully been sampled. They were abundant in both the mangrove and the rocky shores. *Nerita* is a group of herbivorous mollusks. They usually inhabit the middle to upper intertidal zones, and usually present in large numbers, and with some degree of gregariousness (Tan & Clements 2008). Higher number of Neritidae might occur in Mersing coastal areas.

Other common snails of the Mersing intertidal areas are the scavenging mud snail from the family Nassaridae. Two species of nassariid snail were sampled during the survey i.e. *Nassarius jacksonianus* and *Nassarius livescens*. They were sampled from the mangrove and mud flat areas. When inactive, the nassariid normally bury themselves in sand with only their siphon out. They are scavengers and have quite well developed olfactory sense. As soon as carrion or food detected, they immediately rush towards it in groups (Morton et al. 1995).

The Bivalves

A total of 12 bivalve species were sampled in this survey. There were four species of Veneridae (venus clam), two species of Psammobiidae (sunset clams), two species of Ostreidae (oysters), and one species each from the family Mytilidae (mussel), Isognomonidae (leaf oyster), Donacidae (wedge shells) and Mactridae (surf or trough clam). The bivalves sampled include some commercial species such as the *Meretrix meretrix* and the *Mactra grandis*. Most of the bivalves were sampled from the mangrove and adjacent mud/sand flat areas. The rock oysters, as it was named for, however were more abundant on rocky shores. They formed a thick layer on the lower intertidal zone area. The oysters can also be found cemented on the nearby jetty and mangrove tree trunks.

The number of bivalve species sampled in this study was however lower than expected. Morris & Purchon (1981) in their extensive research on Malaysian bivalves listed 35 species of Veneridae, four Psammobiidae, five Ostreidae, 13 Mytilidae, four Isognomonidae, seven Donacidae and seven Mactridae present in Malaysian coastal waters. The lower species number might be due to the sampling approach adopted where no specific sampling apparatus such as sledge, dredge or grab sampler were employed. Most bivalves live as infaunal organism, thus many species may not be presented in this preliminary survey. The bamboo shell (Solenidae) for example is very common in the muddy sand flat area and was traditionally harvested by the locals (pers. comm.). However not a single individual was found during the random survey.

The Arthropods

Sixteen macroinvertebrates from the phylum Arthropoda were sampled, which was represented by ten species of crabs (Decapoda), four species of barnacles (Cirripedia), one species of hermit crab (Diogenidae) and one species of horse-shoe crab (Xiphosura). The decapod crab such as the *Uca*, was abundant on mangrove floor and sand flat during low tide, at teluk Gorek and Tanjung Penyabong areas. Four species of Uca was sampled, i.e. *Uca annulipes*, *U. forcipata*, *U. perplexa* and one unidentified *Uca* sp. The *Uca* crab intensively feeding during low tide, and quickly retreat into their burrows when approached. Beside the *Uca*, *Dotilla* and *Ilyoplax* were the other species of ocypodid crab sampled.

Other decapod like the tree climbing crabs (sesarmidae) was known as one of the dominant crabs in Malaysian mangroves (Tan & Ng 1994). However during the sampling only one species has successfully been sampled. There are probably few other sesarmid crab species within the area, but was not presented during the short survey. The crabs in general were among the most important and most abundant crustaceans found within the mangroves. It has been reported that six of the 30 families of the brachyuran crab are highly associated with the mangrove ecosystem and these contain some of the most advanced species. Sasekumar (1999) recorded 22 species of crabs during his survey in Johor Mangrove. According to Tan & Ng (1994) there may be as many as 76 species in a single mangrove ecosystem.

Other crustaceans sampled were the barnacles, from the family Balanidae and Chthamalidae, which were abundant mostly on rocks and some on mangrove trunk. *Chthamalus* was more abundant, particularly in upper intertidal areas. Only a few *Balanus* was found, and most of them inhabiting the lower intertidal zone. Clear zonation occurred between these two families where *Chthamalus* was very dominant on upper shore levels, similar to other places in Malaysian coastal waters (Cob et al. 2002).

