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Freshwater Molluscan Assemblages in Upper Part of Choen River Basin, Northeastern Thailand

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Abstract.– Freshwater molluscan assemblages were studied from the upper part of the Choen River Basin, Northeastern Thailand. Ten plots of 1x1 m^2 were used to collect specimens from 10 stations in the dry season from June to July 2015. In total, 5,394 specimens belonging to seven families, 14 genera and 18 taxa of gastropods and two families, five genera and six taxa of bivalves were found. The species with the highest abundance was *Filopaludina (Siamopaludina) martensi martensi* (1,568 specimens or 29.07%) and the species with the lowest abundance were *Pila polita, Corbicula lamarckiana, Trapezoideus exolescens comptus* and *Cristaria plicata* (one specimen for each species 0.02%). Ecological statistics were also analyzed, which comprised of density = 53.94 individuals/m^2, Shannon-Weiner diversity index (H′) = 2.27, Fisher's alpha (α) = 3.23, and similarity index (SI) among each station ranging from 0 – 67.12. Based on cluster analysis and canonical correspondence analysis (CCA), each species was related to environmental parameters, including velocity, dissolved oxygen, water temperature, electric conductivity and total dissolved solids. It was possible to divide the freshwater molluscs of the upper part of the Choen River Basin into two assemblages, i.e. *Brotia (Brotia) baccata – Corbicula blandiana* assemblage, which was found from a sand–gravel base stream with rapid current, and *Filopaludina (Siamopaludina) martensi martensi – Pilsbryoconcha exilis compressa* assemblage, which was found from a clay base stream or river with stagnant or slow current.

KEY WORDS: Upper part of Choen River Basin, sand-gravel base stream, clay base stream, rapid current, stagnant water, gastropods, bivalves

INTRODUCTION

Freshwater molluscs have a very wide range of zoogeography (Bogan, 2008; Strong et al., 2008). Background knowledge of the diversity and assemblages of these animals is strategically crucial and important as the topic not only represents but also crosses over the interrelationships between biotic and abiotic factors within, and across, freshwater mollusc assemblages. Physical and chemical factors in the water have been shown to relate to diversity, dispersion and changes in the community and relationships within and among communities (Sharma et al., 2013). Such relationships are shown to be fragile, and have been consistently reported to be disturbed or altered by climate change, where flash floods and less frequent precipitation have been shown to be related to the changing world climate.

According to Brandt (1974) and Nabhitabhata (2009), 286 and 95 taxa of non-marine aquatic gastropods and bivalves have been reported from Thailand, respectively. These taxa were collected and sampled for taxonomic purposes from all

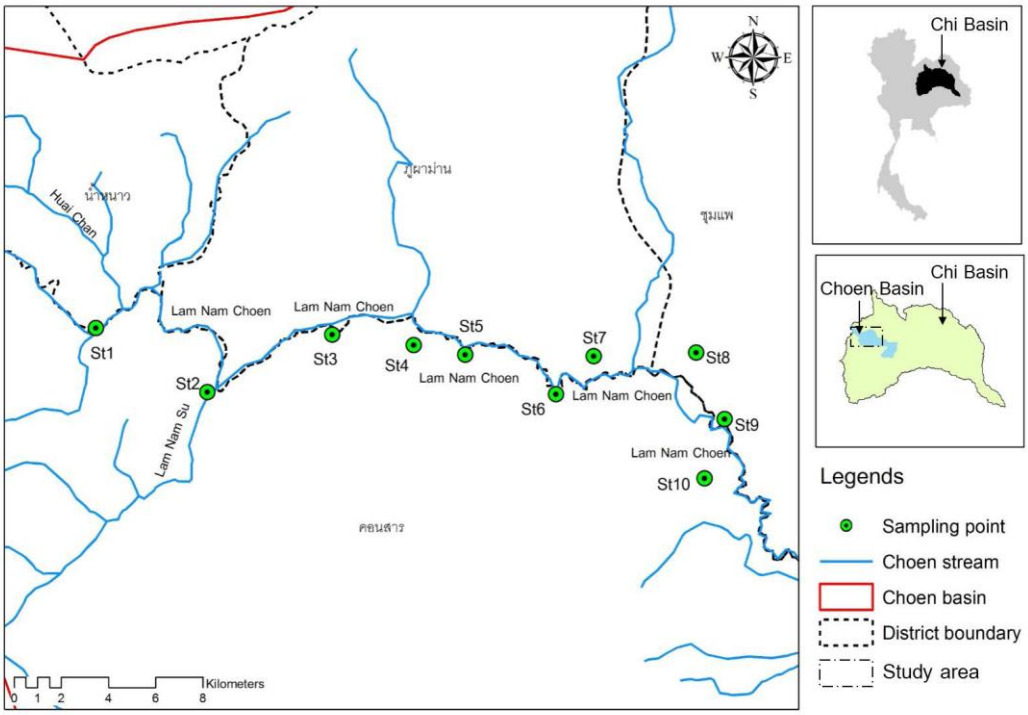

FIGURE 1. Sampling stations for freshwater molluscs in upper part of Choen River Basin. The name of stream in each station (St) are as in Table 1.

provinces and most districts of Thailand during 1963-1971 (Brandt, 1974).

