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A preliminary random checklist of benthic organisms in selected lakes of west peninsular Malaysia

Abstract

The freshwater ecosystem (Kelana Jaya Lake, Seremban Lake Garden and Kanching Eco Forest Park) of west Peninsular Malaysia was the focus of the study's attempt to offer a current checklist of benthic organisms. Three benthic organisms were identified in the urbanized Kelana Jaya Lake, namely the red-rim melania (*Melanoides tuberculata*), apple snail (*Pomacea* sp.), and an Odonata damselfly nymph. Four different species were identified for Seremban Lake Garden: *Hydrilla verticillata*, *Viviparus* sp., nymph of Odonata, and *Macrobrachium* sp. The freshwater prawn *Macrobrachium* was the only genus identified for Kanching Eco Forest Park. Our attempts to promote aquatic ecosystem management and conservation in Malaysia can use the checklist of benthic creatures from the freshwater ecosystems as a continuous baseline for future reference.

Keywords: benthic organisms, Peninsular Malaysia, aquatic ecosystem

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Introduction

Benthic organisms, including invertebrates and fish, live on the lowest level of the aquatic habitat, usually near the sediments. They serve a role in maintaining the habitat and as a food source for humans and other aquatic animals. Most benthic organisms are detritivores in the food chain. Animal wastes or dead organic matter are consumed and converted into dissolved nutrients for other microorganisms, aquatic plants, or algae.[1–28] Recently, there has been an increase in pollution and environmental degradation due to human activities. Nutrient run-off (eutrophication) is still a recurring problem and has caused the concentrations of heavy metal toxins to increase over the years. The impact of pollution on the benthic communities is detrimental. Algae or phytoplankton consume the excess nutrients. Blooms of harmful algae kill nearby organisms occupying the same habitat. The dead macro and microfauna from the bloom, including the phytoplankton, will be decomposed by aerobic bacteria. Thus, it creates an environment with low oxygen concentrations, and it is unsuitable for other organisms to inhabit.[2]

Aside from environmental damage, heavy metal pollution is believed to affect the development of benthos. For instance, shell deformities in benthos, such as marine bivalves, have been observed. Bivalves are filter feeders; they can absorb pollutants and surrounding particles to keep the water clean and support the growth of other organisms. Filter-feeding bivalves can be a bioindicator species.[3] They are sensitive to environmental change yet resilient to pollution and abundant in numbers.[4] Therefore, benthic organisms are extensively studied for the better health of the environment. Studying benthic organisms in the aquatic ecosystem of Peninsular Malaysia will provide an essential understanding of the health of ecosystems and their diversity. This study aims to investigate the presence and provide the latest checklist of benthic organisms in aquatic habitats of freshwater ecosystems of west Peninsular Malaysia.

Materials and methods

Observational studies and samplings for benthic organisms were conducted from November to December 2022 at the freshwater ecosystems (Kelana Jaya Lake, Seremban Lake Garden and Kanching Eco Forest Park). They were collected by scooping around the sediments with a long butterfly net and then placed on a scale cutting mat. Photographs were then taken using a smartphone camera. Some photographs were taken without the cutting mat due to the mat not being available. Subsequently, the benthos were immediately released to the same place where they were collected. The samples were identified following the publications of Morni et al.,[5] Dance[6] iNaturalist[7] Palomares and Pauly[8] and by comparing the shell characteristics and identification described by Perez et al.[9] Each species name was then cross-checked with the WoRMS Editorial Board[10] to ensure the taxa used in this study are accurate and updated Table 1.

Table 1 Details of the freshwater ecosystem sampling sites were collected in the present study

No.	Sites	Latitude	Longitude	Site description
1	Kelana Jaya Lake, Selangor	3°06'05.5" N	101°35'48.2" E	Urban lake
2	Seremban Lake Garden, Negeri Senbilan	2°43'19.1" N	101°56'37.7" E	Urban lake
3	Kanching Eco Forest Park, Selangor	3°17'59.7" N	101°37'09.4" E	Recreational river

Results and discussion

Tables 2 to 9 show the photographs and identification of each collected benthos. The identification of benthos was done to the lowest taxonomic level possible. Also included in the tables were their trophic levels, habitats, sizes, and conservation status based on IUCN.[11]