Other Arthropod sampled is the horse-shoe crab, *Carcinoscorpius rotundicauda*. They were found crawling along the water edge during low tides, in pairs, probably looking for a good spot to lay their eggs. It was the only non-crustacean group of Arthropoda sampled in this study. Horseshoe crabs are actually not really a "crabs," but more closely related to trilobites, and still have some primitive characteristics. There are only four species currently exists and three of them live within the Indo-Pacific region i.e. *Tachypleus gigas*, *Tachypleus tridentatus* and *Carcinoscorpius rotundicauda* (Sekiguchi 1988). This species is currently under treat and listed in the IUCN red list.

The macroinvertebrate fauna sampled from the study sites are as follows:
Bivalves (12 species)

Phylum: Mollusca
Class: Bivalvia
Order: Mytiloidea
Family: Mytilidae
Genus: *Musculista*
Species: *Musculista senhousia* (Benson in Cantor, 1842) (Plate 1-a)
Phylum: Mollusca
Class: Bivalvia
Order: Pterioida
Family: Isognomonidae
Genus: *Isognomon*
Species: *Isognomon epiphium* Linnaeus, 1758 (Plate 1-b)
Phylum: Mollusca
Class: Bivalvia
Order: Ostreoida
Family: Ostreidae (true oysters)
Genus: *Saccostrea*
Species: *Saccostrea cucullata* I. von Born, 1778 (Plate 1-c)
Species: *Saccostrea mordax* Gould, 1850 (Plate 1-d)
Phylum: Mollusca
Class: Bivalvia
Order: Veneroida
Family: Psammobiidae
Genus: *Hiatula*
Species: *Hiatula diphos* Linnaeus, 1771 (Plate 1-e)
Genus: *Asaphis*
Species: *Asaphis violascens* (Forsskål in Niebuhr, 1775) (Plate 1-f)
Phylum: Mollusca
Class: Bivalvia
Order: Veneroida
Family: Donacidae
Genus: *Donax*
Species: *Donax cuneatus* Linnaeus, 1758 (Plate 1-g)
Family: Mactridae
Genus: *Mactra*
Species: *Mactra grandis* Gmelin, 1791.
Family: Veneridae (venus clam)
Genus: *Anomalocardia*
Species: *Anomalocardia squamosa* (Linnaeus 1758) (Plate 1-h)
Genus: *Gafrarium*
Species: *Gafrarium divaricatum* Gmelin, 1791 (Plate 1-i)
Species: *Gafrarium tumidum* Röding, 1798 (Plate 1-j)
Genus: Meretrix
Species: Meretrix meretrix Hewitson, 1876 (Plate 1-k)