However, in Thailand, studies related to freshwater molluscan assemblages and species diversity have not been well researched, especially the understanding of the assemblage interactions among streams within the same river basin. There have been a few reports about this topic for the main river basins in Thailand, such as Lower Pa Sak River (Pungchimplee, 2007), Khwae Noi River (Deein et al., 2005) and Pong River (Tarbsripair and Khunsook, 2003). However, there have been limited reports of the diversity and assemblages from the Choen River Basin; only three taxa of bivalves were reported by Brandt (1974), which were *Pseudodon cambodjensis tenerrimus, Hyriopsis (Hyriopsis) bialatus* and *Physunio eximius*.

The Choen River is a sub-basin of the Chi River Basin in Northeastern Thailand. The catchment area of the Choen River Basin covers 727 km^2 across Phetchabun, Chaiyaphum and Khon Kaen Provinces (Department of Water Resources, 2009) (Fig. 1). The basin has been partially trespassed and transformed for agricultural practices and urban development, especially in the restricted area for 1A and 1B basin classes (Chandrachai et al., 1996). This extensive land use could further suppress and alter freshwater communities within the basin, especially the molluscan assemblage. The issue calls for updated diversity and spatial distribution studies of freshwater

molluscan assemblages for better management plans for the area.

The aims of this research were to describe and relate differences in species composition of the freshwater molluscan assemblages. Systematic sampling were used to collect molluscs in 10 stations at intervals of 5 km., and to correlate the physico-chemical properties of the water and the distribution of each freshwater molluscan species from upstream to downstream in the upper part of the Choen River Basin.

MATERIALS AND METHODS

Sampling stations and methods

The upper part of the Choen River Basin is located in Khon San District (Chaiyaphum Province) and Chum Phae and Phu Pha Man Districts (Khon Kaen Province). Spatial distribution of freshwater molluscs were studied. Ten sampling stations were selected from tributaries and reservoirs every 5 km along the Choen River (Fig. 1 and Table 1), in the dry season due to the shallow water (where the substrate and molluscs could easily be seen and collected), which allowed us to assess the greater diversity than in other seasons. The sampling procedure used in this study followed Pungchimplee (2007). Ten 1x1 m^2 quadrats were randomly assigned in each station, and each quadrat was collected by one person for 10 min. After identification and taking photographs, 30 individuals of each species were preserved in 70% ethanol and the others were released to their habitats for minimal disturbance of the natural population. The preserved samples were kept as reference collections in the Department of Biology, Faculty of Science, Mahasarakham University. Identification and classification of these freshwater molluscs were based on Brandt (1974) and Jivaluk et al. (2007).

TABLE 1. Sampling stations in upper part of Cheon River Basin.

Station	Name of stream	Substrate type	Stream type	Longitude (E°)	Latitude (N°)	Location	
						District	Province
1	Huai Sanam Sai	Gravel	Tributary	791129	1843149	Khon San	Chaiyaphum
2	Lam Nam Su	Gravel	Tributary	795854	1840423	Khon San	Chaiyaphum
3	Huai Kaeo	Mud	Reservoir	801139	1842864	Khon San	Chaiyaphum
4	Huai Prong	Mud	Tributary	804603	1842422	Khon San	Chaiyaphum
5	Huai Bung Namlad	Mud	Tributary	806784	1842019	Khon San	Chaiyaphum
6	Huai Laeng	Mud	Tributary	810631	1840340	Khon San	Chaiyaphum
7	Nong Yai	Mud	Reservoir	812222	1841952	Phu Pha Man	Khon Kaen
8	Khlong Ban That	Mud	Tributary	816565	1842101	Chum Phae	Khon Kaen
9	Tham Ban Sanam Bin	Mud	Tributary	817782	1839291	Chum Phae	Khon Kaen
10	Huai Sai Khao	Mud	Tributary	816922	1836770	Khon San	Chaiyaphum

The physical and chemical characteristics of the water and substrate types were collected at each sampling station. Substrate types were determined in the field by wentworth grain size classification of clastic sediments (Pettijohn, 1975). The dominant size for its grains were measured by using millimeter scale and then using hand lens to estimate size smaller than 0.5 mm. Dominant grain sizes larger than 2 mm were identified as gravel, 0.0625-2 mm. as sand, and smaller than 0.0625 mm as mud. The water temperature was measured with a thermometer while the ambient relative humidity was measured with a humidity meter (WBT-DEW POINT-ST 321S). A Secchi disc and a calibrated wooden pole were used to measure the water transparency and the water depth, respectively. The pH of the water sample was determined by a HANNA HI98107 model pH meter while a multimeter

