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Zooplankton from the waters of Sri Buat and Sembilang, Pahang, Malaysia

Nur Elisa Binti Jeffry¹, Azman Abdul Rahim^{1,2*}

ABSTRACT

This study delved into exploring the diversity and population dynamics of zooplankton inhabiting the waters adjacent to Sri Buat and Sembilang Islands, Pahang, Peninsular Malaysia. Sampling was carried out from seven different stations with three replicates at each of the designated station. Chlorophyll- α concentrations from these waters ranged from 13.3 $\mu\text{g/L}$ to 16.0 $\mu\text{g/L}$. This study successfully identified a total of 67 zooplankton taxa with the Class Copepoda has the highest percentage composition (90.60%) with 26 species identified, while echinoderm larvae (14.45%) has the least percentage composition. A total of 26 copepod species were identified, with *Euterpina acutifrons* (17.23%), *Paracalanus aculeatus* (17.14%), *Acrocalanus gibber* (10.1%), *Paracalanus parvus* (9.49%), *Oithona rigida* (8.78%), and *Canthocalanus pauper* (6.06%) dominating the study area. The range for the Shannon-Wiener Diversity Index (H') and Pielou's Evenness Index (J') was between $H' = 2.441$ and $H' = 2.847$, and $J' = 0.3706$ and 0.4103 , respectively. In general, a significant surge is noticed in the abundance of zooplankton groups, especially beyond the depth of 10 m. Abundances of the different groupings of zooplankton were also positively correlated with Chlorophyll- α concentrations, which is consistent with many studies that have taken place in the coastal waters of Peninsular Malaysia.

Keywords: Sri Buat, Zooplankton, Pahang, Copepoda, Malaysia.

1. INTRODUCTION

The twin islands of Sri Buat and Sembilang (Figure 1), together with the better known Tioman Island were gazetted as Marine Protected Area (Pahang Marine Park) in 1994. Situated roughly 11 nautical miles east of Tanjung Gemok, Pahang, these two islands collectively span 8.1 km² of low-lying terrain, comprising diverse marine habitats. These habitats include a shallow drying reef channel that divides the islands, patchy subtidal reefs alongside an extensive lagoon, as well as thriving mangroves and seagrass meadows. To date, only one scientific study briefly mentioning about the marine biodiversity for these twin islands is known.

However, many studies on zooplankton had been carried out in the neighbouring waters of Pahang Marine Park such as; Othman and Azman, (2007), Gan et al., (2010), Lim et al., (2010), Azman and Melvin, (2011), Lim et al., (2012), Azman and Othman,

(2013), Chew et al., (2014), Chew et al., (2016); Lim et al., (2019), Tan and Azman, (2017), Tan and Azman, (2018), Tan et al., (2014), Metillo et al., (2019) and Feirulsha and Rahim, (2020), for waters in the Sultan Iskandar Marine Park; and studies by Peralta and Yusoff, (2015), and Shafie et al., (2023), for southern waters of Peninsular Malaysia. Basic biodiversity inventories to inform island conservation priorities are still lacking for these twin islands. The objective of this study was to establish baseline information on zooplankton from Sri Buat and Sembilang islands, to improve monitoring efforts and conservation management plans for the area.

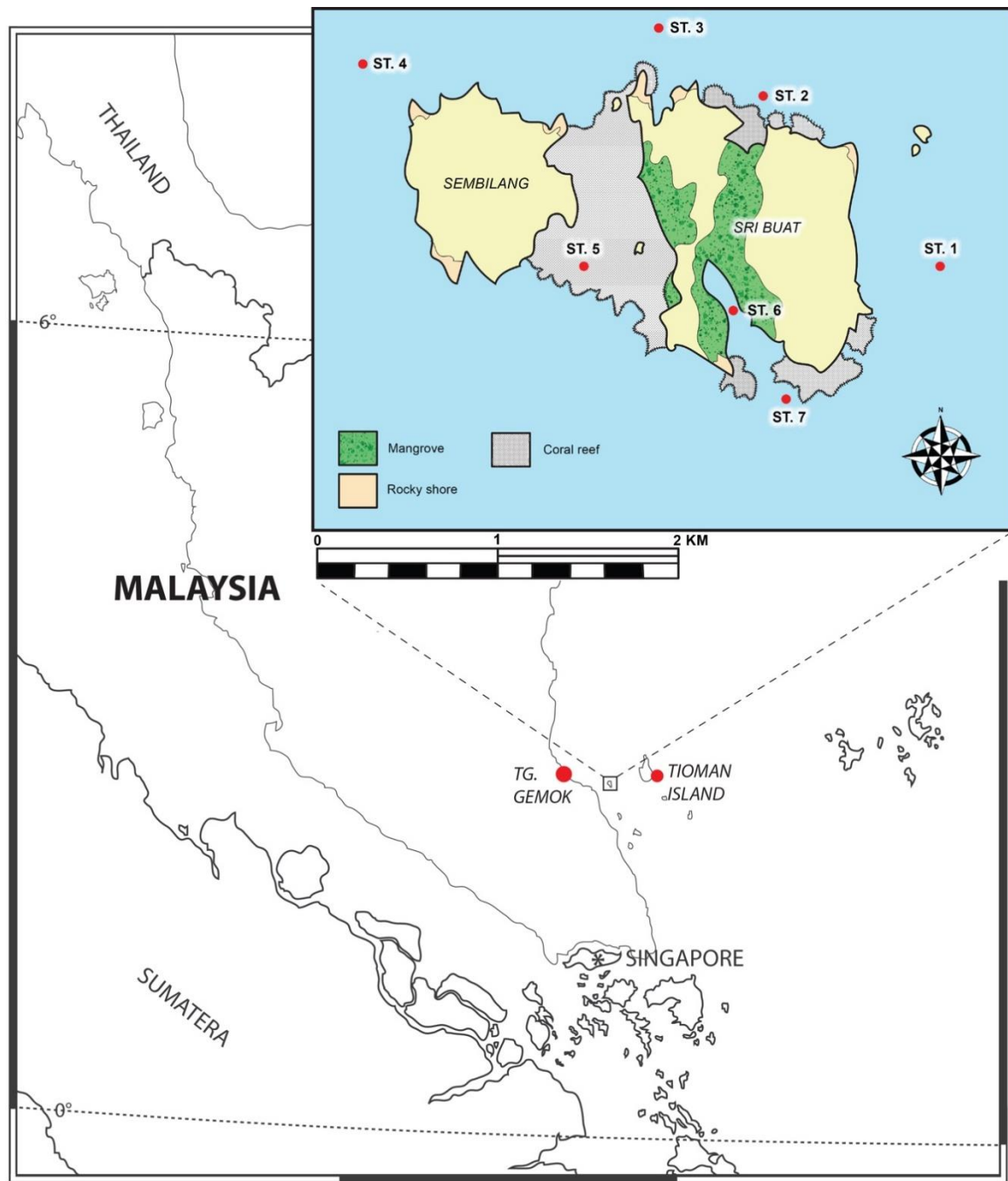


Figure 1 Map of the study area and the location of sampling station.

