

BIODIVERSITY OF LITTORAL MACROINVERTEBRATES IN THE MEKONG RIVER

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ABSTRACT

Biodiversity of the littoral macroinvertebrate communities was researched in 8 stations in An Giang, Dong Thap, Can Tho and Vinh Long. Results of study showed 125 species of 3 major phylum of macroinvertebrate: Mollusca, Arthropoda and Annelida. The results indicated that littoral macroinvertebrate communities were quite highly diversified (the Shannon – Wiener index $H' = 0.2 - 3.1$) and dense ($1 - 1251 \text{ ind./m}^2$).

Keywords: Biodiversity, Littoral macroinvertebrate, Mekong River.

TÓM TẮT

Đa dạng thành phần loài động vật không xương sống cỡ lớn ven bờ sông Mekong

Đa dạng thành phần loài động vật không xương sống ven sông Mekong được nghiên cứu tại 8 khu vực chính thuộc các tỉnh An Giang, Đồng Tháp, Cần Thơ và Vĩnh Long. Kết quả ghi nhận được 125 loài thuộc 3 ngành lớn là ngành Thân mềm, Chân khớp và Giun đốt. Qua đánh giá cho thấy khu hệ động vật này rất đa dạng về thành phần loài (chỉ số đa dạng Shannon-Wiener $H' = 0.2 - 3.1$) và phong phú về số lượng ($1 - 1251 \text{ cá thể/m}^2$).

Từ khóa: đa dạng, động vật không xương sống cỡ lớn, sông Mekong.

1. Introduction

The Mekong is the longest river in the Southeast Asia. From its source on the Tibetan Plateau, it runs for 4800 km down to the south through the border of Myanmar, Laos PDR and Thailand, downward to Cambodia. It starts breaking up into plural flows and forms a vast Mekong River Delta in Viet Nam and finally run into the South-China Sea by 8 estuaries.

Even though being important river in Vietnam but there is no fully researches on littoral macroinvertebrate communities in the part of the Mekong delta. Meanwhile, they are not only main biological component in intertidal river food web for ecosystem but they are also very helpful to apply for human lives. Some mollusks, crustacea play an important role for local people earning their living since being known as precious

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aquatic products to provide great food. They were also known to be useful bioindicator for environmental monitoring and bioconservation. In this work, we would provide a baseline study of biodiversity of macroinvertebrate in the Mekong River for further research on bioconservation and environmental management.

2. Methodology

2.1. Sampling stations

Samples of littoral macroinvertebrates were collected at the 8 stations in two branches of Mekong River: Hau River and Tien River during March 2008. These sampling stations located from the Cambodia border toward the sea were coded by MK with coordination such as: MK1 (N10.01131, E105.81263), MK2(N10.34438, E105.47410), MK3(N10.74809, E105.13438), MK4(N10.95466, E105.08680), MK5(N10.90844, E105.18149), MK6(N10.80600, E105.26488), MK7(N10.43772, E105.58299), MK8(N10.26264, E105.94705) (Figure 1).

