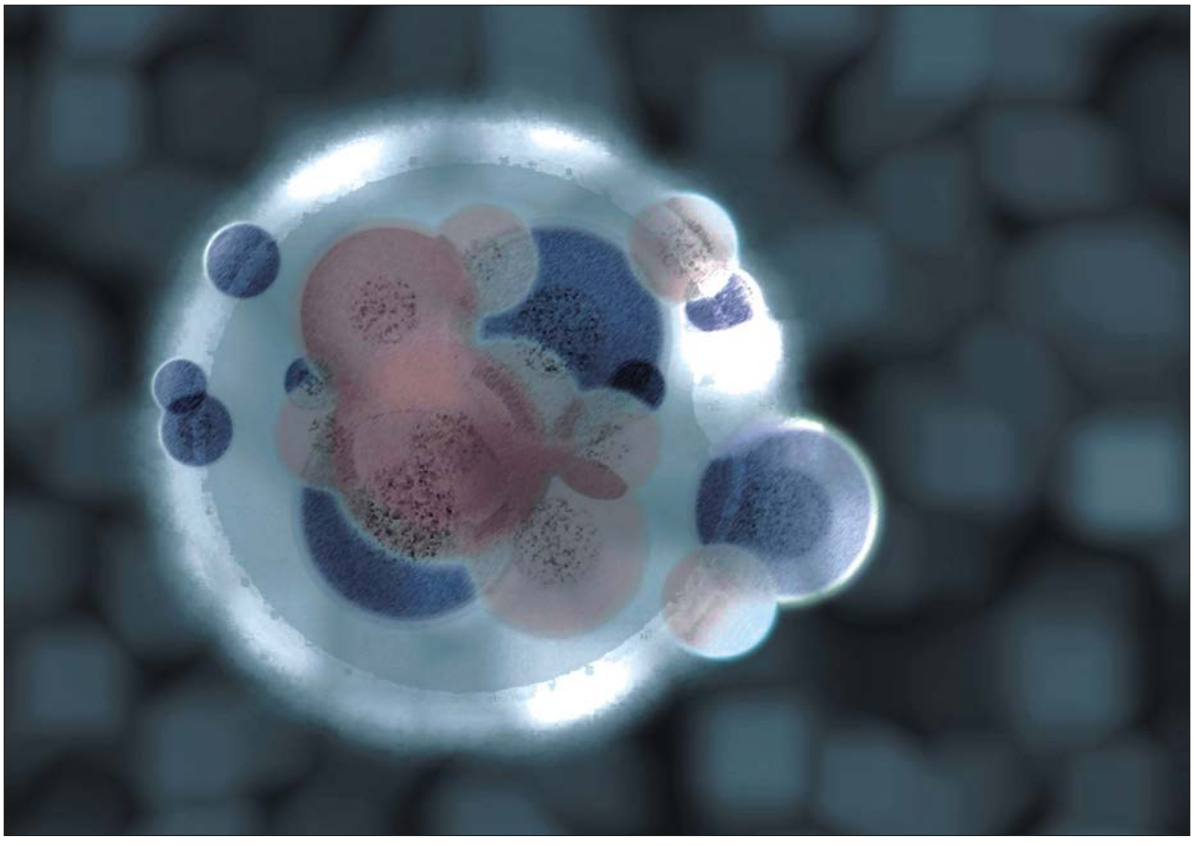

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Benthic Faunal Composition of *Penaeus monodon* Fabricius Culture Pond in West Coast of Peninsular Malaysia