2. METHODOLOGY

Zooplankton samples were collected at 7 sampling stations from the waters of Sri Buat and Sembilang, Pahang (2°40'57.6"N 103°54'56.4"E) on 21 August 2023, (Figure 1). Three sample replicates were collected at each sampling station by vertical hauls through the whole water column using a 140 µm mesh plankton net near the sea surface. Immediately after sampling, specimens for morphological examination were fixed in a 4% formalin-seawater solution. Temperature and salinity in the surface water were measured using a multiparameter water quality meter (Aquaread water monitoring system – AP-2000). Water samples were also taken to measure the Chlorophyll- α concentrations in the laboratory. For detailed observations, specimens were photographed using an OLYMPUS SZX9 microscope with attached Canon-M100 for imaging. All materials were lodged at the Universiti Kebangsaan Malaysia Muzium Zoologi (UKMMZ), Malaysia.

3. RESULTS & DISCUSSION

The physico-chemicals parameters of the study area were presented in (Figure 2). The water temperature recorded a typical tropical shallow water norms, thus it was ranged from 28.60 °C to 28.70 °C. Water temperature was found to be higher at four stations (ST1, ST2, ST4 & ST7) and slightly lower at two stations (ST3, ST5 and ST6) possibly due to colder reef water influx from the drying reef channel zone. During the sampling, pH values were on the alkaline side for all the stations and recorded the maximum value of 8.08 (ST6) and the minimum reading of 7.85 at ST1. Salinity values in all stations were consistent; the range value for salinity was within the range of 30.30 – 30.31 PPT (Figure 2). Chlorophyll- α concentrations ranging from 13.3µg/L to 16.0µg/L (Figure 2). Chlorophyll- α concentrations showed positive correlation with water depth. The highest values were recorded at ST1 (22.3 m) and ST2 (16.3 m) and the lowest at ST7 (5 m). In accordance with the study done by Tan et al., (2002) that stated prolonged exposure to solar radiation may be the cause of low levels of Chlorophyll- α due to pigment deterioration.

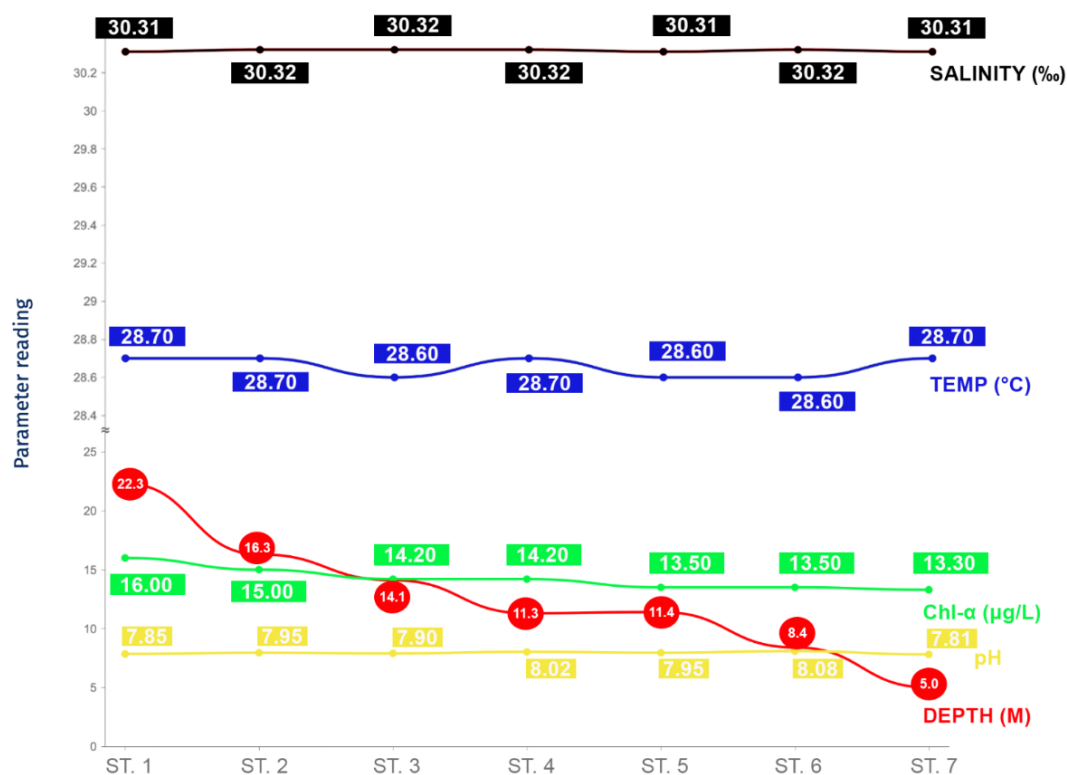


Figure 2 Physico-chemical parameters of the study area.

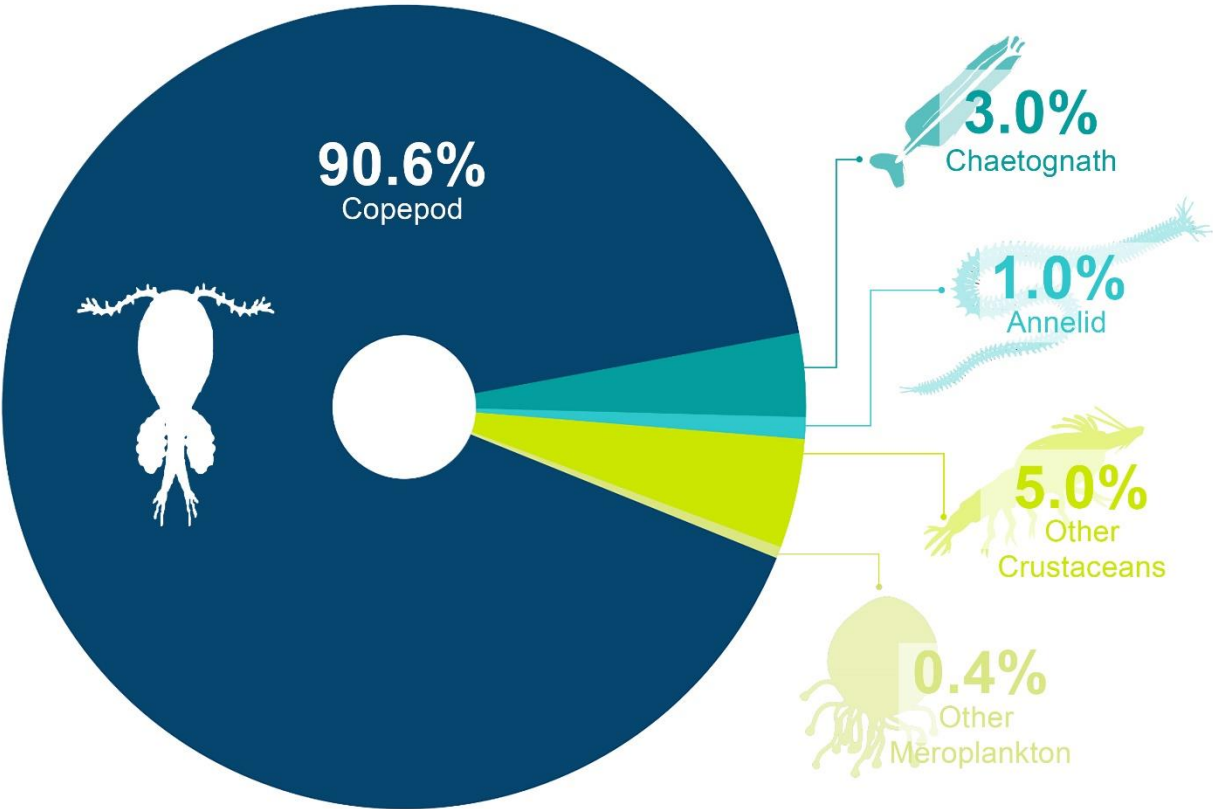


Figure 3 Faunal composition of zooplankton in the study area.