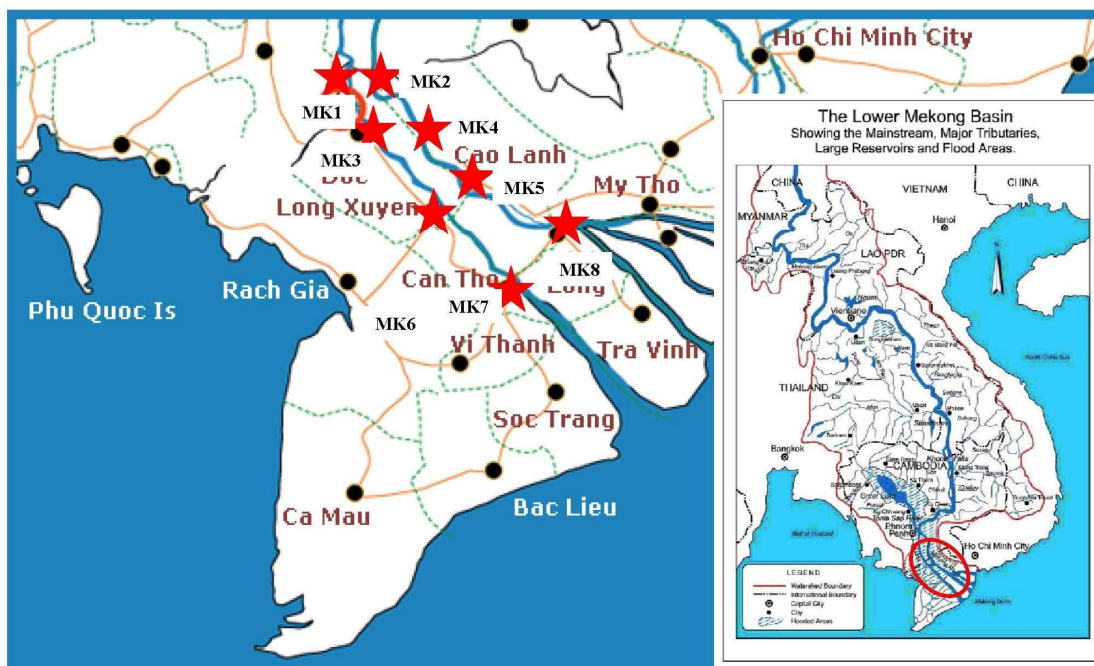


Figure 1. Sampling stations in the Mekong River, Vietnam

2.2. Sampling methods

In each station, samples of littoral macroinvertebrate were collected following both sweeping and kicking methods by a D-frame net with dimension of 30 cm x 20 cm with mesh size of 475 μ m in the littoral area 1.5 m from the water's edge and 20m along the river in 10 times. All macroinvertebrates' samples were treatment at field by formaline 7% in the 150 mL jars before transferring to laboratory for identification.

In the laboratory, invertebrate specimens were identified to species according to

valid taxonomic document ([1], [2], [3], [4], [5], [6], [7]) under stereo – microscope. All data was done data mining and processing in the Microsoft Excel. The software PRIMER v6 was applied to measure the diversity of littoral macroinvertebrate. The Shannon-Wiener diversity index (H') (Shannon and Weaver, 1949) was used to calculate from the proportional abundances p_i of each species (abundance of the species (N_i) per total abundances (N_t)):

$$H' = -\sum (p_i \cdot \log(p_i))$$

in which $p_i = N_i/N_t =$ relative abundance of each species or genera the i .

3. Results

3.1. Composition and abundance of littoral macroinvertebrate communities

Total of 9714 individuals of littoral macroinvertebrate specimens were identified to 125 species (table 1, figure 2). Mollusca contributed high percentage of species in the communities with 56 species (45% of total), Gastropoda dominated. Next to Mollusca, 26 species of Crustacea were recorded in which Decapoda contributed to 14 species (11%).

In the littoral area of the Mekong River, Mollusca and Decapoda was considered being good food sources for local people. Other component of littoral macroinvertebrate must be concerned to group of aquatic insect and Annelida. Hirudinea was found one 1 species.

Some taxa such as Diptera, Hemiptera, Decapoda, Mesogastropoda, Mytiloidea and Veneroidea occurred in almost stations meanwhile Coleoptera, Ephemeroptera, Hirudinea, and Trichoptera only being found only in 2 stations.

Number of species in sample at each station ranged from 1 to 19 but number of species from 10 samples per station showed higher from 11 to 47. These values were high in stations such as site MK2 (47 species), MK7 (44 species), MK8 (41 species), MK1 (31 species) and MK3 (30 species). In contrast, station MK6 and MK5 showed low number of species. Figure 1 shows average and standard deviation of species number per stations.