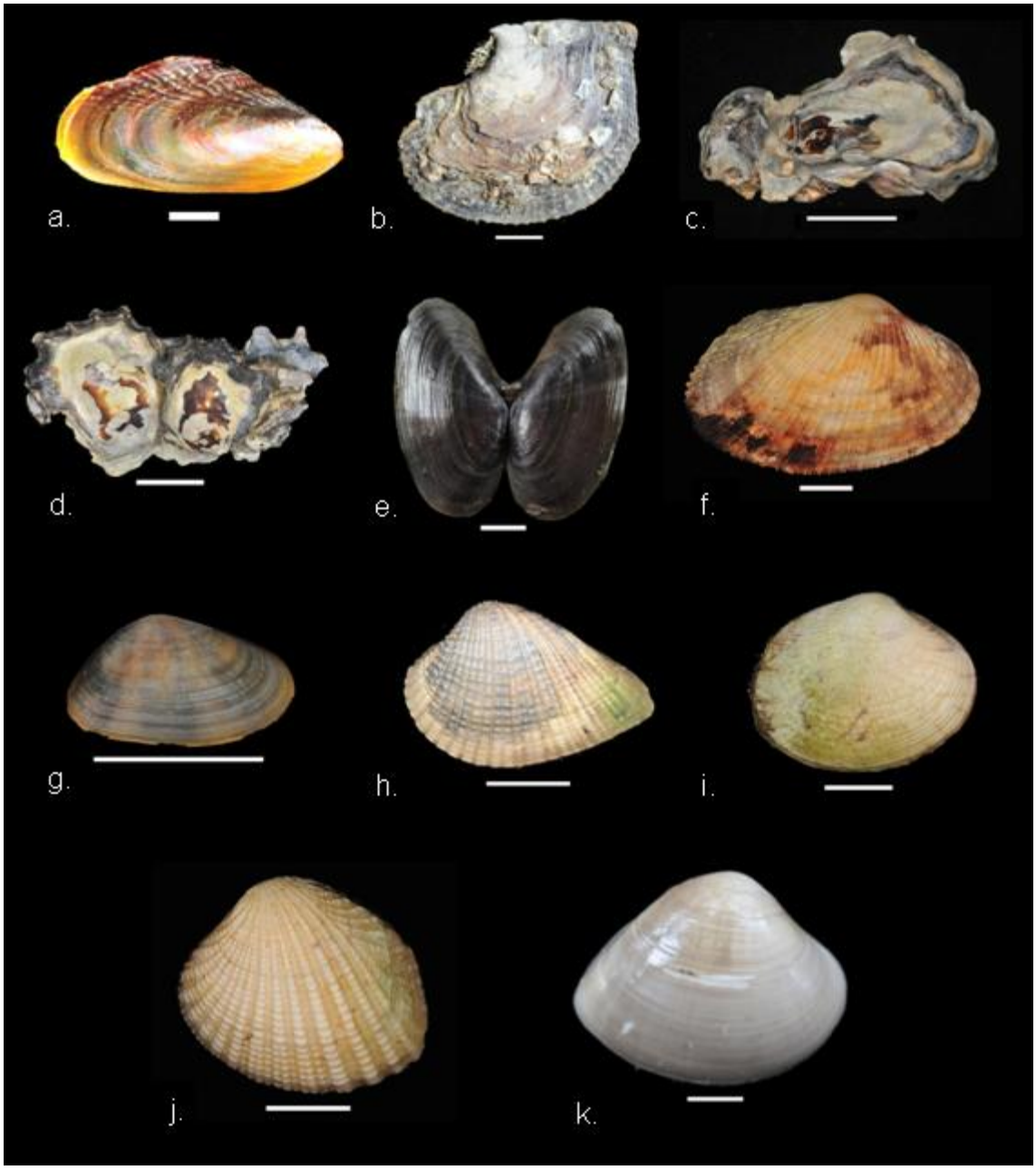

Plate 1. Some of the bivalves sampled: a. *Musculista senhousia;* b. *Isognomon epiphium;* c. *Saccostrea cucullata;* d. *Saccostrea mordax;* e. *Hiatula diphos;* f. *Asaphis violascens;* g. *Donax cuneatus;* h. *Anomalocardia squamosa;* i. *Gafrarium divaricatum;* j. *Gafrarium tumidum;* k. *Meretrix meretrix*. Scale bar = 1 cm, except a. 1 mm.

Gastropoda (35 species)

Phylum: Mollusca
Class: Gastropoda
Order: Caenogastropoda
Family: Assimineidae
Genus: *Assiminea*
Species: *Assiminea brevicula* Pfeiffer, 1854.
Phylum: Mollusca