Four major groups of zooplankton were found in the study area, namely copepod (Figure 4), chaetognath (Figure 10), annelid (Figure 6), and other crustacean larvae, (Figure 5), in addition to several other rare forms belonging to other meroplanktons (Figure 3, 7,8,9,11). Copepods were the dominant group of zooplankton representing 90.6%, this high percentage was also recorded in the neighbouring waters by many authors, Rezai et al., (2004) in Straits of Malacca, Nakajima et al., (2005) in Tioman Island, Laily and Azman, (2017) in Aur Island, and Shafie et al., (2023) in the Johor Straits. The copepod assemblage included 28 species. *Euterpina* spp. was notably abundant across all stations, while *Paracalanus* spp. was also dominant but less prevalent overall.

There were six dominant copepod species in total for this study area; namely *Euterpina acutifrons* (17.23%), *Paracalanus aculeatus* (17.14%), *Acrocalanus gibber* (10.1%), *Paracalanus parvus* (9.49%), *Oithona rigida* (8.78%), and *Canthocalanus pauper* (6.06%) dominating the study area. Based on the results, the diversity index (H') of Sri Buat and Sembilang falls to the moderate category ranging from 2.44 to 2.85 (Table 1). The moderate diversity observed is primarily influenced by environmental factors. The study area, characterised by a habitat-rich environment, encompasses extensive intertidal reef areas, patchy subtidal reefs, a vast lagoon, as well as abundant mangroves and seagrass meadows. These features render the area highly conducive to the abundance and diversity of zooplankton.

Table 1 Diversity index (H') and evenness index (J') of zooplankton in the study area

Station	No. of Taxa	Depth (m)	Chl- α ($\mu\text{g/L}$)	Evenness (J')	Shannon Index (H')
1	47	22.3	16.0	0.3488	2.797
2	42	16.3	15.0	0.4103	2.847
3	44	14.1	14.2	0.358	2.757
4	42	11.3	14.2	0.3076	2.559
5	41	11.4	13.5	0.3239	2.586
6	37	8.4	13.5	0.4061	2.710
7	32	5.0	13.3	0.3590	2.441

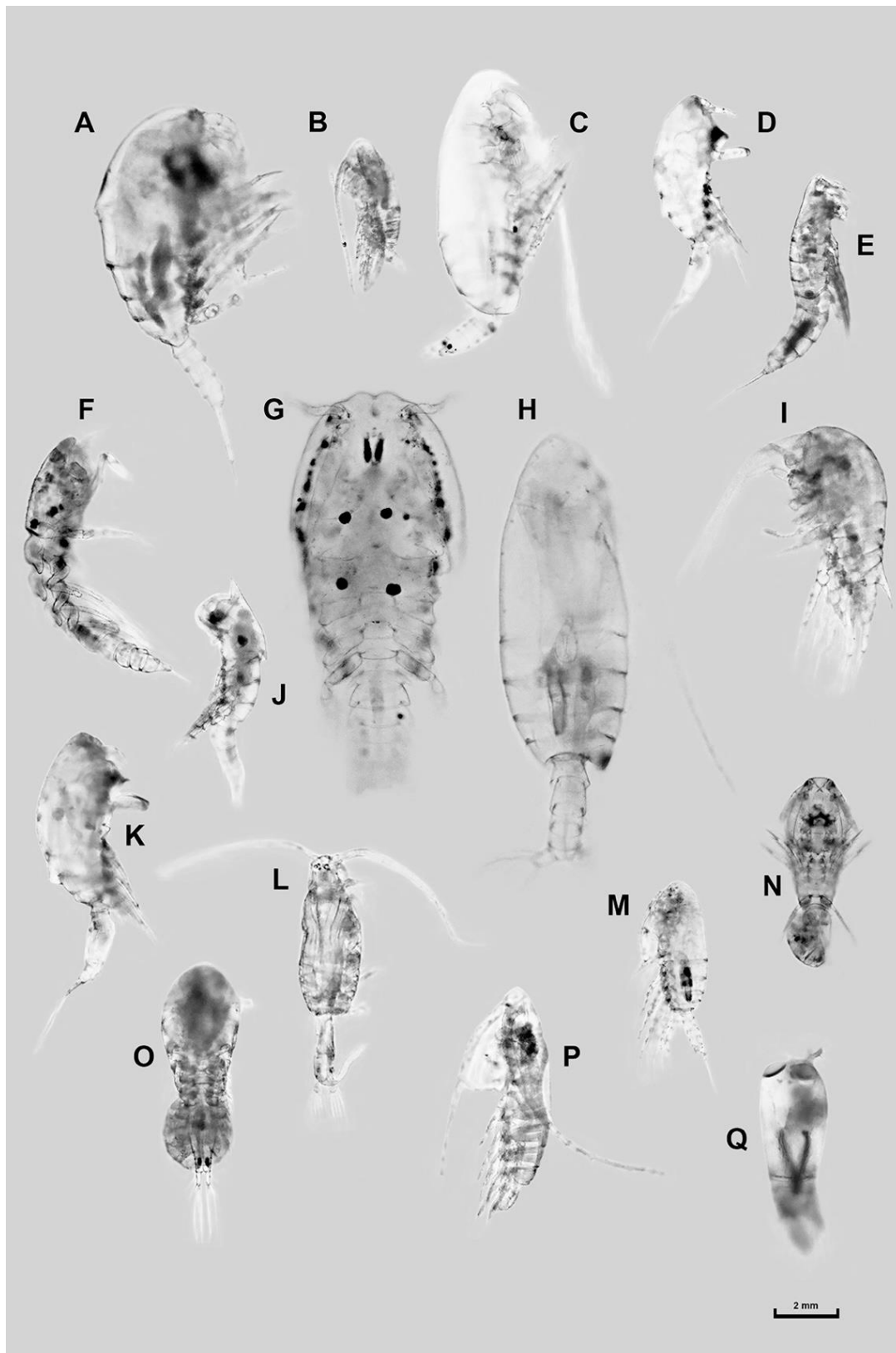


Figure 4 Some commonly found copepods from the study area. (A) Calanoida, (B) *Canthocalanus*, (C) *Candacia*, (D) *Paracalanus*, (E) *Microsetella*, (F) *Clymnestra*, (G) *Sapphirina*, (H) *Calanopia*, (I) *Oithona*, (J) *Euterpina*, (K) *Parvocalanus*, (L) *Acartia*, (M) *Acrocalanus*, (N) *Temora*, (O) *Oncaea*, (P) *Subeucalanus*, (Q) *Corycaeus*