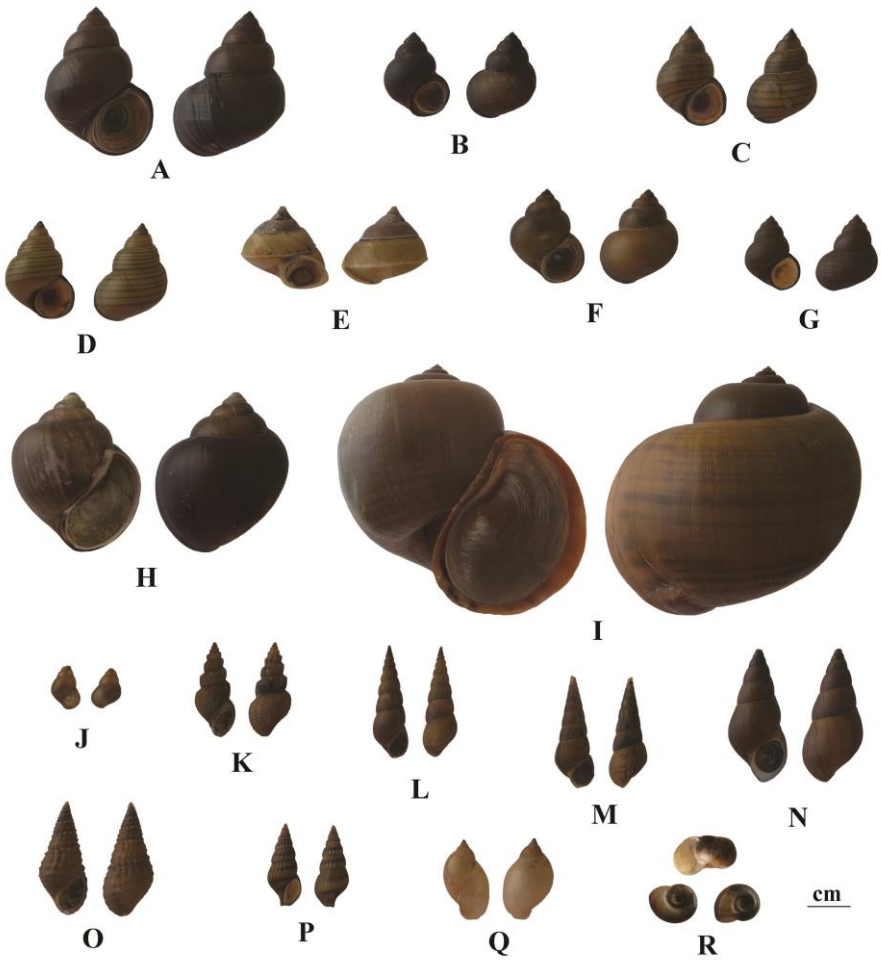

FIGURE 2. Freshwater gastropods from upper Choen River Basin. (A) *Filopaludina (Siamopaludina) martensi martensi*; (B) *F. (S.) martensi cambodjensis;* (C) *F. (F.) sumatrensis polygramma;* (D) *F. (F.) sumatrensis speciosa;* (E) *Trochotaia trochoides;* (F) *Mekongia rattei;* (G) *Sinotaia arturrolli;* (H) *Pila polita;* (I) *Pomacea canaliculata;* (J) *Bithynia (Digoniostoma) siamensis goniomphalos;* (K) *Thiara scabra;* (L) *Melanoides tuberculata;* (M) *Adamietta housei;* (N) *Brotia (B.) manningi;* (O) *B. (B.) baccata;* (P) *Clea (Anentome) helena;* (Q) *Lymnaea (Radix) auricularia swinhoei;* and (R) *Indoplanorbis exustus*.

HANNA HI99301 was used to determine the electric conductivity and total dissolved solids. Dissolved oxygen was measured using a YSI model 55 probe. Water velocity was estimated by timing the linear movement of a calibrated mass on the water body surface.

Data Analysis

Density and ecological indices including Shannon-Weiner diversity index, Fisher's Alpha, and similarity index by Bray-Curtis (Washington, 1984) were calculated. These ecological indices were calculated and compared among sampling stations, and they were used to represent the community structures in terms of abundance and diversity in different sampling sites. Fisher's Alpha was calculated by Javascript program (Angeletti, 2016). Canonical correspondence analysis (CCA) was analyzed by PCORD (version 5.0), which this analysis was used to determine the ordination among the freshwater mollusc sample scores and physical and chemical environmental factor loadings (Zieritz et al., 2016).