Class: Gastropoda
Order: Caenogastropoda
Family: Batillaridae
Genus: *Batillaria*
Species: *Batillaria zonalis* Bruguière, 1792 (Plate 2-a)
Phylum: Mollusca
Class: Gastropoda
Order: Caenogastropoda
Family: Cerithiidae
Genus: *Cerithidea* Swainson, 1840
Species: *Cerithidea cingulata* Gmelin, 1791 (Plate 2-b)
Species: *Cerithidea djadjariensis* Martin, 1899 (Plate 2-c)
Genus: *Cerithium* Bruguière, 1789
Species: *Cerithium lifuense* Melvill & Standen, 1895 (Plate 2-d)
Genus: *Rhinoclavis* (Proclava) Thiele, 1929
Species: *Rhinoclavis (Proclava) sordidula* (Gould, 1849).
Genus: *Clypeomorus* Jousseaume, 1888
Species: *Clypeomorus bifasciatus* (Sowerby II, 1855) (Plate 2-e)
Phylum: Mollusca
Class: Gastropoda
Order: Cycloneritimorpha
Family: Neritidae
Genus: *Nerita* Linnaeus, 1758
Species: *Nerita articulata* Gould, 1847 (Plate 2-f)
Species: *Nerita (Argonerita) chamaeleon* Linnaeus, 1758 (Plate 2-g)
Species: *Nerita histrio* Linnaeus, 1758 (Plate 2-h)
Species: *Nerita planospira* Anton, 1839 (Plate 2-i)
Species: *Nerita undata* Linnaeus, 1758 (Plate 2-j)
Phylum: Mollusca
Class: Gastropoda
Order: Littorinimorpha
Family: Cassidae Swainson, W.A., 1832
Genus: *Cassidula*
Species: *Cassidula bisulcata* ("Kuroda, T." Kira, T., 1955) (Plate 2-k)
Family: Littorinidae
Genus: *Echinolittorina* Habe, 1956
Species: *Echinolittorina malaccana* (Philippi, 1847).
Genus: *Littoraria* Griffith & Pidgeon, 1834
Species: *Littoraria angulifera* Lamarck, 1822.
Species: *Littoraria carinifera* Menke, 1830 (Plate 2-l)
Species: *Littoraria melanostoma* (Gray, 1839).
Species: *Littoraria pallescens* Philippi, 1846.
Species: *Littoraria scabra* Philippi, 1847 (Plate 2-m)
Family: Naticidae
Genus: *Tectonatica* Sacco, 1890
Species: *Tectonatica tigrina* Roding, 1798 (Plate 2-n)
Family: Strombidae

Genus: *Strombus* Linnaeus, 1758

Species: *Strombus canarium* Linnaeus 1758.