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Abstract: The present study deals with the results on benthic faunal abundance and diversity of tiger shrimp *P. monodon* culture ponds in Perak, West coast of Peninsular Malaysia. To observe the abundance and composition of benthic organisms, sampling was carried out every three weeks interval throughout the culture period. In addition, observations on water temperature, dissolved oxygen, salinity, transparency, pH and organic matter of soil were also made. The major groups of macro-benthos comprised of gastropoda, foraminifera, polychaeta, bivalvia and insecta, whereas, meio-benthos comprised of harpecticoid copepoda, ostracoda, nematoda, gastropoda, foraminifera, bivalvia, insecta, crustacean nauplii and polychaeta. In macro-benthos, the abundance of different sizes of gastropoda increased throughout the culture duration which consists of 37-98.20% for <1 cm length, 1.80-61.50% for 1-2 cm length and 1.18-1.30% for >2 cm length. The other group of benthic organisms both in macro and meio-benthos decreased linearly with the culture period. The depletion symptom indicates that culture species may intensively prey upon the consumable (<0.5 cm in size) benthic fauna together with detritus and artificial diet or the pond bottom deterioration through uneaten feed, faeces and toxic gases may affects their abundance and composition.

Key words: Benthos, biodiversity, *Penaeus monodon*, aquaculture, Malaysia

INTRODUCTION

Benthic macro and meio-faunal communities play an important role in culture pond ecosystem. Beside, their trophic relationship they offer themselves as a live or dead food for culture organisms. They are high in protein, fats, cellulose, lignin, starch, waxes and oils that supplemental feed cannot be provided[1,2]. The composition of benthic biodiversity in the culture pond depends on the pond preparation, management and chemicals used. The benthic organisms were totally absent in poorly prepared pond bottom before the start of culture in Malaysia[3]. The information related to the predation of benthic fauna by shrimps is available[4-6], however, benthic faunal diversity study in brackish water shrimp ponds is meager. Therefore, this study aims to present the various groups of benthic faunas found in shrimp culture ponds in the West coast of Peninsular Malaysia. The variation of total benthic faunas throughout the culture period was also observed.

MATERIALS AND METHODS

The studied shrimp farm is situated at Kampung Telega Nanas (5°45′N and 101°37′E), Perak, West coast of Malaysia. It is about 8 year's old farm and considered aged ponds. Three culture ponds were selected for this study at the beginning. Out of three ponds, two ponds were infected by white spot virus (WSV) at the middle of culture period, whereas, another one remained uninfected. Therefore, sampling was carried out in one pond (4673 m^2) till end of 116 days culture period.

The culture pond was prepared by draining and drying. Surface sludge was removed manually by water jet. Lime applied 2.9, 0.55 and 3.8 t for $CaCO_3$, $Ca(OH)_2$ and dolomite, respectively. Tea seed cake (TSC) was used 0.1 t. At the beginning, the ponds were pumped (filtered through 400-500 μm mesh net) with about 20.0-30.0 cm seawater from the reservoir and kept for 1 week, which allows growing phytoplankton. Water depth was then adjusted to 1 m prior to stock. Stocking density was 48 PL_{22} m^{-2}. A set of four paddlewheels for surface water circulation (12 h/d) and compressed air line for bottom aeration was used. The paddlewheels increased up to six after 1 month. During the culture period 10-20% of water was changed five times. The water was discharged through the cannel to the adjacent mangrove water body and refilled through pump from reservoir. Other chemicals were used in following manner during the culture period; P_2O_5-20 kg, Zeolite-200 kg, Bio Sys-1.2 kg, Aquakit-450 g,

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Bacterial substrate-68.22 l, Lacto bacillus-12.0 l, HUFA-11.6 l, Lacpan-202 g, Flumequine-130 g, Oxolinicacid-125 g, Norfloxacin-446 g, Molasses-11.5 kg, Rice bran-12.5 kg and Boiled Fish-5 kg.

Pond parameters and collection of benthos: Water quality parameters were measured *in situ* at every three-week interval, dissolved oxygen (DO) by DO meter (YSI model 57), water salinity and temperature by SCT meter (YSI model 33), water pH-by-pH meter (EDT model FE 253) and transparency by Secchi disk.

For organic matter, Ekman grab was used to collect soil samples. Three samples were collected in a diagonal direction (corner to corner) from each pond by using a small boat. Samples were brought back to laboratory for further analysis within 2-4 h. In the laboratory, soil samples were dried in room temperature and grinned. Later on, it was sieved through 200 μm mesh screen. Organic matter of soil was detected by ignition method.