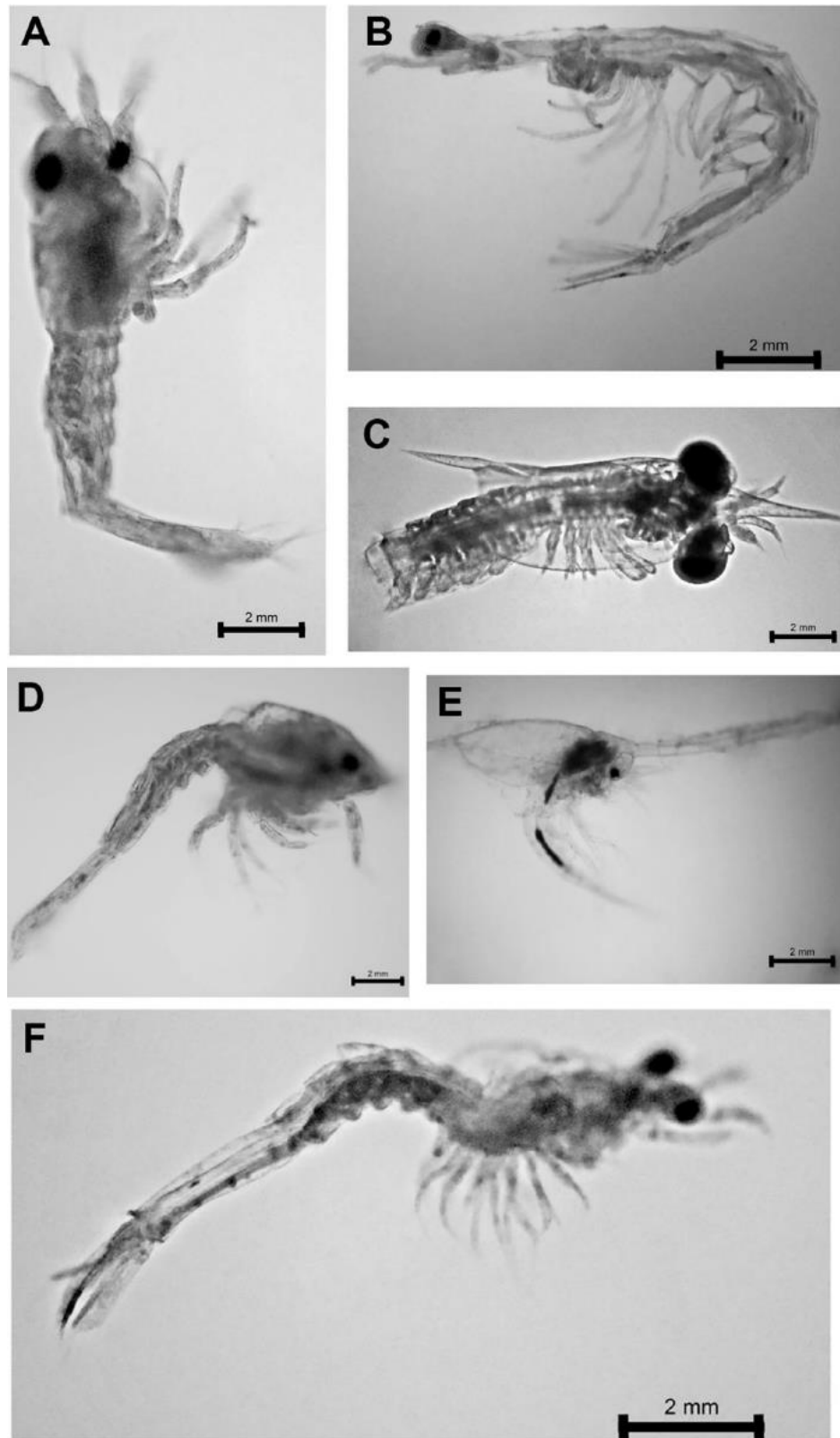


Figure 5 Common Shrimp-like crustaceans and larvae found in the study area. (A) Anomuran zoea, (B) Luciferidae, (C) Juvenile stomatopod, (D) Porcellanid, (E) Brachyuran zoea, (F) Mysid.