RESULTS AND DISCUSSION

Overall, 5,394 individual molluscs were collected from 100 1x1 m^2 quadrats in 10 stations. These specimens could be classified to 18 taxa of gastropods (seven families and 14 genera) and six taxa of bivalves (two families and five genera) (Figs. 2-3 and Table 2).

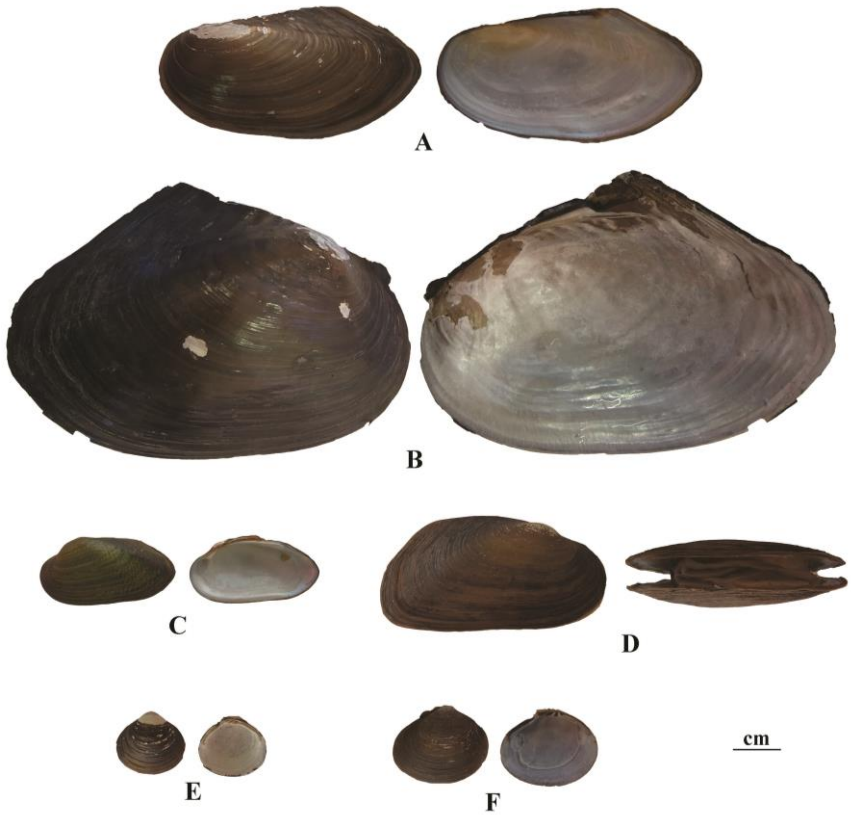

FIGURE 3. Freshwater bivalves from upper part of the Choen River Basin. (A) *Plisbryoconcha exilis compressa;* (B) *Cristaria plicata*; (C) *Scabies phaselus*; (D) *Trapezoideus exolescens comptus;* (E) *Corbicula blandiana*; and (F) *Corbicula lamarckiana*.

TABLE 2. Species and number of individuals of freshwater molluscs collected from 10 stations in upper part of Choen River Basin.

Family/Taxa	Station				
	1	**2**	**3**	**4**	**5**
Class Gastropoda					
Family Viviparidae					
1. *Filopaludina (Siamopaludina) martensi martensi*	0	0	80	143	111
2. *Filopaludina (Siamopaludina) martensi cambodjensis*	0	0	1	3	1
3. *Filopaludina (Filopaludina) sumatrensis polygramma*	0	9	7	323	0
4. *Filopaludina (Filopaludina) sumatrensis speciosa*	0	0	196	18	122
5. *Trochotaia trochoides*	0	0	0	1	0
6. *Mekongia rattei*	107	0	0	0	0
7. *Sinotaia arturrolli*	0	0	0	0	0
Family Ampullariidae					
8. *Pila polita*	0	0	1	0	0
9. *Pomacea canaliculata*	0	0	20	15	48
Family Bithyniidae					
10. *Bithynia (Digoniostoma) siamensis goniomphalos*	0	0	6	31	90
Family Thiaridae					
11. *Thiara scabra*	13	4	0	0	0
12. *Melanoides tuberculata*	17	0	1	0	0
13. *Adamietta housei*	0	0	0	0	0
14. *Brotia (Brotia) manningi*	217	0	0	0	0
15. *Brotia (Brotia) baccata*	89	416	0	0	0
Family Buccinidae					
16. *Clea (Anentome) helena*	0	3	7	3	6
Family Lymnaeidae					
17. *Lymnaea (Radix) auricularia swinhoei*	0	0	7	0	44
Family Bulinidae					
18. *Indoplanorbis exustus*	5	0	0	0	0
Class Bivalvia					
Family Amblemidae					
19. *Plisbryoconcha exilis compressa*	0	0	0	0	110
20. *Cristaria plicata*	0	0	0	0	0
21. *Scabies phaselus*	0	0	0	0	2
22. *Trapezoideus exolescens comptus*	1	0	0	0	0
Family Corbiculidae					
23. *Corbicula blandiana*	5	243	0	0	0
24. *Corbicula lamarckiana*	1	0	0	0	0
Total specimens	**455**	**675**	**326**	**537**	**534**
Total taxa	**9**	**5**	**10**	**8**	**9**
Density	**45.5**	**67.5**	**32.6**	**53.7**	**53.4**
Shannon-Weiner index (H')	**1.36**	**0.78**	**1.2**	**1.11**	**1.79**
Fisher's alpha (α)	**1.59**	**0.73**	**1.9**	**1.33**	**1.54**

