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Freshwater Molluscs in Alimentary Canal of Molluscivorus Catfish *Helicophagus leptorhynchus* Ng and Kottelat, 2000 from the Chi River at Maha Sarakham Province, Northeastern Thailand

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ABSTRACT.– The aim of this study is to investigate diversity of molluscs in the Chi River by alimentary canal content analysis of molluscivorous catfish *Helicophagus leptorhynchus* Ng and Kottelat, 2000, which were caught from the Chi River in Maha Sarakham Province. Nineteen species of freshwater molluscs were found in the alimentary canal contents of 85 *H. leptorhynchus* specimens. These fish were collected during October 2009 to September 2010 from the Chi River at Kantharavichai District, Maha Sarakham Province, Thailand. These molluscs comprise ten species of gastropods and nine species of bivalves. The highest frequency of occurrence of food items were 79.29% for *Corbicula fluminea*; whereas the second and the third were 35.29% for *Limnoperna siamensis* and 14.12% for *Melanoides tuberculata*, respectively. This result might be interpreted that this catfish feeds on both infaunal and epifaunal molluscs.

KEYWORDS: freshwater molluscs, gut contents, Mekong River Basin, molluscivore, Pangasiidae

INTRODUCTION

The molluscivorous pangasiid catfish genus *Helicophagus* Bleeker, 1858 comprises three species: *H. typus* Bleeker, 1858, *H. wanndersii* Bleeker, 1858, and *H. leptorhynchus* Ng and Kottelat, 2000. Gut contents of *H. typus* from Plamboyan Market were examined by Musikasinthorn et al. (1998), with the original locality of the specimen being assumed as the Kapuas River basin, West Kalimanton, Borneo. At least 280 small bivalves *Potamocorbula* sp. belonging to the family Corbulidae (5.7–8.0 mm in shell length) were found in the stomach of *H. typus.*

Helicophagus waandersii Bleeker, 1858 was originally described from the Hani River, Palembay Southern Sumatra, and then Ng and Kottelat (2000) described the Indochinese population as a new species, *H. leptorhynchus*, based on a more slender snout, longer anal fin, shorter caudal peduncle, longer head, and larger eyes. These two allopatric species were confirmed by average genetic distance (d=0.004) by Pouyaud et al. (2004). The gut contents of *H. leptorhynchus* in the Chao Phraya River, reported by Vidthayanon (1993), contained small bivalves and gastropods, fruits, and seed of higher plants. The Mun River population, four specimens (80–150 mm, SL) of *H. leptorhynchus*, were collected during June to July, the gut content mainly contained *Corbicula* sp. and less frequently *Physunio* sp. (Vidthayanon, 1993). For the Mekong River population, Baird (2007) examined the gut contents of 1,617 fish belonging to at least 73 species from the Siphandone wetlands in Khong District, Champasak Province, southern Laos. He reported that *H. leptorhynchus* feed on a lot of molluscs, little crabs, and probably shrimps.

Gut contents of 30 individuals of *H. leptorhynchus* from Mekong River at Mueang Nong Khai, Nong Khai Province during March to May 2006 were analyzed. Small bivalves, *Corbicula tenuis*, were the most abundant food item, which were found in all fish specimens. Other food items were freshwater sponge, freshwater prawn, plant debris, phytoplankton, earthworms, insect larva, and water worm. Therefore, it might be indicated that this catfish could be considered as bottom feeder fish (Jiwyam and Tippayadara, 2009).

In the Mun River, Grudpan et al. (2016) studied and analyzed gut content of 822 *H. leptorhynchus* from Tha Ngoi and Khong Chiam in Ubon Ratchathani Province during February 2008 to February 2009, and twenty species of both gastropods and bivalves were found.

However, gut content analysis of the Chi River population has never been done. This study aimed to investigate a full year of food items in gut content of the Chi River population of *H. leptorhynchus*, with fish caught from the Chi River in Maha Sarakham Province, northeastern Thailand (Fig. 1).

MATERIALS AND METHODS

We surveyed twice a week for *H. leptorhynchus* during October 2009 to September 2010 at Ban Din Dam Market, the local market near the Chi River, Mueang District, Maha Sarakham Province, northeastern Thailand (Figs 1, 2A, B). All native fishes in this market were caught in the Chi River between Ban