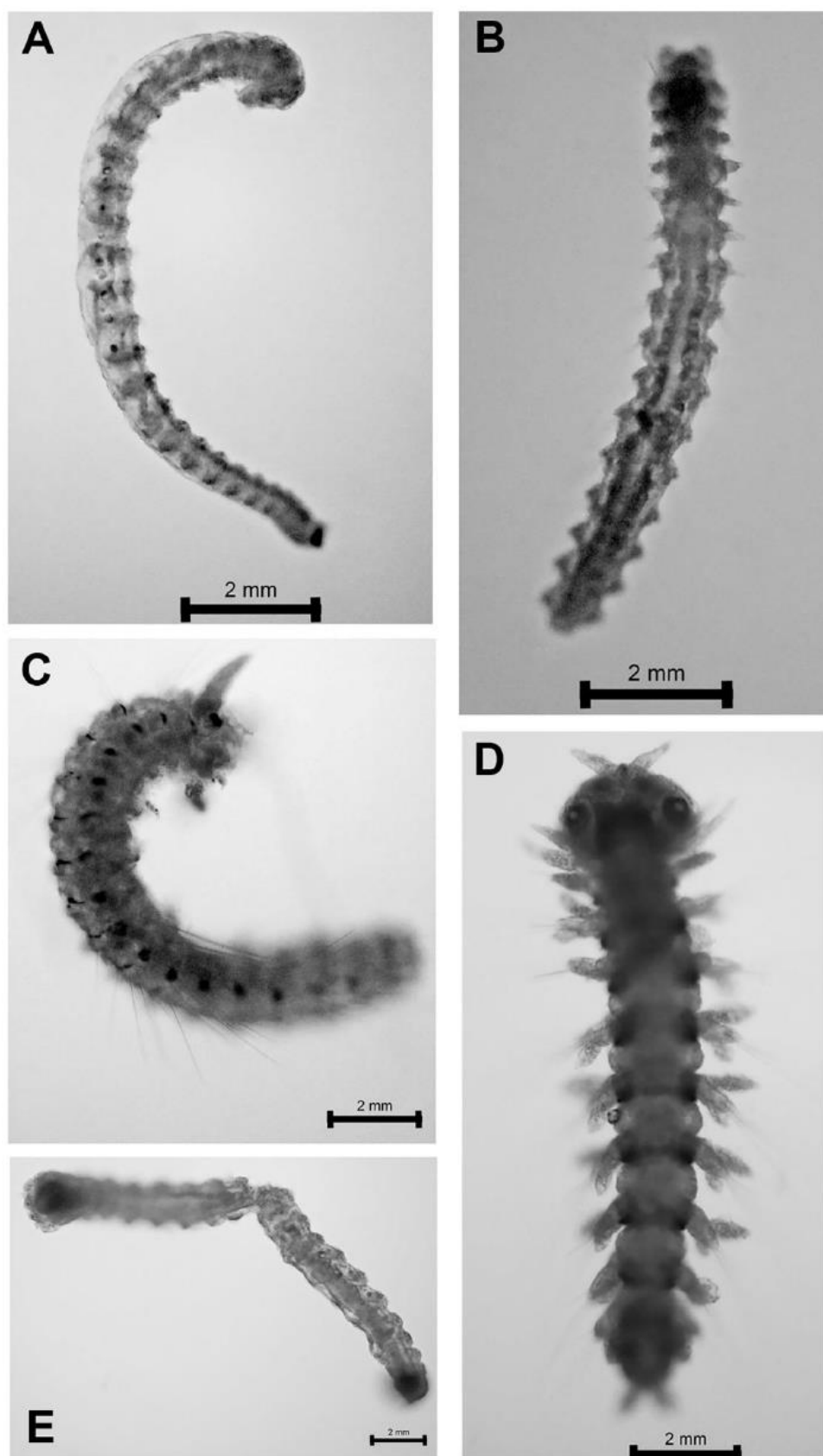


Figure 6 Common polychaetes found in the study area. (A) Naididae, (B) Syllidae, (C) Polychaete larvae, (D) Naididae, (E) *Vanadis* spp

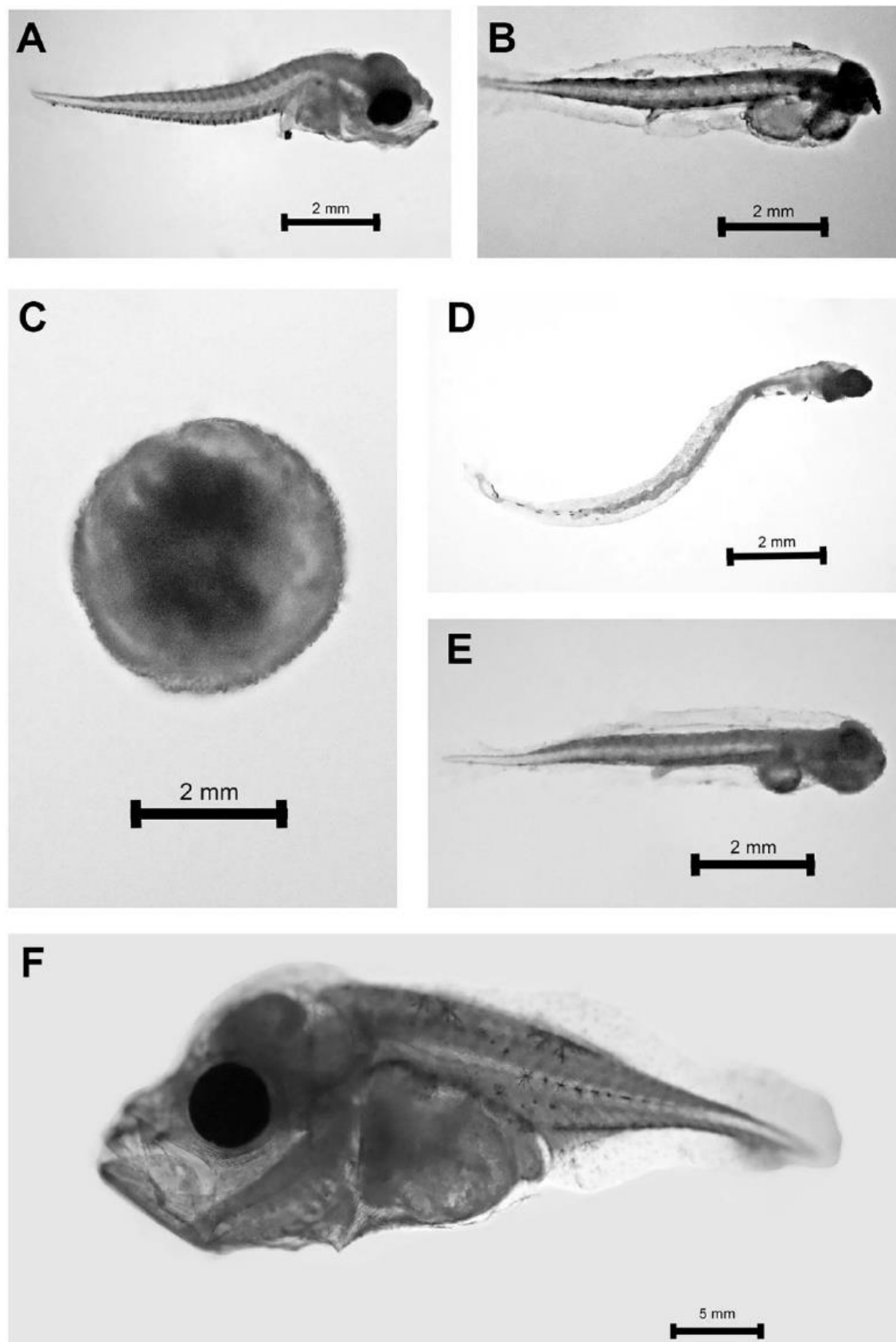


Figure 7 Common chordates found in the study area. (A), (B), (D), (E), (F): Fish larvae representative of many species, (C) Fish egg