In this study, *Filopaludina (Siamopaludina) martensi martensi* was the most abundant species (29.07% of total specimens); whereas, the species with the lowest abundance were *Pila polita*, *Corbicula lamarckiana*, *Trapezoideus exolescens comptus* and *Cristaria plicata* (one specimen per species, 0.02% of total

TABLE 2. continued.

Family/Taxa	Station					Total
	6	7	8	9	10	
Class Gastropoda						
Family Viviparidae						
1. *Filopaludina (Siamopaludina) martensi martensi*	190	55	281	262	446	1,568
2. *Filopaludina (Siamopaludina) martensi cambodjensis*	9	1	9	16	0	40
3. *Filopaludina (Filopaludina) sumatrensis polygramma*	3	0	37	87	0	466
4. *Filopaludina (Filopaludina) sumatrensis speciosa*	146	0	382	23	155	1,042
5. *Trochotaia trochoides*	1	0	4	0	3	9
6. *Mekongia rattei*	0	0	0	0	0	107
7. *Sinotaia arturrolli*	0	0	0	21	1	22
Family Ampullariidae						
8. *Pila polita*	0	0	0	0	0	1
9. *Pomacea canaliculata*	16	81	3	20	20	223
Family Bithyniidae						
10. *Bithynia (Digoniostoma) siamensis goniomphalos*	1	0	17	17	0	162
Family Thiaridae						
11. *Thiara scabra*	0	0	0	0	0	0
12. *Melanoides tuberculata*	0	0	0	0	0	18
13. *Adamietta housei*	3	0	0	0	5	8
14. *Brotia (Brotia) manningi*	0	0	0	0	0	217
15. *Brotia (Brotia) baccata*	0	0	0	0	0	505
Family Buccinidae						
16. *Clea (Anentome) helena*	109	1	13	1	26	169
Family Lymnaeidae						
17. *Lymnaea (Radix) auricularia swinhoei*	4	0	2	0	11	68
Family Bulinidae						
18. *Indoplanorbis exustus*	0	0	0	0	0	5
Class Bivalvia						
Family Amblemidae						
19. *Plisbryoconcha exilis compressa*	5	45	27	42	9	238
20. *Cristaria plicata*	0	0	0	1	0	1
21. *Scabies phaselus*	7	193	50	2	3	257
22. *Trapezoideus exolescens comptus*	0	0	0	0	0	1
Family Corbiculidae						
23. *Corbicula blandiana*	0	0	0	0	1	248
24. *Corbicula lamarckiana*	0	0	0	0	0	1
Total specimens	**494**	**376**	**825**	**492**	**680**	**5,394**
Total taxa	**12**	**6**	**11**	**11**	**11**	**24**
Density	**49.4**	**37.6**	**82.5**	**49.2**	**68**	**53.94**
Shannon-Weiner index (H')	**1.48**	**1.24**	**1.4**	**1.54**	**1.07**	**2.27**
Fisher's alpha (α)	**2.22**	**1.01**	**1.79**	**1.99**	**1.86**	**3.23**

specimens). The highest species richness was observed in station six (12 species were collected from this station). The lowest species richness was observed in station two (only five species were found). The average density of freshwater molluscs in the upper Choen River was 53.94 individuals per m^2. The Shannon-Weiner diversity index (H′) was 2.27 (Table 2).

TABLE 3. Bray-Curtis similarity index among 10 stations in upper part of Choen River Basin.

Station	1	2	3	4	5	6	7	8	9
2	17.35								
3	0.26	2.00							
4	0.00	1.98	30.13						
5	0.00	0.50	56.28	33.43					
6	0.00	1.03	62.93	36.28	52.14				
7	0.00	0.19	21.94	15.77	33.41	19.54			
8	0.00	1.60	52.48	33.04	42.83	57.62	22.81		
9	0.00	1.71	33.74	55.20	42.30	50.71	27.88	57.86	
10	0.18	0.59	53.48	29.58	46.29	67.12	16.67	62.33	54.27