The abundance of macro and meio-benthos was investigated in every three weeks interval. Ekman grab sampler covering an area with 225 cm^2 was used for macro-benthos collection. Three samples were collected in a diagonal direction (corner to corner) from each pond. For meio-benthos collection, Ekman grab sampler was brought down into the sediment as slow as possible by using a long bar instead of rope to avoid the turbulence of pond bottom. Later on, 2 cm tube core was used inside the Ekman grab to collect meio-benthos (Prof. Dr. Yoshihisa Shirayama, University of Tokyo, personal communication). All samples were preserved immediately with 10% buffered formalin mixed with rose bengal. In the laboratory, samples were sieved through 1000 μm mesh screen to retain macro-benthos and 53 μm mesh screen for meio-benthos. The organisms were counted and calculated for total amount in m^2 for macro-benthos and 10 cm^2 for meio-benthos.

RESULTS AND DISCUSSION

Data on DO, salinity, temperature, pH, transparency and soil organic matter (Table 1) shows that culture water parameters play important roles for the culture species where they grow. Compared with the reported studies[7,8] the pond parameters were suitable for shrimp culture. Soil organic matter decreased with the culture time, probably as the result of using bacterial products (probiotics) in the ponds. Heterotrophic microorganisms or nitrifying bacteria decomposed or mineralized the organic matter in the pond ecosystem, while they consume oxygen and release CO_2 and ammonium during oxidization process[9].

Table 1: Water quality parameters and soil organic matter of shrimp culture pond

Parameters	Range	Mean
DO (mg L^{-1})	06.80-10.30	08.63±1.06
Salinity (ppt)	16.00-28.20	21.96±3.81
Temperature (°C)	30.00-32.00	31.27±0.56
Water pH	07.22-08.44	07.95±0.39
Transparency (cm)	17.00-37.00	27.67±7.25
SOM (% dry weight)	02.70-07.20	03.69±1.59

SOM= Soil organic matter

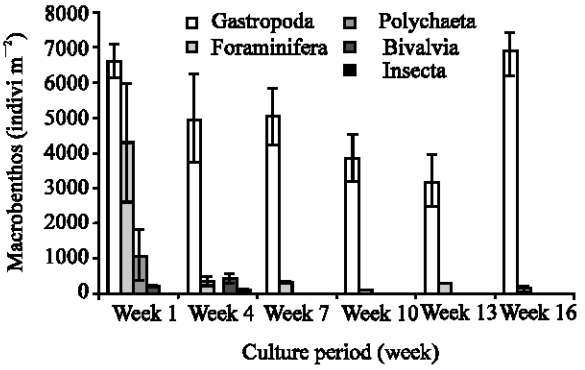

Fig. 3: Composition of macro-benthos in shrimp culture pond throughout the culture period

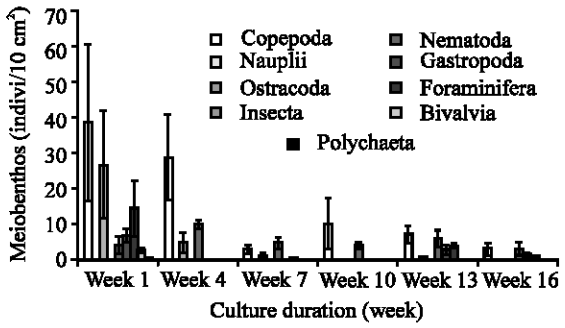

Fig. 4: Composition of meio-benthos in shrimp culture pond throughout the culture period