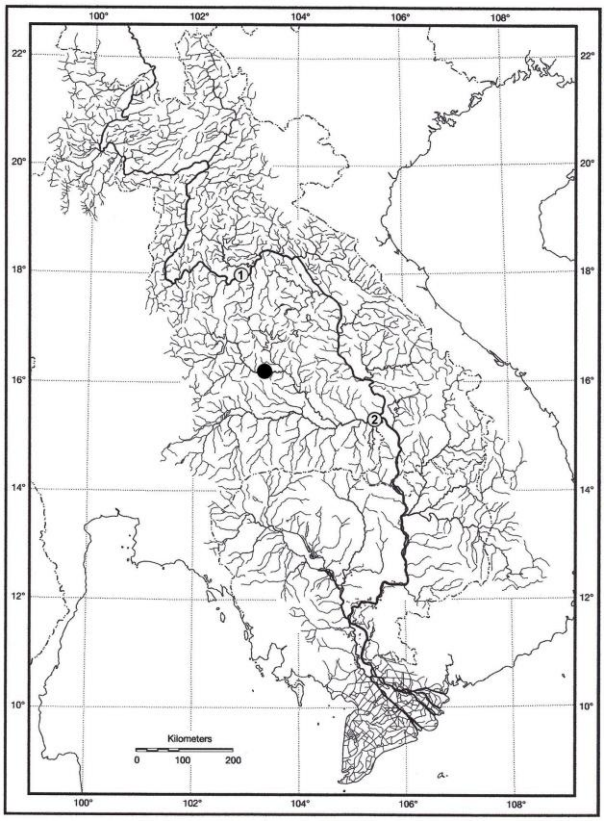

FIGURE 1. Map of the middle and lower Mekong Basin; the black circle represents the collection locality in this study. Number in circle represent the localities of previous studies; 1=Jiwyam and Tippadara (2009); 2=Grudpan *et al.* (2016). Remarks: Records from Chaopraya and Mun Rivers by Vidthayanon (1989) no exactly specified localities.

Tha Song Khon and Ban Tha Khon Yang. One-hundred and forty-two specimens of *H. leptorhynchus* were collected for study. The standard length (SL) of all specimens were measured (Table 1). Fish specimens were dissected to examine the alimentary canal contents (Fig. 2C, D), these alimentary canals were removed and preserved in 70% ethanol. Preserved alimentary canals were cut open, gut contents were washed in a petri dish, and then molluscs were identified according to Brandt (1974) and other articles that published about taxonomic revision of some taxa up to date (Prasankok, 2019; Ng et al., 2020; Jeratthitikul et al., 2021b; Pfeiffer et al., 2021; Goncalves et al., 2022). The individual contents were then counted followed the method and formula in Jiwyam and Tippayadara (2009) and Sagar et al. (2019), then the frequency of occurrence (Ofi), was calculated using the following formula;

Ofi = 100*Ni/Nf Where

Ni = number of fish with prey i in gut,
Nf = number of fish which contained food in the gut.

RESULTS

Helicophagus leptorhynchus from the Chi River at Mueang District, Maha Sarakham Province were collected twice a week from local market during the study period. In total, 142 specimens with a size range from 11.8 to 53.5 cm for SL and weights ranging from 20 to 1,100 g were examined (Table 1). The highest number of fish was obtained in December 2009 (n = 74), whereas lowest in June, August, and September 2010 (n = 0) (Table 1; Fig. 3). The results of gut content analysis revealed that this species feed mainly on both freshwater bivalves and gastropods, which comprise 10 species of gastropods and 9 species of bivalves (Tables 1–3; Figs 4, 5).

A total of thirty individuals of *H. leptorhynchus* containing small byssus attachment bivalve *Limnoperna siamensis* in their gut content were inspected. Seven fish were caught in November 2009 (containing 5, 48, 18, 59, 2, 3, and 1 bivalves, respectively); eleven fish were caught in December 2009 (containing 24, 4, 1, 25, 3, 1, 2, 1, 1, 1, and 7 bivalves, respectively); nine fish in January 2010 (containing 21, 1, 24, 3, 3, 4, 18, 9, and 9, bivalves, respectively); one fish caught in February (one bivalve); and two fish in March 2010 (containing one and two bivalves, respectively).

Melanoides tuberculata was found in the gut content of four *H. leptorhynchus* in December 2009 (n = 2, 1, 1, and 23), two individuals in March 2010 (n = 1 and 2), one individual in April 2010 (n = 1), and five individuals in May 2010 (n = 39, 194, 141, 60, and 118).

Frequency of occurrence (Ofi) indicated that food preference of *H. leptorhynchus* is small bivalves, such as *Corbicula fluminea* and *Limnoperna siamensis* (present in 75.29% and 35.29% of fish which contained food in the gut, respectively; Table 2).