Freshwater molluscan assemblages were determined by analyzing and comparing the Bray-Curtis similarity index (Table 3), form which two assemblages were divided at a similarity level of 25% and they conformed to two different river bed substrate types of gravel bed and muddy bed (Table 1 and Fig. 4). The gravel bed was at stations 1 and 2, which had a molluscan assemblage comprised of *Filopaludina (Filopaludina) sumatrensis polygramma*, *Mekongia rattei*, *Thiara scabra*, *Melanoides tuberculata*, *Brotia (Brotia) manningi*, *Br. (Br.) baccata*, *Clea (Anetome) helena*, *Indoplanorbis exustus*, *Tr. exolescens comptus*, *Co. blandiana* and *Co. lamarckiana*. This is called the *Brotia (Brotia) baccata – Corbicula blandiana* assemblage. The muddy bed was at stations 3-10, which had a molluscan assemblage comprised of *F. (S.) martensi martensi*, *F. (S.) martensi cambodjensis*, *F. (F.) sumatrensis*

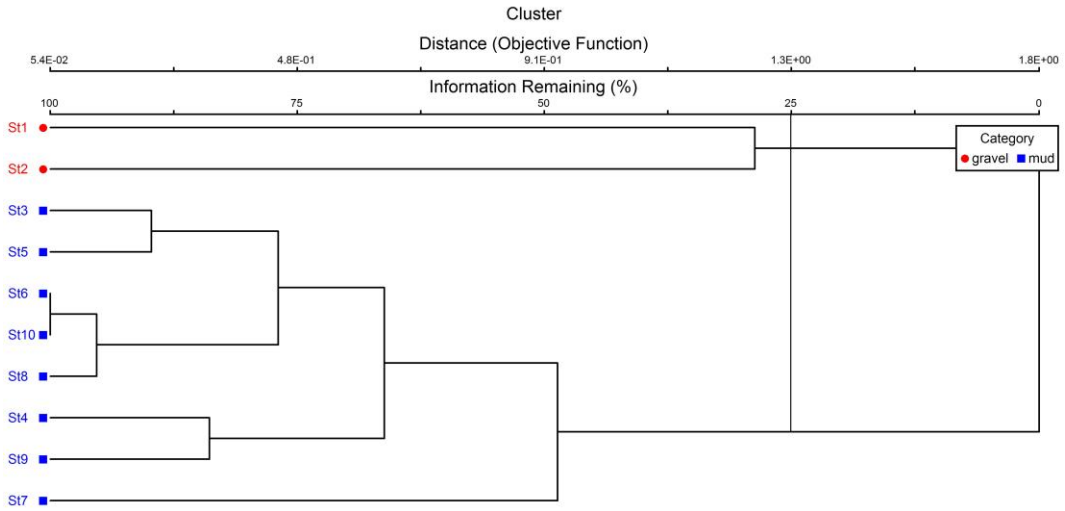

FIGURE 4. Cluster analysis of freshwater molluscs from 10 stations in upper part of Choen River Basin.

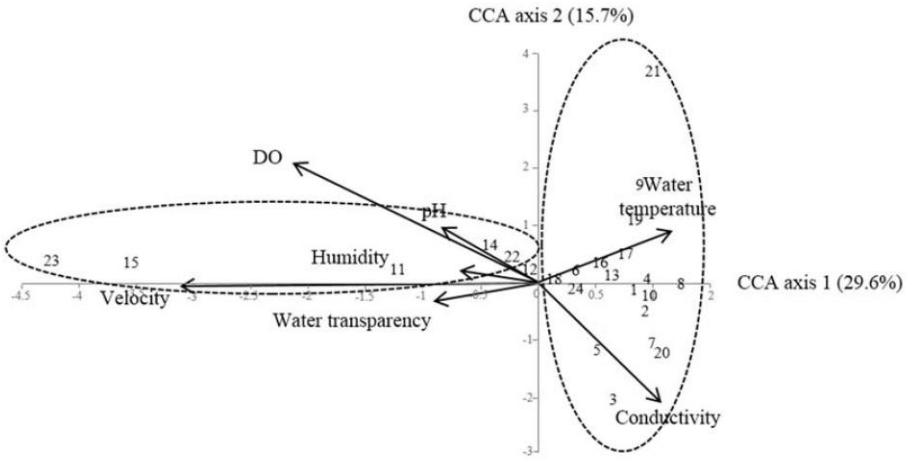

FIGURE 5. CCA biplot showing ordination among freshwater molluscan species with sample scores and water characteristics as factor loadings. Numbers in Figure indicate taxa in Table 2.

polygramma, F. (F.) sumatrensis speciosa, Trochotaia trochoides, Sinotaia arturrolli, P. polita, Pomacea canaliculata, Bithinia (Digoniostoma) siamensis goniomphalos, Me. tuberculata, Adamietta housei, C. (An.) helena, Lymnaea (Radix) auricularia swinhoei, Plisbryoconcha. exilis compressa, Cr. plicata and *Scabies phaselus*. This is called the *Filopaludina (Siamopaludina) martensi martensi – Pilsbryoconcha exilis compressa* assemblage. The study from Australian rivers, there are also significantly difference between macroinvertebrate communities from stony or cobble riverbeds and sandy or muddy riverbeds (Marchant and Barmuta, 1994).