Table 1. The composition of littoral macroinvertebrate

STT	Taxa	Number of species	Percentage
	Mollusca (<i>Thân mềm</i>)		
1	Gastropoda (<i>Chân đầu</i>)	32	25,6%
2	Bivalvia (<i>Hai mảnh vỏ</i>)	24	19,2%
	Annelida (<i>Giun đốt</i>)		
3	Polychaeta (<i>Giun nhiều tơ</i>)	3	2,4%

4	Oligochaeta (<i>Giun ít tơ</i>)	13	10,4%
	Crustacea (<i>Giáp xác</i>)		
5	Decapoda (<i>Tôm-cua</i>)	14	11,2%
6	Amphipoda (<i>Chân khác</i>)	9	7,2%
7	Isopoda (<i>Chân đều</i>)	3	2,4%
	Aquatic Insecta (<i>Côn trùng nước</i>)		
8	Trichoptera (<i>Cánh lông</i>)	2	1,6%
9	Diptera (<i>Hai cánh</i>)	10	8%
10	Odonata (<i>Chuồn chuồn</i>)	4	3,2%
11	Hemiptera (<i>Cánh nửa</i>)	3	2,4%
12	Coleoptera (<i>Cánh cứng</i>)	5	4%
13	Ephemeroptera (<i>Phù du</i>)	2	1,6%
14	Hirudinea (<i>Đũa</i>)	1	0,8%
	Total of taxa	125	100%

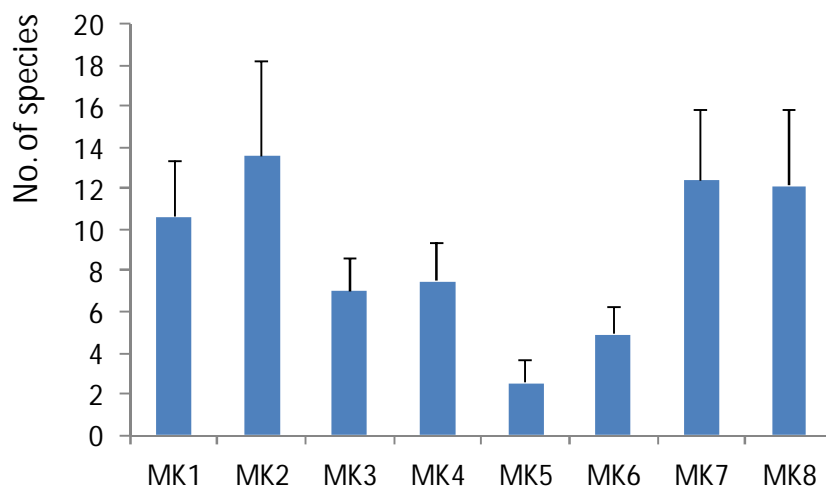


Figure 2. Average and standard deviation of species number macroinvertebrate

Abundance of the macroinvertebrate in each sample of station was high ranged from 1 – 1251 inds/m² but average values per station ranged from 6,6 – 546,4 inds/m² (figure 3). They contributed highest density in the MK6 (546,4 inds/m²) which aquatic insect like Hemiptera, Mesogastropoda, Diptera and Veneroida were dominant. These common species occurred both on sediment substrata, alluvium, organic fertilizer substrata, macro-algae and aquatic vegetation and in the water column.