The major groups of macro-benthos comprised of gastropoda, foraminifera, polychaeta, bivalvia and insecta, whereas, meio-benthos comprised of harpecticoid copepoda, ostracoda, nematoda, gastropoda, foraminifera, bivalvia, insecta, crustacean nauplii and polychaeta (Table 2, Fig. 1 and 2). The variation of benthic faunal composition throughout the culture cycle is given in Fig. 3 and 4. The abundance of different sizes of gastropoda increased throughout the culture duration which consists of 37-98.20, 1.80-61.50 and 1.18-1.30% of <1, 1-2, >2 cm length, respectively. This fluctuation of gastropoda abundance may be due to the rejection of bigger size (1.0-2.0 cm) of *Telscopium telescopium*, which shrimps may unable to prey and consume. The other

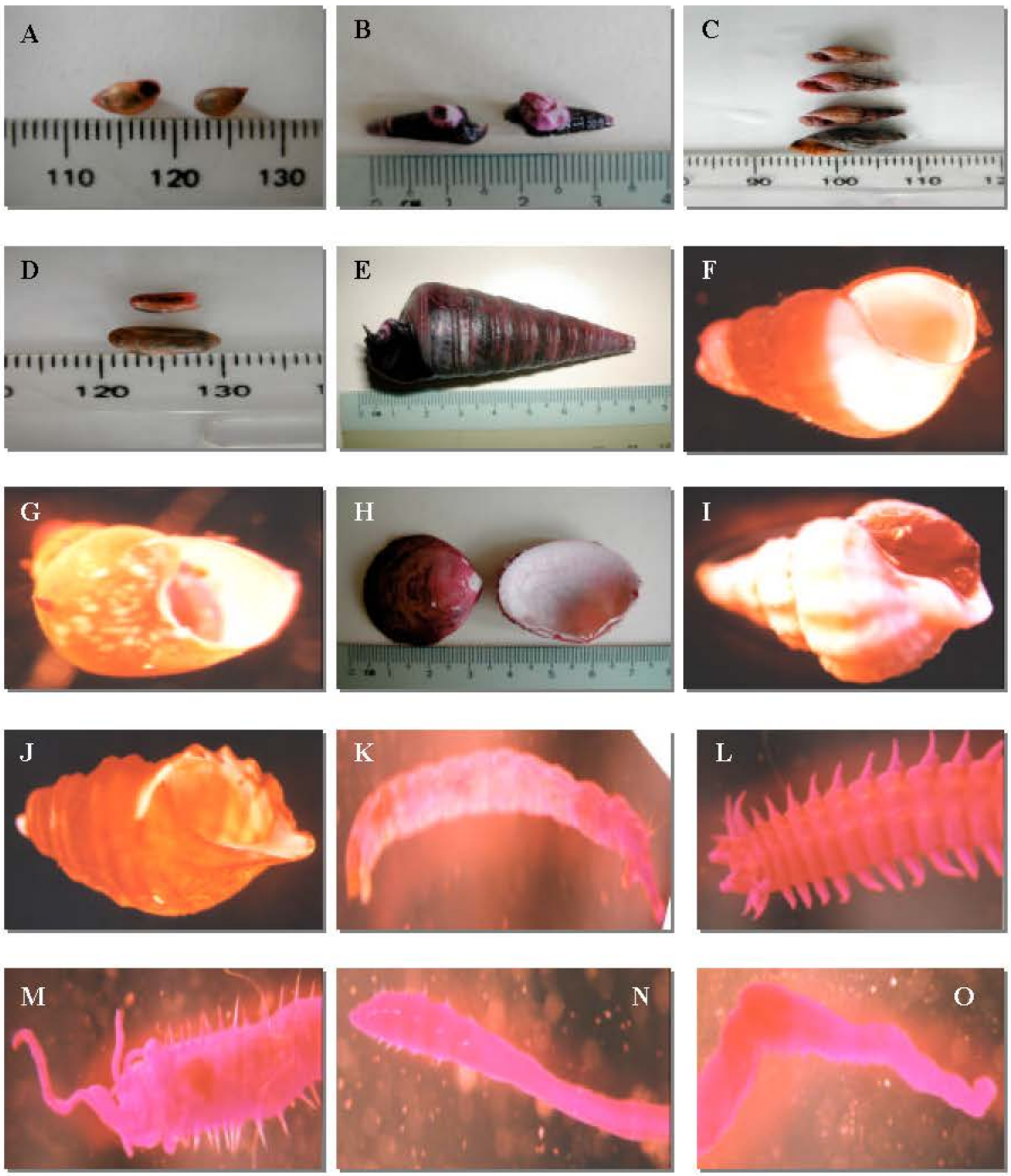

Fig. 1: Some of the macrobenthos found in the shrimp culture pond; (A) *Stenothyra polita* (B) *Certhidea cingulata* (C) *Littorina melanostoma* (D) *Modiolus nitidus*, (E) *Telescopium telescopium* (F) *Fairbankia* sp. (x12) (G) **Syncera brevicula** (x8) (H) *Gelonia ceylonica* (I) *Nassarius suturalis* (x8) (J) *Morula musiva* (x10) (K) *Cricotopus* sp. (x10) (L) *Namalycostis abiuma* (x8) (M) *Liomia* sp. (x12) (N) *Leiochrides* sp. (x12) (O) **Archannelida (Family; x16)**