CCA revealed correlations between the physico-chemical properties of the water and the molluscs (Figs. 5-6). Velocity and DO were correlated to the molluscan assemblage in stations 1 and 2 (Fig. 7). Gravel bed stream, running water and slightly cooler water temperature could contribute to a relatively high amount of DO. According to Fig. 5, the distributions of *Co. blandiana*, *Br. (Br.) baccata*, *Th. scabra*, *Br. (Br.) manningi* and *Me. tuberculata* were related to the running water current and amount of dissolve oxygen. Whereas, for stations 3, 5-6 and 8-10, the water temperature, EC and TDS were related to *Po. canaliculata*, *Pi. exilis compressa, L. (R.) auricularia swinhoei, F. (F.) sumatrensis speciosa, C. (An.) helena, A. housei, P. polita, F. (S.) martensi martensi, B. (D.) siamensis goniomphalos, T. trochoides, F. (S.) martensi cambodjensis, Si. arturrolli* and *Cr. plicata*. These stations had a slightly higher temperature, EC and TDS (Figs. 5-6). Our CCA result conformed to the conclusion of Costa and Melo (2008) and Miscrendino (2001), which they concluded that microhabitats (environmental conditions such as substrate size, water velocity, DO, etc.) were most important in determination of river assemblage structure than are differences among stations.

Between stations 1 and 2, both of which were located in a mountainous stream habitat, nine and five taxa of molluscs were observed, respectively. The water velocity

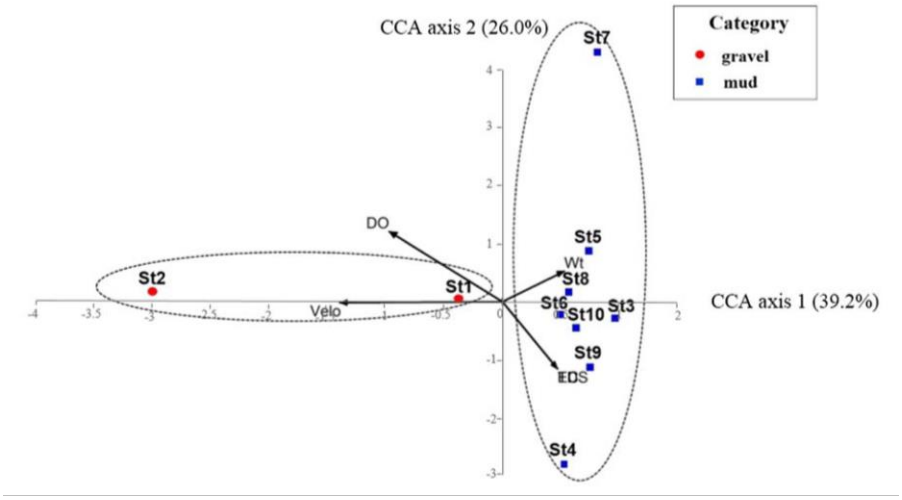

FIGURE 6. CCA biplot showing ordination among stations and water characteristics as factor loadings.

of station 1 was slower than station 2 (Table 4.) The small water volume for the natural stream condition in station 1 might be a more suitable condition for several species of molluscs than the strong currents in station 2. Although both stations 1 and 2 are in the same mountainous stream habitat, they are different tributaries of the Choen River (Fig. 1 and Table 1). Station 1 (Huai Sanam Sai) flows down from Nam Nao National Park without anthropogenic disturbance upstream. Whereas, upstream of station 2 (Lam Nam Su) has many agricultural fields, which may have resulted in soil erosion and the leaching of pesticides and inorganic fertilizers into the stream. This condition might affect the physical and chemical properties of the water for freshwater molluscs, and may explain the low species diversity at station 2 when compared to station 1.

The highest density of molluscs was observed in station 8 (82.5 individuals per m^2), where the mud bottom dweller *Filopaludina* spp. were found. These taxa are generally found as epifauna in shallow and stagnant water. They are usually found in a freshwater community with abundant vegetation cover on the bank of the river. These descriptions fitted well with the description of station 8 in this study. The lowest mollusc density was found in station 3 (32.6 individuals per m^2), where the water level was slightly deeper than at the other stations due to sediment dredging for water management. In addition, the water surface at this station was mostly covered by water hyacinth. Station 6 had the highest species diversity with 12 taxa of molluscs being discovered. This station is far away from urban and agricultural areas and the water level was deep but it had slightly higher water transparency. Furthermore, this station (on the banks of the river) was covered by a small patch of riparian forest (Fig. 7), which might relate to this condition being the most suitable habitat for most molluscan species. Bolotov et al. (2014) observed the optimal habitat for the endangered freshwater bivalve *Margarifera*