Table 2 Red-rim melania Melanoides tuberculata collected from Kelana Jaya Lake

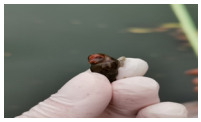
Scientific name: *Melanoides tuberculata* Family: Thiaridae Trophic level: Endobenthos Benthos classification by size: Macrobenthos Benthos classification by type: Zoobenthos Benthos classification by location: Endobenthos Size: ± 2 cm IUCN status: Least concern	 

Table 3 Damselfly nymph of Odonata collected from Kelana Jaya Lake

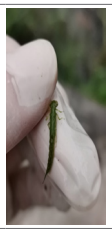
Order: Odonata Suborder: Zygoptera Trophic level: Secondary consumers Benthos classification by size: Macrobenthos Benthos classification by type: Zoobenthos Benthos classification by location: Hyperbenthos Size: ± 2 cm	

Table 4 Apple snail Pomacea sp. and their eggs (right photo) spotted at Kelana Jaya Lake

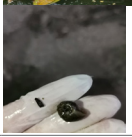
Scientific name: *Pomacea* sp. Family: Ampullarioidea Trophic level: Primary consumer Benthos classification by size: Macrobenthos Benthos classification by type: Zoobenthos Benthos classification by location: Endobenthos Size: ± 1 cm IUCN red list: Least concern	 

Table 5 Water thyme *Hydrilla verticillata* collected from Seremban Lake Garden

Scientific name: *Hydrilla verticillate* Family: Hydrocharitaceae Trophic level: Producer Benthos classification by size: Macrobenthos Benthos classification by type: Phytobenthos Benthos classification by location: Hyperbenthos Size: 12.5 cm in height. IUCN red list: Least concern	

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Table 6 River snail (*Viviparus* sp.) collected from Seremban Lake Garden

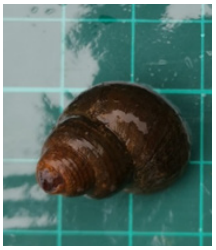
Scientific name: *Viviparus* sp. Family: Viviparidae Trophic level: Primary consumer Benthos classification by size: Macrobenthos Benthos classification by type: Zoobenthos Benthos classification by location: Endobenthos Size: 2.2 cm IUCN red list: Either Least concern or Data deficient	

Table 7 Dragonfly nymph (Order Odonata) collected from Seremban Lake Garden

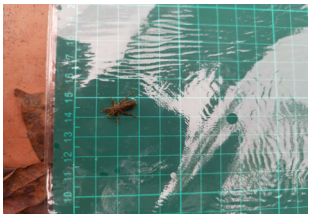
Order: Odonata Suborder: Anisoptera Trophic level: Secondary consumer. Benthos classification by size: Macrobenthos Benthos classification by type: Zoobenthos Benthos classification by location: Hyperbenthos Size: ± 2 cm	

Table 8 Freshwater prawn *Macrobrachium* sp. collected from Seremban Lake Garden

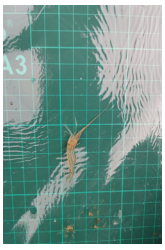
Scientific name: *Macrobrachium* sp. Family: Palaemonidae Trophic level: Primary consumer Benthos classification by size: Macrobenthos Benthos classification by type: Zoobenthos Benthos classification by location: Hyperbenthos Size: 4 cm for length of body. IUCN red list: Mostly categorized as Least concern	

Table 9 Freshwater prawns *Macrobrachium* spp. collected from Kanching Eco Forest Park

Scientific name: *Macrobrachium* spp. Family: Palaemonidae Trophic level: Primary consumer Benthos classification by size: Macrobenthos Benthos classification by type: Zoobenthos Benthos classification by location: Epibenthos Size: 2 to 4 cm IUCN red list: Mostly categorized as Least concern	

There were, however, some limitations to this study. Firstly, some benthos, such as damselflies, were caught in their juvenile stage, and their organisms were found dead. Therefore, species-level identification was made just by observation. Secondly, mud or algae accumulation on the bodies of benthos may alter the appearance and colour of the benthos. Therefore, it is difficult to identify each species down to its lowest taxonomic level. Thirdly, the size of each organism may not be accurate as some photographs were taken without the scale cutting mat, and the measurement was done by comparing it to the length of the index finger.