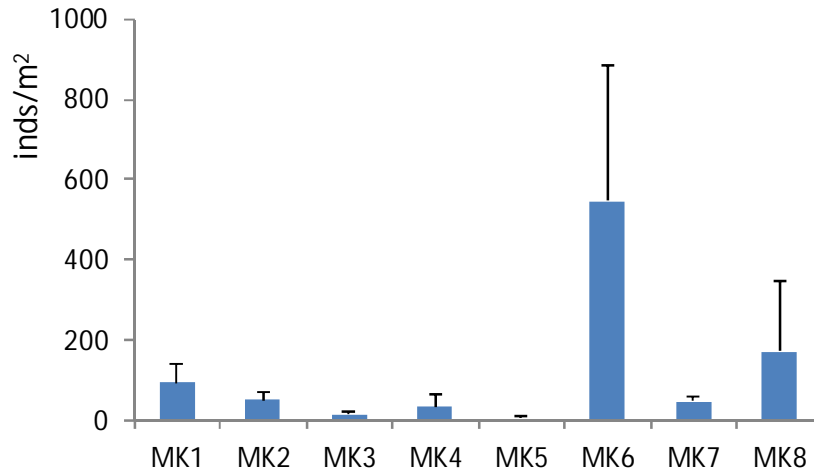


Figure 3. Average and standard deviation of macroinvertebrate abundance

3.2. Biodiversity of the littoral macroinvertebrate by Shannon-Wiener index

Biodiversity of littoral macroinvertebrate communities was measured by Shannon-Wiener index (H'). The results ranged from 0.2 to 3.1 (table 2, figure 4). The highest diversity value was found at site MK2 and the lowest diversity at site MK6. This trend is similar to that observed for taxon richness. The highest diversity index values were found at stations with sediment features containing high organic matter or rubbish such as at site MK2, MK7, MK8 and MK3. Meanwhile low diversity index values were found at stations with alluvium sediment, organic fertilizer substrata, such as at sites MK6 and MK4.

Table 2. The Shannon-Wiener diversity index of littoral macroinvertebrates

Station	MK1	MK2	MK3	MK4	MK5	MK6	MK7	MK8
H'	2	3.1	2.7	1.4	1.6	0.2	2.9	2.7

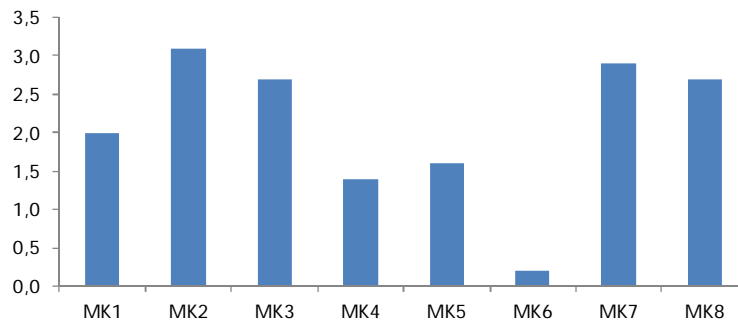


Figure 4. The biodiversity index of littoral macroinvertebrate communities

5. Conclusion

125 species of littoral macroinvertebrates was recorded in the Mekong River, Vietnam. The composition of these communities mainly belongs to 3 phylums: Mollusca, Arthropoda and Annelida. Mollusca was found highest dominant in the communities with 45 percentages of total species. The Shanon – weiner index was applied to measure biodiversity of littoral macroinvertebrates communities to reported high value. This study not only provided to science the basic information of biodiversity of littoral macroinvertebrate for further research on aquatic products, environmental management but also for littoral food web of river ecosystem.

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APPENDIX

The composition of littoral macroinvertebrate species was recorded in 8 stations of the Mekong River

Science name	Station							
	MK 1	MK 2	MK 3	MK 4	MK 5	MK 6	MK 7	MK 8
MOLLUSCA								
Gastropoda								
Thiaridae								
<i>Clea helena</i> Busch, von dem, 1847	*	*	*	*				
<i>Clea scalarina</i> Deshayes, 1876				*				
<i>Melanoides tuberculatus</i> Muller, 1774				*	*		*	
Ellobiidae								
<i>Melampus fasciatus</i> Horstmann, 1979	*							
Lymnaeidae								
<i>Lymnaea viridis</i> Lee et al., 1995	*				*			
<i>Lymnaea collumella</i> Say, 1817					*			
<i>Lymnaea swinhoei</i> Adams, 1866			*					
Stenothyridae								
<i>Stenothyra glabrata</i> A.Adams, 1850	*	*	*	*			*	
<i>Stenothyra moussoni</i> von Martens, 1897		*	*	*			*	
<i>Stenothyra maculata</i> Brandt, RAM, 1974					*			
<i>Stenothyra annandalei</i>			*	*	*			
<i>Stenothyra hybocystoides</i> Bavay, 1895							*	
<i>Stenothyra</i> sp			*	*				
<i>Gastropoda larva</i>				*				
Bithyniidae								
<i>Bithynia s. siamensis</i> Leach, 1815	*	*	*	*				
Neritidae								
<i>Neritina violacea</i> Gmelin, 1791	*			*				
<i>Clithon sowerbyana</i> Recluz, 1842				*				
Viviparidae								