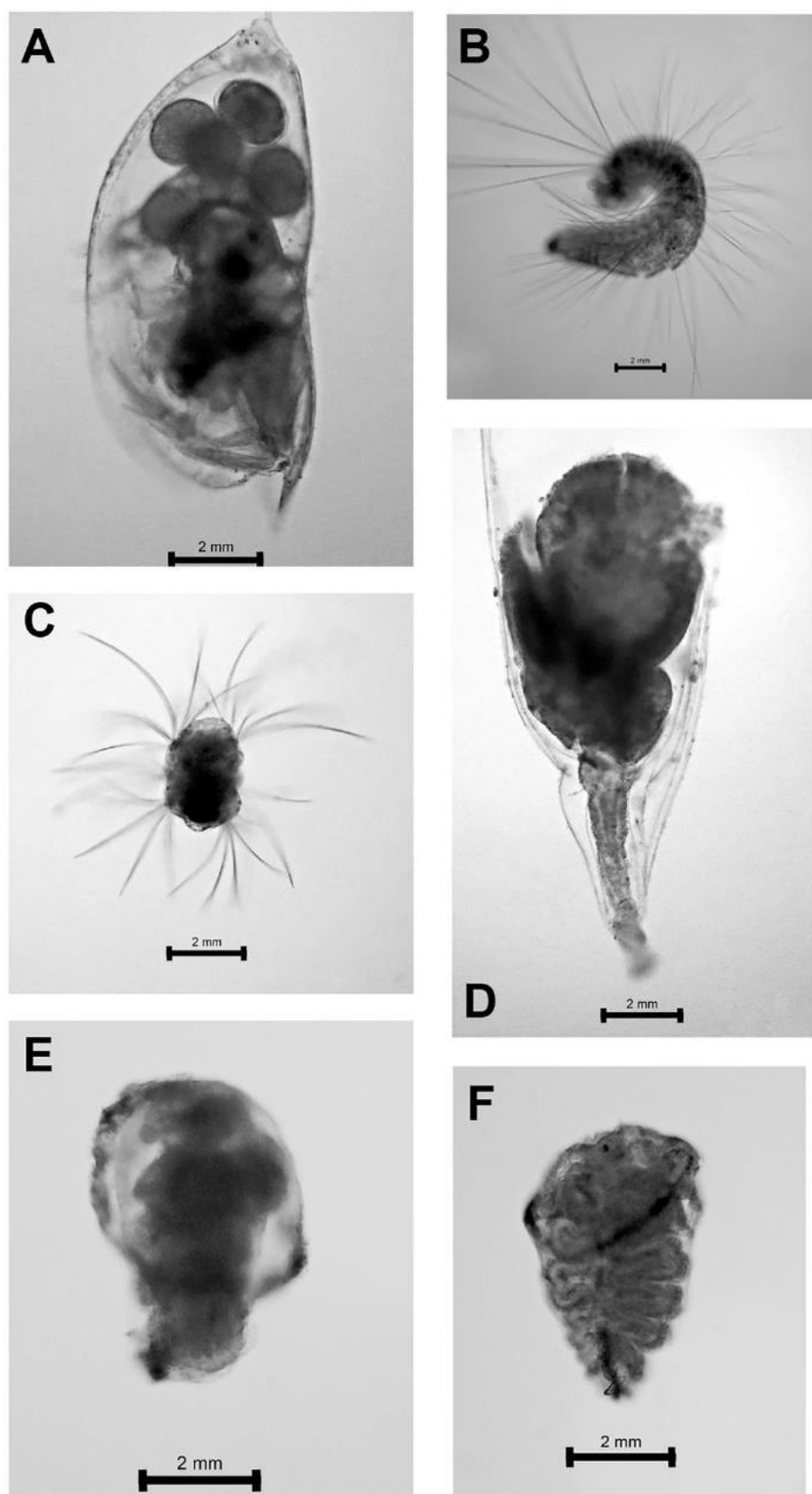


Figure 8 Other common larvae found in the study area. (A) Ostracod, (B), (C): Polychaete larvae, (D), (E), (F): Bryozoan larvae

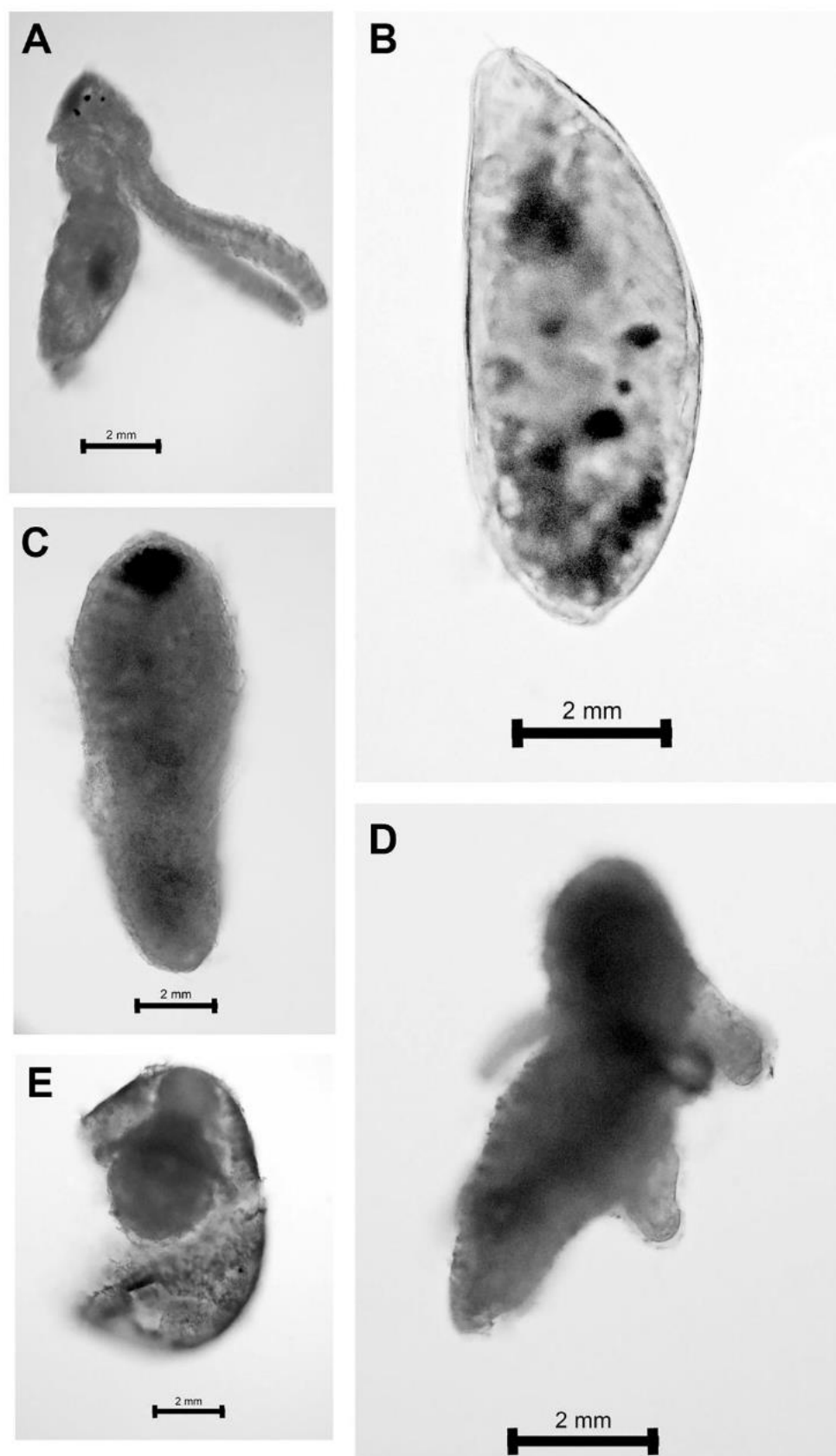


Figure 9 Other common larvae found in the study area. (A) *Creseis*, (B) Cyprid larva, (C) Polychaete larva (D), (E): Bipinnaria larvae