Three distinct species of benthic animals were found at Kelana Jaya Lake. They were the red-rim melania *Melanoides tuberculata* (Table 2), damselfly nymph of Odonata (Table 3), and apple snail *Pomacea* sp. with their eggs (Table 4). Kelana Jaya Lake is a large lake in the city where there are lots of human activities nearby the lake. The water is exceptionally green, and litter, such as plastic bottles, were observed during sampling. The red-rim melania is known for its burrowing nature and is native to Malaysia.[12]

Identifying the damselfly nymph to the lowest possible level was impossible at this stage of its life cycle. Also, the IUCN red list status was not confirmed because the species was not identified. The Odonata larvae live in freshwater. Depending on the species and food availability, its larval stage takes two weeks to a few months.[13] Two of the most invasive species in the genus *Pomacea* (*P. canaliculata* and *P. maculata*) have been recorded in Selangor.[14] By only visual observation and without a genetic analysis, the authors have difficulty identifying the correct species.

Seremban Lake Garden consists of multiple small turbid lakes. There were four distinct species found in this urban lake, namely water thyme *Hydrilla verticillata* (Table 5), river snail *Viviparus* sp. (Table 6), nymph of Odonata (Table 7) and freshwater prawn *Macrobrachium* sp. (Table 8). *Hydrilla verticillata* can be found throughout Malaysia, India, Sri Lanka, China and the USA up to an altitude of 610 m in water, including lakes, ponds, rivers, streams and marshes.[15] It was present in the deserted brown water of the Seremban Lake, where no benthic life form was collected. According to Kritzberg et al.,[16] brown water is a sign of low productivity and biodiversity of phytoplankton

communities due to lesser light reaching into the water. While in other moving lakes, river snails (*Viviparus* sp.) were found. *Viviparus* is a genus of giant freshwater snails with a gill and an operculum, an aquatic gastropod in the family Viviparidae, the river snails.[7] Another spotted organism, a dragonfly nymph, has a broad body compared to a damselfly nymph and has short appendages instead of the long fin-like gills seen in a damselfly nymph. The common dragonflies were usually found in ponds and drainages in the countryside.[13] A group of freshwater prawn *Macrobrachium* sp. was caught while scooping around the lake. Ng et al.[17] identified two species of *Macrobrachium* prawns at UKM Lake, another turbid lake, about 40 km north of Seremban.

The Kanching Eco Forest Park (Taman Eko Rimba Kanching) is located in Rawang, Selangor, and is renowned for its seven levels of waterfalls and pools connected to the Kanching River. Two freshwater prawns, *Macrobrachium* spp., were found in this forest park (Table 9). The authors, however, were unable to differentiate the species. According to Ng and Choy,[18] there were 15 species of freshwater prawns under the genus *Macrobrachium* presented in Peninsular Malaysia. Only the prawns were collected from different levels of pools. The lack of gastropods and other benthos could be due to the water velocity. The water in the pool was clear but flowing extremely fast. According to Koehl,[19] organisms that live anchored to the substratum, basically benthos, the force of flowing water may stress them and cause deformity.

Conclusion

This preliminary study is conducted to provide an inventory of benthic organisms found in freshwater ecosystems (Kelana Jaya Lake, Seremban Lake Garden and Kanching Eco Forest Park). Three different kinds of benthic organisms were found in the inhabited Kelana Jaya Lake. Four distinct species were found in Seremban Lake Garden, while the sole genus discovered in Kanching Eco Forest Park was *Macrobrachium*. Finally, this preliminary study's list of benthic organisms can serve as baseline data for ongoing efforts to enhance aquatic ecosystem management and conservation in Malaysia.

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None.

Conflicts of interest

The authors declare no conflict of interest.