<i>Mekongia swainsoni cf. hainesiana</i> Lea, 1856	*		*					
<i>Mekongia swainsoni swainsoni</i> Lea, 1856.			*	*				
<i>Mekongia sp</i>			*					
<i>Angulyagra polyzonata</i> Frauenfeld, 1862		*						
<i>Trochotaia trochoides</i> Martens, 1860		*						
<i>Sinotaia aeruginosa</i> Reeve		*						
Assimineidae								
<i>Cyclotropis bollingi</i> Brandt, 1974		*	*	*				
<i>Assiminea obtusa</i>			*					
<i>Cyclotropis sp</i>				*				
<i>Assiminea microscopica</i> Brandt, 1968				*				
Pilidae								
<i>Pila pesmei</i> Morelet, 1889		*						
<i>Pila polita</i> Deshayes, 1830							*	
Fairbankiidae								
<i>Fluviocingula elongata</i> Dang		*						
Pleuroceridae								
<i>Eurycaelon anthonyi</i>							*	
Planorbidae								
<i>Hippeutis umbilicalis</i> Benson, 1836				*				
Bivalvia								
Corbiculidae								
<i>Corbicula leviuscula</i> Prime, 1864	*	*	*	*	*	*	*	
<i>Corbicula lamarckiana</i> Prime, 1864	*	*	*	*				
<i>Corbicula larva</i>	*	*	*	*				
<i>Corbicula cyreniformis</i> Prime, 1860	*		*					
<i>Corbicula castanea</i> Morelet, 1865	*							
<i>Corbicula bocourti</i> Morelet, 1865							*	
<i>Corbicula baudoni</i> Morelet, 1886		*	*	*			*	
<i>Corbicula sp</i>		*						

<i>Corbicula fluminea</i> Muller, 1774		*		*		*		
<i>Corbicula iravadica</i> Hanley & Theobald, 1876					*			
<i>Corbicula regia</i> Clessin, 1878							*	
Mytilidae								
<i>Limnoperna siamensis</i> P. A. Morelet, 1866	*	*	*	*	*	*	*	
<i>Limnoperna sp</i>		*						
<i>Brachidontes arcuatulus</i> Hanley 1843	*	*						
<i>Brachidontes exustus</i> L. 1758						*		
Amblemidae								
<i>Ensidens ingallsianus ingallsianus</i> Lea, 1852	*	*						
<i>Uniandra contradens tumidula</i> Lea, 1856		*						
<i>Pilsbryconcha exilis exilis</i> Lea, 1389		*						
<i>Uniandra contradens crosseii</i> Deshayes, 1876		*						
Unionidae								
<i>Oxynaia micheloti</i> Morelet, 1886		*						
<i>Medionidus conradius</i> Lea, 1834								*
<i>Indonaia humilis</i> Lea, 1856				*				
Arcidae								
<i>Scaphula pinna</i> Benson, 1856		*	*		*		*	
Pisidiidae								
<i>Afropisidium clarkeanum</i> G.& H. Nevill, 1871			*					
POLYCHAETA								
Nereidae								
<i>Namalycastis longicirris</i> Takahashi, 1933	*	*	*	*	*			
<i>Dendronereis aestuarina</i> Southern, 1921					*			
Nephtydididae								
<i>Nephtys polybranchia</i> Southern, 1921			*				*	