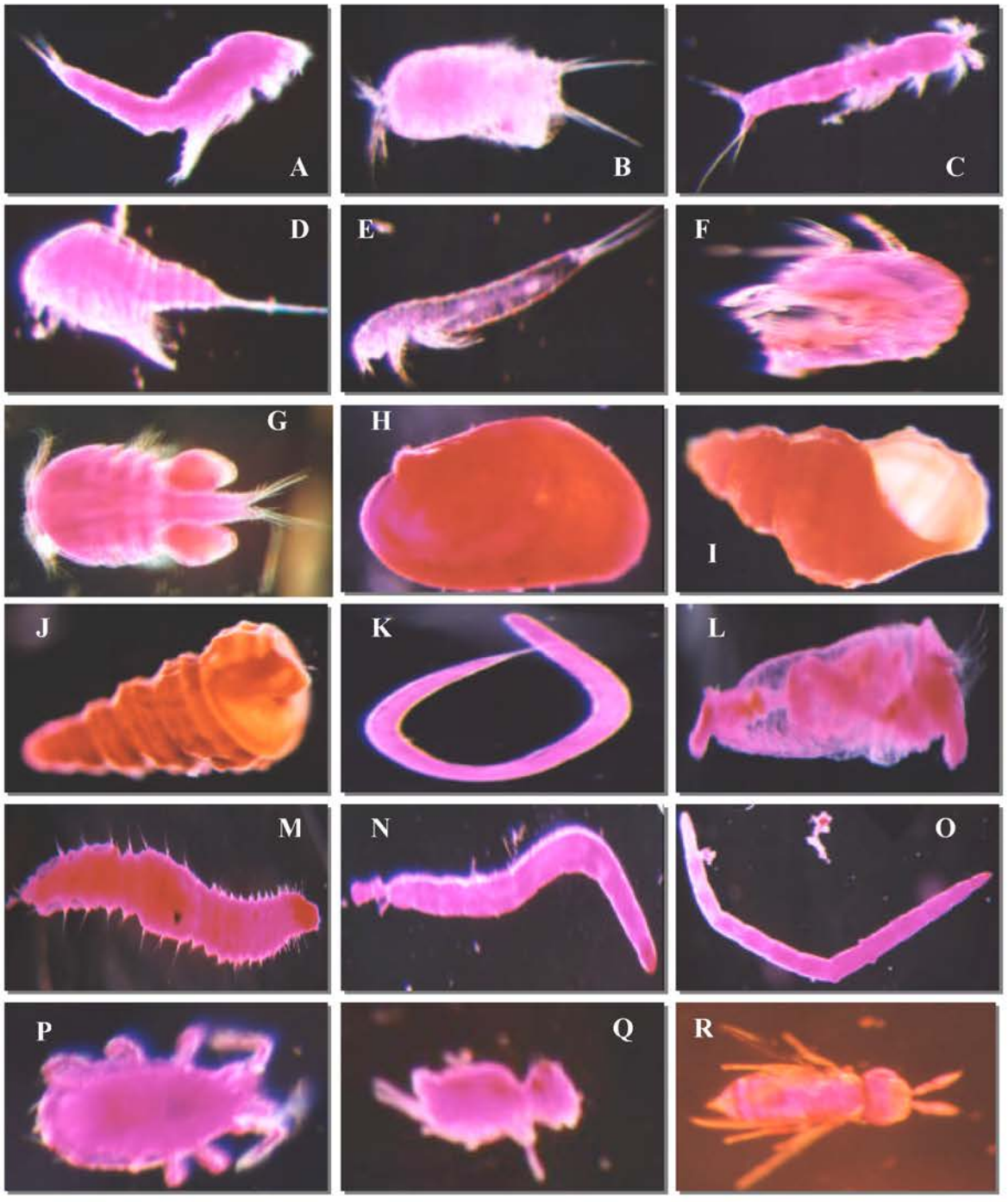

Fig. 2: Some of the meiobenthos found in the shrimp culture ponds; (A) *Euterpina acutifrons* (x40) (B) *Nitokra affinis* (x32) (C) *Euterpina* sp. (x32) (D) *Microsetella* sp. (x40) (E) *Darcythompsonia* sp. (x50) (F) *Tegastes* sp. (x40) (G) *Tisbe* sp. (x25) (H) *Modiolus* larvae (x12) (I) *Littorina* larvae (x20) (J) *Cerithidae* larvae (x20) (K) Spirina sp. (x25) (L) *Pectinaria* sp (x20)

Table 2: Major groups of macro and meio-benthos in the shrimp culture pond

Major groups	Macro-benthos	Major groups	Meio-benthos
Mollusca		Mollusca	
Gastropoda	*Stenothyra polita*	Gastropoda	*Littorina* sp.
	Cerithidae cingulata		*Salinator* sp.
	Telescopium telescopium		*Cerithidae* sp.
	Littorina melanostoma		
	Fairbankia bombayana	Bivalvia	*Modiolus* sp.
	Syncera brevicula		*Gelonia* sp.
	Turritella sp.	Annelida	
	Nassarius suturalis	Polychaeta	Syllidae (F)
	Morula musiva		*Pectinaria* sp.
		Insecta	*Culicoides* sp.
			Psephenivorus sp.
			Bezzia sp.
Bivalvia	*Modiolus nitidus*		*Smiuthurus* sp.
	Gelonia ceylonica		*Cricotopus* sp.
Annelida	*Namalycastis* sp.		Hydrachnellidae (F)
Polychaeta	Caitellidae (F)		Pentatomidae (F)
	Archannelida (F)		
	Terebellidae (F)	Foraminifera	Foraminifera (F)
		Crustacea	
Insecta	*Cricotopus* sp.	Copepoda	*Euterpina acutifrous*
Foraminifera	Foraminifera (F)		*Tegastes* sp.
			Nitokra affinis
			Microsetella sp.
			Enhydrosoma sp.
			Crustacean nauplii
		Nematoda	*Spirina* sp.
			Halalaimus sp.
			Sabatiera sp.
		Ostracoda	*Cypridina* sp.

F=Family

group of benthic organisms both in macro and meio-benthos decreased linearly with the culture period. The depletion symptom indicates that culture species may intensively prey upon the consumable (<0.5 cm in size) benthic fauna or the pond bottom deterioration through uneaten feed, faces and toxic gases may affects their abundance and composition. Decrease of total benthic organisms density also observed by Tidwell[10] in ponds in which the shrimps were fed with supplemental diets. However, the exact contribution of benthic organisms on the growth of shrimp is still unknown in the semi-intensive culture pond. Therefore, future study is needed to understand about the omnipresence benthos in shrimp pond and their contribution on the shrimp growth throughout the culture period.

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