References

1. Covich AP, Palmer MA, Crowl TA. The role of benthic invertebrate species in freshwater ecosystems: Zoobenthic species influence energy flows and nutrient cycling. *BioScience*. 1999;49(2):119–127.
2. Qu C, Song J, Li N. Cause of jellyfish blooms and their influence on marine environment. *Ying Yong Sheng Tai Xue Bao*. 2014;25(12):3701–3712.
3. Krishnakumar PK, Qurban MA, Sasikumar G. Biomonitoring of trace metals in the coastal waters using bivalve molluscs. *Trace Elements - Human Health and Environment*. InTech Open; 2018.
4. Yap CK, Chew W, Cheng WH. Higher bioavailability and contamination by copper in the edible mussels, snails and horseshoe crabs at Kampung Pasir Puteh: Evidence of an industrial effluent receiving site at Pasir Gudang area. *Advancements in Bioequivalence & Bioavailability.* 2019;2(5):ABB.000548.2019.
5. Morni WZW, Rahim SAKA, Rumpet R, et al. Checklist of gastropods from the Exclusive Economic Zone (EEZ), Sarawak, Malaysia. *Tropical Life Sciences Research*. 2017;28(1):117–129.
6. Dance SP. *Smithsonian handbooks: Shells*. New York, USA: DK Publishing, Inc; 2002.
7. *iNaturalist.* 2022.
8. Palomares MLD, Pauly D. *SeaLifeBase*. World Wide Web electronic publication. Version 12/2022. 2022.
9. Perez KE, Clark SA, Lydeard C. *Freshwater Gastropod Identification Workshop*. University of Alabama, Tuscaloosa, Alabama. 2004.
10. WoRMS Editorial Board. *World Register of Marine Species*. 2023.
11. IUCN. *The IUCN Red List of Threatened Species*. Version 2022-2. 2023.
12. Chiu YW, Gan YC, Kuo PH, et al. Mitochondrial genetic diversity of the freshwater snail *Melanoides tuberculata*. *Biochemical Genetics*. 2019;57:323–337.
13. Choong CY, Yasser MA, Nurfarhana-Hizan H. *Ancient Creatures: Dragonflies and Damselflies of Malaysia*. Ministry of Water, Land and Natural Resources, Putrajaya, Malaysia. 2018.
14. Phoong MJP, Hah HE, Rao SR. Invasive apple snails in wetlands of Selangor, Malaysia: Species, distribution, and ecological associations. *Journal of Tropical Biology and Conservation*. 2018;15:43–60.
15. Pal DK, Nimse SB. Little known uses of common aquatic plant, *Hydrilla verticillata* (Linn. f.) Royle. *Natural Product Radiance*. 2006;5(2):108–111.
16. Kritzberg ES, Hasselquist EM, Škerlep M, et al. Browning of freshwaters: Consequences to ecosystem services, underlying drivers, and potential mitigation measures. *Ambio*. 2020;49:375–390.
17. Ng EL, Assaad NM, Dyari HRE. Identifying the diversity of freshwater aquatic species in Tasik Ghazali, UKM using taxonomy analysis. *Malaysian Applied Biology*. 2022;51(5):179–185.
18. Ng PKL, Choy SC. Notes on some freshwater caridean prawns (Palemonidae and Atyidae) from Endau-Rompin area, Johore-Pahang, Peninsular Malaysia. *Raffles Bulletin of Zoology.* 1990;38(1):11–20.
19. Koehl MAR. How do benthic organisms withstand moving water? *American Zoologist*. 2015;24(1):57–70.
20. Zakirah MT, Nurul-Zalizahana Z, Yahya N, et al. Community study of brachyuran crab at Setiu Lagoon, Terengganu, Malaysia. *Borneo Journal of Resource Science and Technology*. 2022;12(2):11–23.
21. Ng PKL, Sivasothi N. *A guide to the mangroves of Singapore II*. Singapore Science Centre; 2002.
22. Nur Anis Fadilah S, Singh HR, Nur Hilwani I. The gastropod community of the Lukut mangroves, Negeri Sembilan. *Proceedings of ISER 10th International Conference*. Kuala Lumpur, Malaysia; 2015.
23. Yurimoto T. Status of blood cockle, *Tegillarca granosa* (Linnaeus, 1758), aquaculture and sustainable production in Selangor, Malaysia. *Malaysian Fisheries Journal*. 2020;19:1–20.
24. Vongpanich V. Family Mactridae (Mollusca: Bivalvia) in Thai waters. *Phuket Marine Biological Center Special Publication*. 2000;21(2):483–498.
25. Al-Asif A, Hamli H, Kamal AHM, et al. Benthic macrofaunal assemblage in seagrass-mangrove complex and adjacent ecosystems of Punang-Sari Estuary, Lawas, Sarawak, Malaysia. *Biodiversitas*. 2020;21(10):4606–4615.
26. Rahayu DL. Notes on littoral hermit crabs (excluding Coenobitidae) (Crustacea: Decapoda: Anomura) mainly from Singapore and Peninsular Malaysia. *The Raffles Bulletin of Zoology*. 1996;44(2):335–355.

27. Rafi NIFM, Ishak IM, Rahim F, et al. Diversity of sea shore invertebrates at west coast Peninsular Malaysia. *Junior Researcher International Conference (iJURECON)*. 2020;42–47.

28. Razali MRM, Zaleha K. Fishery aspect of horseshoe crab [*Tachypleus gigas* (Müller, 1785)] in the Peninsular Malaysia: Exploitation status. *Universal Journal of Applied Science*. 2017;5(2):11–15.

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