OLIGOCHAETA								
Tubificidae								
<i>Aulodrilus prothecatus</i> Chen	*	*		*	*			*
<i>Branchiura sowerbyi</i> Beddard, 1892		*		*			*	*
Aelosomatidae								
<i>Aelosoma bengalense</i> Stephenson, 1911	*							
<i>Aelosoma hemprichii</i> Ehrenberg								*
Naididae								
<i>Dero sp</i>	*	*	*	*	*			*
<i>Dero sp1</i>	*	*	*	*				*
<i>Dero sp2</i>				*				
<i>Dero sp3</i>		*			*			
<i>Dero pectinata</i> Aiyer, 1930		*						
<i>Dero denticulata</i> Treitschke, 1828					*			
<i>Aulophorus tonkinensis</i> Vejd., 1894	*							
<i>Chaetogaster langi</i> Bretscher, 1896		*			*			
<i>Chaetogaster limnaei limnaei</i> on Baer, 1827		*						
DECAPODA								
Palaemonidae								
<i>Palaemonetes sinensis</i> Solland, 1911				*		*		
<i>Macrobrachium equidens</i> Dana, 1852	*	*			*			
<i>Macrobrachium rosenbergii</i> De Man 1879	*							
<i>Macrobrachium pilimanus</i> De Man, 1879		*						
<i>Palaemon curvirostris</i> Nguyen Van Xuan, 1992	*		*		*		*	
<i>Macrobrachium mekongene</i> Dang, 1998		*						
<i>Macrobrachium lanchesteri</i> De Man, 1911					*			
<i>Macrobrachium mirabile</i> Kemp, 1917			*					
<i>Decapoda larva</i>		*	*	*	*	*		
Atyidae								

<i>Caridina verrata verrata</i> Stimson		*		*			*	
Potamidae								
<i>Ranguna cochinchinensis</i> De Man, 1898			*	*	*			
<i>Ranguna brousmichi</i> Rathbun, 1904			*		*			
Parathelphusidae								
<i>Parathelphusa germaini</i> Rathbun, 1902			*					
<i>Somaniathelphusa germaini</i> Rathbun, 1902			*					
AQUATIC INSECTA								
Diptera								
Chironomidae								
<i>Cricotopus</i> sp	*	*		*	*	*		
<i>Chironomus</i> sp		*			*	*	*	
<i>Chironomus attenuatus</i> Walker, 1848			*	*	*	*		*
<i>Pseudodiamesa</i> sp				*				
Ceratopogonidae								
<i>Bezzia</i> sp					*			
<i>Culicoides</i> sp							*	
<i>Culicoides variipennis</i> Coquillett								*
Psychodidae								
<i>Psychoda</i> sp						*		*
Tipulidae								
<i>Tipula</i> sp						*		
Ptychopteridae								
<i>Bittacomorpha</i> sp						*		
Odonata								
Gomphidae								
<i>Aphylla</i> sp	*		*					
<i>Arigomphus</i> sp		*						
Libellulidae								
<i>Sympetrum</i> sp		*						
Coenagrionidae								
<i>Enallagma</i> sp		*					*	

Tricoptera								
Polycentropodidae								
<i>Cymellus sp</i>	*							
Brachycentridae								
<i>Micrasema sp</i>								*
Hemiptera								
Corixidae								
<i>Sigara sp</i>	*		*	*	*	*	*	*
Delphacidae								
<i>Megamelus sp</i>					*	*	*	
Hebridae								
<i>Hebrus sp</i>							*	
Coleoptera								
Psephenidae								
<i>Psepheus sp</i>					*			
Hydrophilidae								
<i>Hydrophilinae sp</i>							*	
Haliplidae								
<i>Haliplus sp</i>							*	
Pleidae								
<i>Neoplea sp</i>							*	
Dytiscidae								
<i>Acilius sp</i>							*	
Ephemeroptera								
Baetidae								
<i>Callibaetis sp</i>							*	
Caenidae								
<i>Caenis sp</i>						*		
AMPHIPODA								
Haustoriidae								
<i>Eohaustorius tandeensis</i> Dang, 1968	*			*				
Hyalidae								
<i>Hyale sp</i>	*		*	*				

<i>Hyale hawaiiensis</i> Joseph, 1972			*			*		
Gammaridae								
<i>Melita</i> sp			*					
<i>Melita vietnamica</i> Dang			*	*		*		
<i>Gammarus</i> sp			*					
Corophiidae								
<i>Corophium</i> sp			*					
<i>Corophium minutum</i>			*					
<i>Corophium intermedium</i>			*					
ISOPODA								
Anthuridae								
<i>Cyathura carinata</i>	*		*					
Corallanidae								
<i>Tachaea chinensis</i> Thielemann		*						
Porcellionidae								
<i>Porcellio</i> sp				*				
HIRUDINEA								
<i>Hirudinea</i> sp		*	*					

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