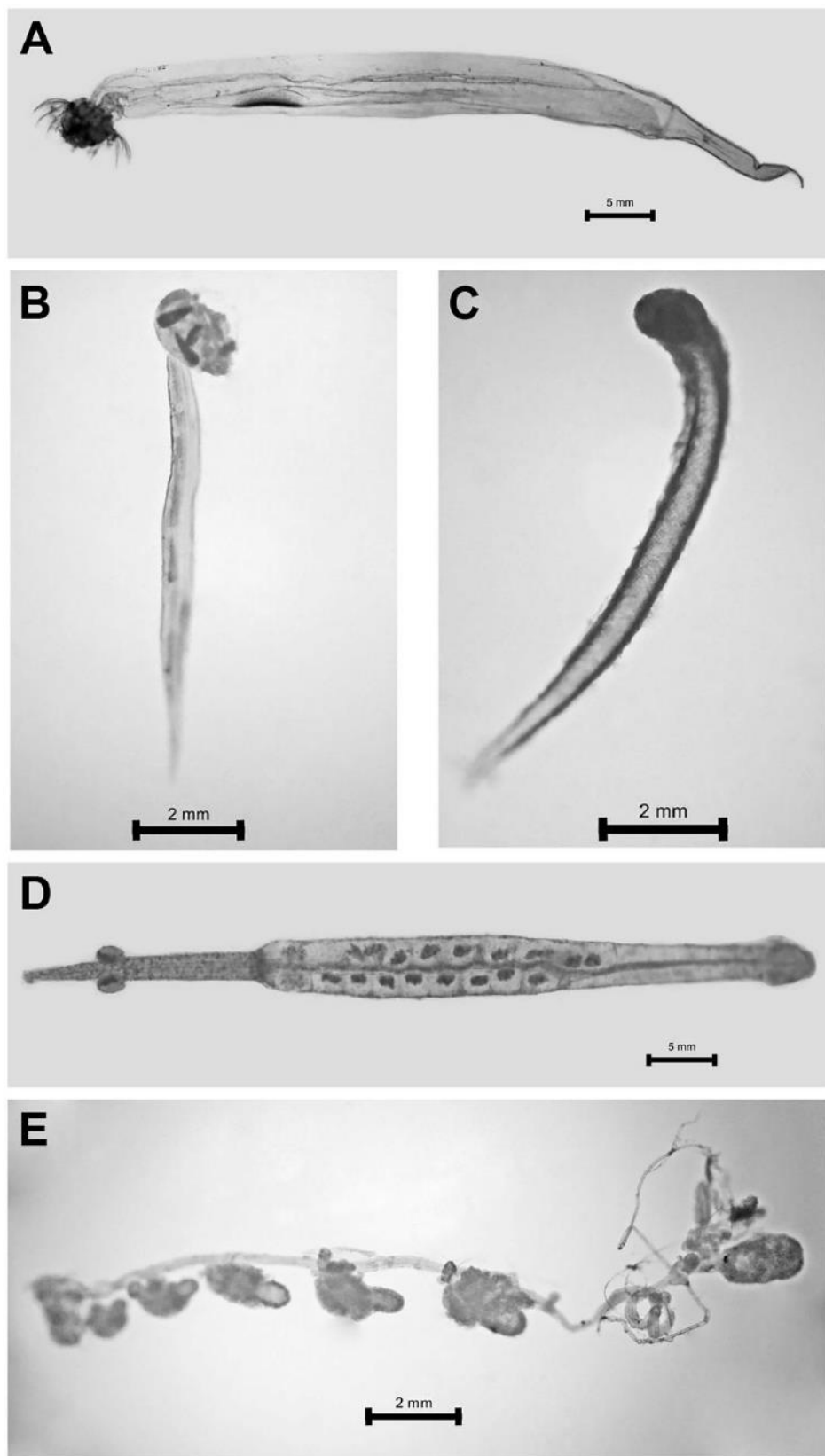


Figure 10 Other appendicularia, chaetognaths and cnidarian larvae found in the study area. (A), (C), (D): Chaetognatha, (B) Oikopleurid appendicularian, (E) Siphonophore larva

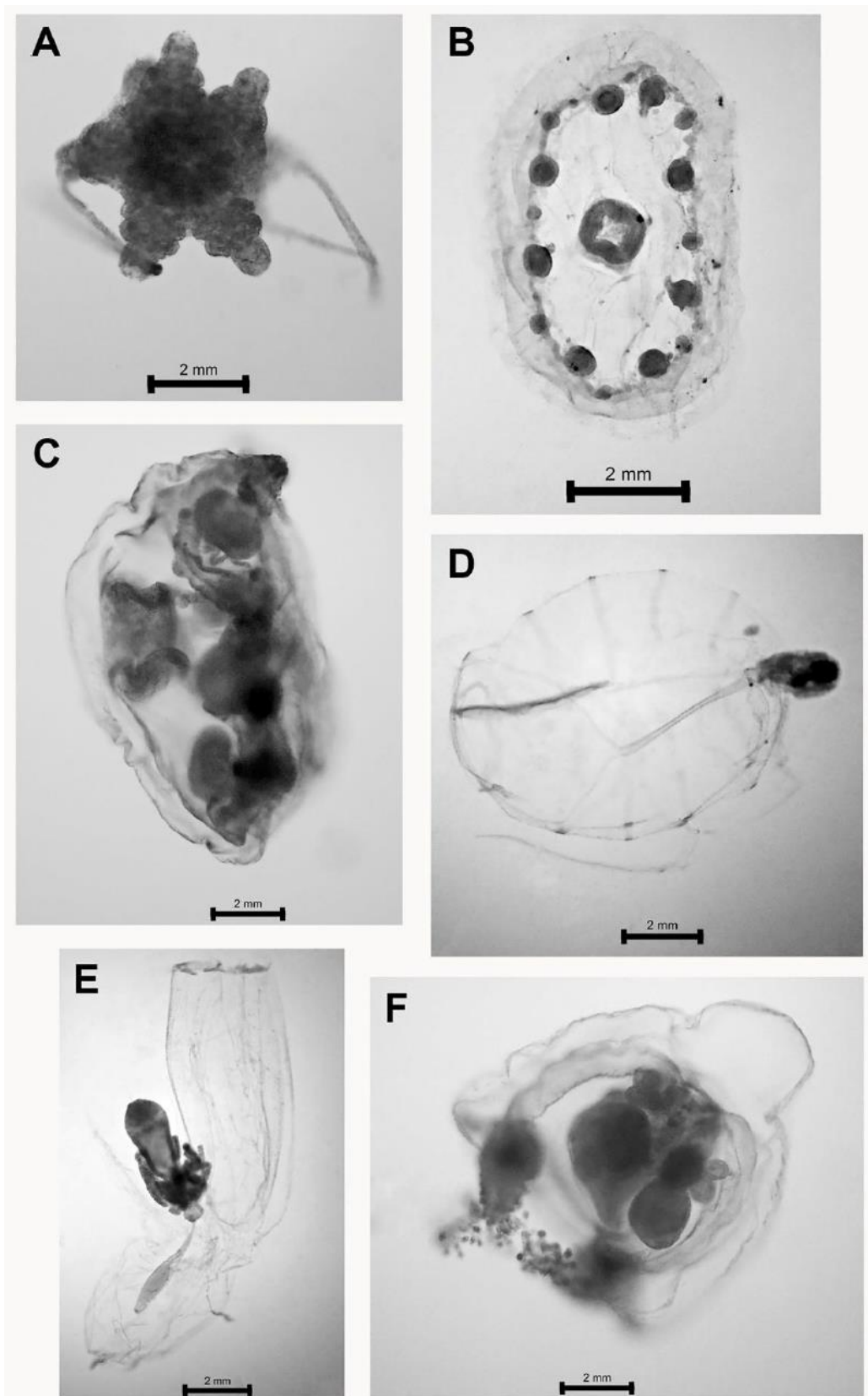


Figure 11 Echinoderm and other gelatinous larvae found in the study area. (A) Echinoderm ophiuroid juvenile, (B), (C), (F): Anthoathecata medusae, (D) Salp; *Thalia*, (E) Siphonophore

4. CONCLUSION

The 67 zooplankton taxa recorded during the expeditious marine biodiversity assessment of Sri Buat and Sembilang waters highlights the unique marine biodiversity of Pahang Marine Park. Based on the findings of this study, the interrelation between zooplankton diversity and abiotic factors (Chlorophyll- α concentrations, salinity, depth) is important. Even though the abiotic characteristics found in this study do not provide a compelling explanation for the zooplankton dispersion and abundance, enough data is still available to determine which of the several potential biological and physical causes is responsible for them.