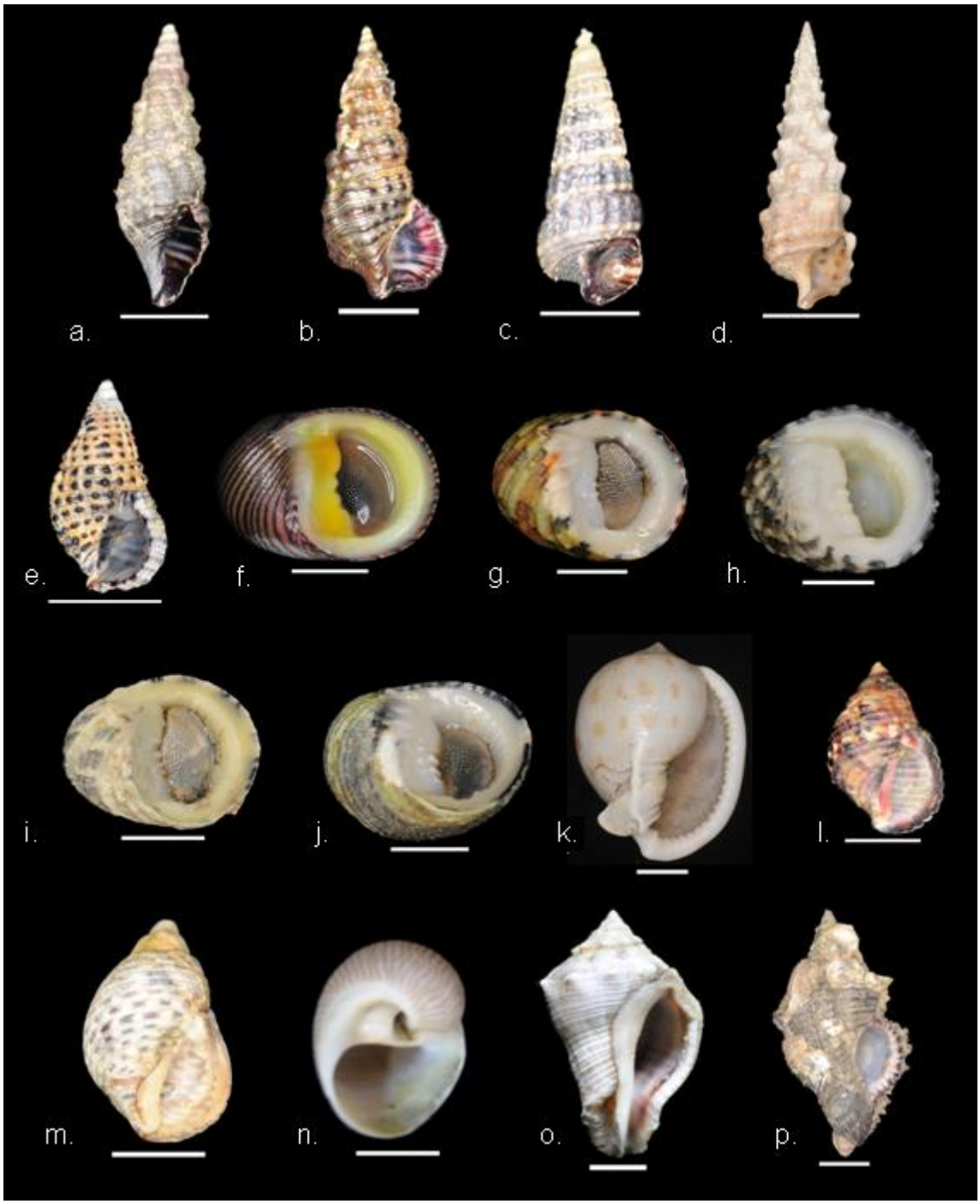

Plate 2. The Gastropoda sampled from the study site: a. *Batillaria zonalis*; b. *Cerithidea cingulata*; c. *Cerithidea djadjariensis*; d. *Cerithium lifuense*; e. *Clypeomorus bifasciatus*; f. *Nerita articulata*; g. *Nerita chamaeleon*; h. *Nerita histrio*; i. *Nerita planospira*; j. *Nerita undata*; k. *Cassidula bisulcata*; l. *Littoraria carinifera*; m. *Littoraria scabra*; n. *Tectonatica tigrina*; o. *Volema myristica*; p. *Chicoreus capucinus*. Scale bar = 1 cm.

Phylum: Mollusca
Class: Gastropoda
Order: Neogastropoda

Family: Melongenidae
Genus: *Pugilina* Schumacher, 1817
Species: *Pugilina cochlidium* (Linnaeus 1758).
Genus: Volema Röding, 1798
Species: *Volema myristica* Röding, 1798 (Plate 2-o)
Phylum: Mollusca
Class: Gastropoda
Order: Neogastropoda
Family: Muricidae
Genus: *Chicoreus* Montfort, 1810
Species: *Chicoreus capucinus* (Lamarck, 1822) (Plate 2-p)
Genus: *Morula* (*Morula*) Schumacher, 1817
Species: *Morula (Morula) rumphiusi* Houart, 1996 (Plate 3-a)
Genus: Thais (Thaisella) Clench, 1947
Species: *Thais* (*Thaisella*) *javanica* (Philippi, 1848) (Plate 3-b)
Species: *Thais (Thaisella) luteostoma* Holton, 1803 (Plate 3-c)
Species: *Thais (Stramonita) clavigera* (Kuster, 1860) (Plate 3-d)
Family: Nassariidae
Genus: *Nassarius* Duméril, 1805
Species: *Nassarius jacksonianus* (Quoy & Gaimard, 1833) (Plate 3-e)
Species: *Nassarius livescens* (Philippi, 1848) (Plate 3-f)
Family: Olividae
Genus: *Oliva*
Species: *Oliva inspidula* Fischer 1807 (Plate 3-g)
Phylum: Mollusca
Class: Gastropoda
SuperFamily: Siphonarioidea
Family: Siphonariidae
Genus: *Siphonaria* Sowerby I, 1823
Species: *Siphonaria normalis* Gould, 1846 (Plate 3-h)
Phylum: Mollusca
Class: Gastropoda
Order: Pulmonata
Family: Ellobiidae
Genus: *Ellobium* Röding, 1798
Species: *Ellobium aurismidae* Linnaeus, 1758 (Plate 3-i)