FIGURE 7. (A) Huai Sanam Sai (St1); (B) Gravel and sand substrate of St1; (C) Lam Nam Su (St2); (D) Gravel substrate of St2; (E) Huai Kaeo (St3); (F) Muddy substrate of St3; (G) Huai Laeng (St6); (H) Muddy substrate of St6.

laosensis, for which they found that 85.9 % of living individuals were observed near the bank of a stream under the shadow of overhanging trees and bushes. According to the results of this study and Bolotov et al. (2014), we could conclude that riparian forest is the most essential habitat for freshwater mollusc conservation.

TABLE 4. Physico-chemical properties of water in each station in upper part of Choen River Basin.

Station	Environmental parameter								
	Air temp. (°C)	Water temp. (°C)	Humidity (%)	Transparency (cm)	pH	Velocity (m/s)	EC (us)	TDS (ppm)	DO (mg/l)
1	30.5	27.2	56	30	7.1	0.3	308	154	4.03
2	32.9	27.4	59	55	8	1.8	148	74	8.34
3	33.9	31.5	42	82.5	8.2	0	432	215	6.4
4	34.6	31.7	37	37.5	8.3	0	750	373	1.98
5	30.9	28.1	61	12.5	7.3	0	262	131	3.25
6	33.3	27.3	42	85	6.8	0	400	200	3.87
7	36.6	35.7	41	27.5	8.9	0	215	109	7.5
8	30.4	27.8	72	27	6.8	0	255	127	4.5
9	33.7	33.6	57	19.75	7	0.2	269.5	134	2.99
10	33.7	28.5	48	1.88	6.8	0.12	155.5	78	3.61

According to the physical and chemical characteristics of the sampling stations (Table 4), the water temperature (27.2–35.7 °C) and pH (7-8.9) fell within the water quality standard for aquatic animals. Nevertheless, stations 4 and 9 had DO values less than 3 mg/l. Water transparencies were less than 30 cm at stations 5, 7, 8, 9 and 10, and they were more than 60 cm at stations 3 and 6. The suitable transparency for freshwater aquatic animals was reported to range between 30-60 cm. (Inland Fisheries Resources Research and Development Institute, 1987).

Filopaludina (F.) sumatrensis polygramma was the most abundant in station 4, which related to the highest conductivity (750 uS) and TDS (373 ppm). Duangsawasdi and Somsiri (1985) reported that the range of electric conductivity in natural water was 150 – 300 uS, which was comparable to the TDA (Menasveta, 2000). It is possible that nearby agricultural and urbanized areas contributed to increased conductivity and TDS in the forms to stormwater and wastewater runoff. However, a higher water temperature at the station could also contribute to the increased conductivity. In addition, *Sc. phaselus* in station 7 was found with a higher water temperature (35.7 °C), although the normal range for the water temperature for aquatic animals was reported to be 23 – 32 °C (Inland Fisheries Resources Research and Development Institute, 1987). This could imply that this mollusc can live in, or tolerate, high temperature water.

CONCLUSION

In total, 5,394 molluscs were found in the upper parts of the Choen River Basin that belonged to 18 taxa of gastropod and six taxa of bivalve. The cluster analysis and CCA divided them into two assemblages: *Brotia (Brotia) baccata – Corbicula blandiana* assemblage and *Filopaludina (Siamopaludina) martensi martensi – Pilsbryoconcha exilis compressa* assemblage. The former assemblage prefers a gravel and pebble substrate with rapid water flow, while the second prefers a muddy substrate with stagnant water. *F. (S.) martensi martensi* was the species with the highest abundance (1,568 individuals; 29.07%), while the species with the lowest abundance were *P. polita, Co. lamarckiana, Tr. exolescens comptus* and *Cr. plicata*, which were found with only one individual per species (0.02%). The average density of molluscs in the upper

Choen River Basin in this study was 53.94 individual/m^2 (46.47 and 7.47 individual/m^2 of gastropod and bivalve, respectively). The site with the highest density of individuals was site 8 (82.5, 74.8, and 7.7 individual/m^2 of mollusc, gastropod, and bivalve, respectively). The lowest density of individuals was site 3 32.6 individual/m^2 of gastropod were collected without bivalves). The Shannon-Wiener (H) diversity index was 2.27, and Fisher's alpha (α) was 3.23, The similarity indexes of the 10 stations ranged from 0 – 67.12, while stations 6 and 10 were very similar. Water velocity, DO, water temperature and TDS were the physical and chemical factors that were found to be related to the range and distribution of freshwater molluscs. Further studies on the interactions among edaphic factors, pollutants and plant communities could provide better insights on how assemblages could be affected due to changes in the regimes.

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