Environmental heterogeneity and spatial arrangement of islands such as Sri Buat and Sembilang, strongly influenced species compositional patterns. Therefore, further study should be conducted to obtain more information and explanations followed by statistical evidence on zooplankton diversity in these waters. With additional survey efforts, it is probable that additional unknown species of zooplankton from these waters will be added to the national biodiversity record. Considering the unique habitat diversity of the neighbouring Tioman Island, it is equally important to ensure diverse marine habitats of areas such as Sri Buat and Sembilang are conserved.

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Author Contributions

Nur Elisa Binti Jeffry: Field sampling, sample sorting, analysed the data, authored and reviewed drafts of the paper.

Azman Abdul Rahim: Conceived and designed the study, field sampling, prepared figures, authored and reviewed drafts of the paper and approved the final draft.

Conflicts of interests:

The authors declare that there are no conflicts of interests.

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Ethical approval

The Animal ethical guidelines are followed in the study for species collection & identification.

Data and materials availability

All data associated with this study are present in the paper.

REFERENCES

1. Azman BAR, Melvin CWH. Two new species of *Urothoe* (Crustacea, Amphipoda, Gammaridea) from the East Johor Islands Archipelago, Malaysia. *Zookeys* 2011; 87:43–62. doi: 10.3897/zookeys.87.817
2. Azman BAR, Othman BHR. Shallow water marine gammaridean amphipods of Pulau Tioman, Malaysia, with the description of a new species. *ZooKeys* 2013; 335:1–31. doi: 10.3897/zookeys.335.5567
3. Chew M, Abdul-Rahim A, Haji-Ross OB. *Tinggianthura alba*: A new genus and species of Anthuridae (Isopoda, Cymothoidea, Anthuroidea) from Pulau Tinggi, Johor, Malaysia with an updated key to the genera of Anthuridae. *PLoS One* 2014; 9:e99072. doi: 10.1371/journal.pone.0099072. Erratum in: *PLoS One* 2014; 9(9):e107419.
4. Chew M, Rahim ABA, Mohd-Yusof NYB. Two new species of *Pendanthura* (Isopoda, Cymothoidea, Anthuroidea) from the east coast of Peninsular Malaysia with an identification key to

- the species of *Pendanthura*. Bull Mar Sci 2016; 92:229–242. doi: 10.5343/bms.2015.1056
5. Feirulsha NS, Rahim ABA. A new species of *Pereionotus* (Amphipoda, Senticaudata, Phliantidae) from Pulau Tinggi, Sultan Iskandar Marine Park, Malaysia. Zoosyst Evol 2020; 96(1):195–203. doi: 10.3897/zse.96.50744
 6. Gan SY, Azman BAR, Yoshida T, Majid AM, Toda T, Takahashi K, Othman BHR. Comparison of day and night mysid assemblages in a seagrass bed by using emergence traps, with key to species occurring at Pulau Tinggi Malaysia. Coas Mar Sci 2010; 34(1):74–81.
 7. Laily A, Azman BAR. Penentuan komposisi dan taburan zooplankton di kawasan perairan Pulau Aur, Johor. In Mustapha MA, Jusoh K, Nazer NSM & Kamil NNNM (ed.). Siri Penyelidikan Sains Sekitaran Dan Sumber Alam, 2017; 9–12. Fakulti Sains & Teknologi Universiti Kebangsaan Malaysia.
 8. Lim JHC, Azman BAR, Othman BHR. Melitoid amphipods of the genera *Ceradocus* Costa, 1853 and *Victoriopisa* Karaman and Barnard, 1979 (Crustacea: Amphipoda: Maeridae) from the South China Sea, Malaysia. Zootaxa 2010; 2384:23–39.
 9. Lim JHC, Azman BAR, Othman BHR. A new species of *Aciconula* (Amphipoda, Senticauda, Caprellidae) from Sultan Iskandar Marine Park, Malaysia. ZooKeys 2019; 859:17–29. doi: 10.3897/zookeys.859.33284
 10. Lim JHC, Azman BAR, Takeuchi I. *Microtripus tinggiensis*, new genus and species (Amphipoda: Caprellidea: Phtisicidae) from Pulau Tinggi, East Johor Islands Archipelago, Malaysia. Proc Biol Soc Wash 2012; 125(3):241–251.
 11. Metillo E, Nishikawa J, Ross OB, Yoshida T, Yusoff FM, Kuppan P, Ohtsuka S, Mulyadi, Sekiguchi H, Toda T, Nishida S. Diel patterns of zooplankton community structure in nearshore waters of different substrates off Tinggi and Sibul Islands, Malaysia, with special reference to copepods. Aquat Ecosyst Health Manag 2019; 22(1):86–102. doi: 10.1080/14634988.2018.1505139
 12. Nakajima R, Yoshida T, Ross O. Monsoonal changes in the planktonic copepod community structure in a tropical coral-reef at Tioman Island, Malaysia. Reg Stud Mar Sci 2015; 2(1):19–26.
 13. Othman BHR, Azman BAR. A new species of Talitridae (Amphipoda: Gammaridea) from Tioman Island, Malaysia. Zootaxa 2007; 1454:59–68.
 14. Peralta HM, Yusoff F. Status of planktonic copepod diversity in the Merambong Sea grass Meadow, Johor, Peninsular Malaysia. Int J Ecosyst 2015; 5(2):39–43. doi: 10.5923/j.ije.20150502.01
 15. Rezai H, Arshad A, Kawamura A. Spatial and temporal distribution of copepods in the Straits of Malacca. Zoo Stud 2004; 43(2):486–497.
 16. Shafie BB, Juneng L, Rahim AA. Effect of Water Circulation to the Distribution of Zooplankton in the Southern Waters of Peninsular Malaysia. Jurnal Riset Biologi dan Aplikasinya 2023; 5(2):70–78. doi: 10.26740/jrba.v5n2.p.70-78
 17. Tan CK, Mansor S, Ibrahim HM, Rashid A. Studies of sea surface temperature and chlorophyll-a variations in East Coast of Peninsular Malaysia. Pertanika J Sci Technol 2002; 10(1):13–24.
 18. Tan HS, Azman BAR, Othman BHR. Taxonomic status of mysid shrimps (Crustacea) from Peninsular Malaysia waters. Malay Nat J 2014; 66(3&4):103–116.
 19. Tan HS, Azman BAR. Diversity of coastal mysids from Pulau Tinggi, Sultan Iskandar Marine Park, Malaysia. Nauplius 2018; 26:e2018037. doi: 10.1590/2358-2936e2018037
 20. Tan HS, Azman BAR. First record of *Rhopalophthalmus longipes* Li, 1964 from Malaysian waters (Crustacea, Mysida). ZooKeys 2017; 642:53–61. doi: 10.3897/zookeys.642.10316