Phylum: Mollusca
Class: Gastropoda
SubClass: Vetigastropoda
Family: Trochidae
Genus: *Monodonta* Lamarck, 1799
Species: *Monodonta labio* (Linnaeus, 1758) (Plate 3-j)
Family: Turbinidae
Genus: *Turbo*
Species: *Turbo bruneus* (Röding, 1798) (Plate 3-k)

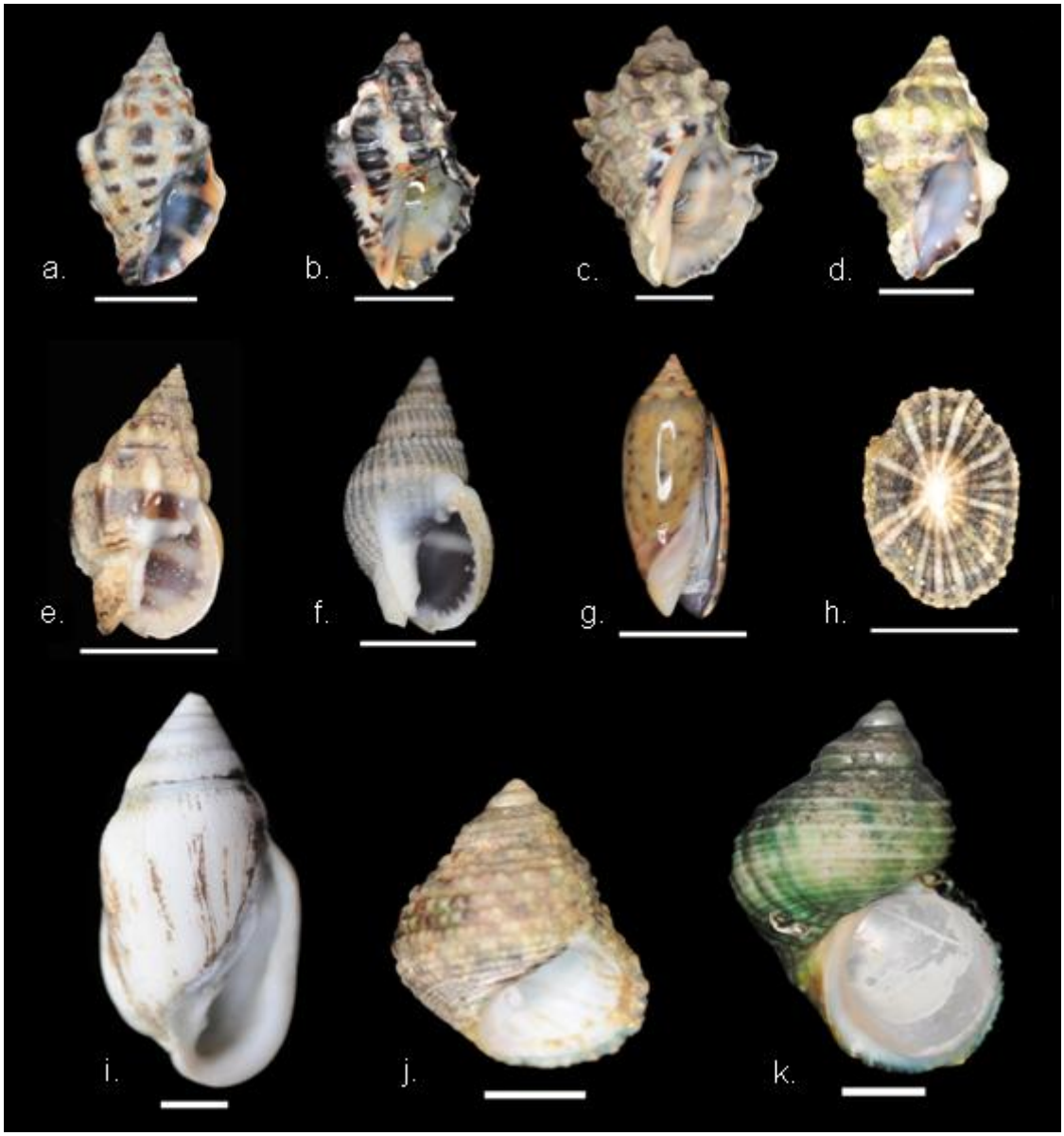

Plate 3. The Gastropoda sampled from the study site (continued): a. *Morula rumphiusi*; b. *Thais javanica*; c. *Thais luteostoma*; d. *Thais clavigera*; e. *Nassarius jacksonianus*; f. *Nassarius livescens*; g. *Oliva inspidula*; h. *Siphonaria normalis*; i. *Ellobium aurismidae*; j. *Monodonta labio*; k. *Turbo bruneus*. Scale bar = 1 cm.

Crustacea (15 species)

Phylum: Arthropoda
Class: Crustacea
Order: Decapoda
Family: Calappidae
Genus: *Matuta* Weber, 1795
Species: *Matuta planipes* Fabricius, 1798.
Phylum: Arthropoda
Class: Crustacea
Order: Decapoda
Family: Diogenidae
Genus: *Clibanarius* Dana, 1852

Species: *Clibanarius* sp.
Phylum: Arthropoda
Class: Crustacea
Order: Decapoda
Family: Grapsidae
Genus: *Sesarma*
Species: *Sesarma* sp.
Phylum: Arthropoda
Class: Crustacea
Order: Decapoda
Family: Ocypodidae
Genus: *Uca* (Austruca) Bott, 1973
Species: *Uca (Austruca) annulipes* (Milne Edwards, 1837).
Species: *Uca (Tubuca) forcipata* (Adams & White, 1849).
Species: *Uca (Austruca) perplexa* (Milne Edwards, 1837).
Species: *Uca* sp.
Genus: Ilyoplax Stimpson, 1858
Species: *Ilyoplax delsmani* De Man, 1926.
Family: Pinnotheridae
Genus: *Dotilla*
Species: *Dotilla myctiroides* (Milne-Edwards, 1852).
Family: Xanthidae
Genus: *Ozius* Milne Edwards, 1834
Species: *Ozius* sp.

Phylum: Arthropoda
Class: Crustacea
Order: Sessilia
Family: Balanidae
Genus: *Amphibalanus* Pitombo, 2004
Species: *Amphibalanus amphitrite* (Darwin, 1854).
Genus: *Balanus* Costa, 1778
Species: *Balanus* sp.
Family: Chthamalidae
Genus: *Chthamalus* Ranzani, 1817
Species: *Chthamalus malayensis* Pilsbry, 1916.
Family: Tetraclitidae
Genus: *Tetraclita*
Species: *Tetraclita squamosa* (Brugiére, 1789).
Phylum: Arthropoda
Class: Crustacea
Order: Xiphosura
Family: Limulidae
Genus: *Carcinoscorpius* Pocock, 1902
Species: *Carcinoscorpius rotundicauda* (Latreille, 1802).

CONCLUSION

The study area showed high macroinvertebrate biodiversity; with 62 different macroinvertebrate species have been identified. Mollusk was the most dominant taxa followed by the Arthropoda. Most of the macroinvertebrates were sampled from the mangroves, particularly the gastropod. Furthermore, the total number of gastropod species sampled was comparable with other studies in other mangroves of much better condition than the study area. There is probably more species present in the Mersing coastal areas; therefore more studies are needed in order to have a more extensive checklist of the macroinvertebrates along the coast.

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