DISCUSSION

In December 2009, we obtained highest number of individuals of *Helicophagus leptorhynchus* (n = 74), their alimentary canals were dissected and examined. There were only 28 individual fish (37.84%) that contained molluscs in their alimentary canal, but the other 46 individuals contained no mollusc materials. The fish species migrates upstream at the beginning of the flooding season and migrates downstream at the end of the flooding season (Rainboth, 1996). In the Mun River, this species migrates from the Mekong River to the Mun River in January. They develop their eggs in the Mun River, spawn their eggs during May to July, and then they migrate back to the Mekong River, whereas juveniles move upstream before moving back

TABLE 1. Molluscs in gut contents of *Helicophagus leptorhynchus*. Nem.=Nematode

Date	Fish Individual	SL (cm)	Body Weight (g)	Gastropods										Bivalves									Remarks
				Mekongia sphaericula	*Melanoides tuberculata*	*Filopaludina sumatrensis*	*Clea helina*	*Clea scalaina*	*Bithy ma* sp.	*Adamietta housei*	*Tarebia granifera*	*Stenothyra* sp.	*Thiara scabra*	*Scaphula pinna*	*Limnoperna siamensis*	*Lens camptus*	*Hyriopsis khoratensis*	*Scabies crispata*	*Ensidens dugasti*	*Lens pallegoixi*	Heterodonta Order indet.	*Corbicula fluminea*	
31/10/2009	(n=2)	30.0–31.0	940–1000	/	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	/	-
20/11/2009	(n=1)	48.0	1340	-	-	-	-	-	-	-	-	-	-	-	/	-	-	-	-	-	-	-	-
25/11/2009	(n=8)	17.3–39.5	40–560	/	-	-	-	-	-	-	-	-	-	/	/	/	-	-	-	-	-	/	-
30/11/2009	(n=1)	17.7	45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	/	-
2/12/2009	(n=5)	20.3–46.0	70–910	/	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	/	-
4/12/2009	(n=3)	17.6–45.3	40–880	-	-	-	-	-	-	-	-	-	-	/	/	/	-	-	-	-	-	/	-
6/12/2009	(n=15)	11.8–43.4	20–880	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11/12/2009	(n=23)	14.7–31.7	24–250	/	/	-	-	-	-	-	-	-	-	/	/	-	-	-	-	-	-	/	-
24/12/2009	(n=28)	19.5–48.5	80–1100	-	/	-	-	-	-	-	/	-	/	-	/	/	-	-	-	-	-	/	Nem. (n = 1)
10/1/2010	(n=9)	15.7–27.1	35–140	-	-	-	-	/	-	-	-	-	-	-	/	-	-	-	-	-	-	/	-
13/1/2010	(n=9)	18.2 – 31	48–270	/	-	/	-	-	-	-	-	-	/	-	/	-	-	-	-	-	/	/	Nem. (n = 1)
19/2/2010	(n=3)	24–32.2	105–255	/	-	/	-	-	-	-	-	-	-	-	/	-	-	-	-	-	-	/	-
10/3/2010	(n=13)	17.2–28.9	40–210	/	/	-	-	-	-	-	-	-	-	-	/	/	-	/	-	-	-	/	Nem. (n = 1)
30/3/2010	(n=4)	19.4–30.9	55–240	-	-	-	-	-	-	-	-	-	-	/	/	-	/	/	-	-	-	/	-
28/4/2010	(n=2)	30.4–30.5	220–235	-	/	/	/	-	-	-	-	-	-	-	-	-	/	/	/	/	-	/	-
26/5/2010	(n=13)	20.4–53.3	80–1840	/	/	-	/	-	/	/	-	-	-	-	-	/	/	-	-	-	-	/	Egg (n = 7)
1/7/2010	(n=1)	25.2	140	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9/7/2010	(n=2)	26.3–28.0	155–200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

FIGURE 2. A. *Helicophagus leptorhynchus* were collected from Din Dam local market near the Chi River, Mueang District, Maha Sarakham Province on 11 December 2009. **B.** plenty of fishes (highest species diversity and abundant) at Din Dam local market on 24 December 2009. **C.** the second author dissected the fishes to collect their alimentary canal. **D.** Bivalve, *Lens comptus* (black arrow) in alimentary canal of *Helicophagus leptorhynchus* collected on 24 December 2009, diameter of coin is 2 cm.

TABLE 2. Quantitative analyses of gut contents of *Helicophagus leptorhynchus* caught from the Chi River in Maha Sarakham Province during October 2009 to September 2010. N_f = Number of fish which contain food in gut; N_i = number of fish with prey i in gut; O_{fi} = Frequency of Occurrence.

Food items	N_f (no)	N_i (no)	O_{fi} (%)
Gastropoda			
1. *Filopaludina (Filopaludina) sumatrensis speciosa*	85	3	3.53
2. *Mekongia sphaericula spiralis*	85	9	10.59
3. *Bithynia (Digoniostoma) siamensis goniomphalos*	85	1	1.18
4. *Stenothyra* sp.	85	1	1.18
5. *Thiara scabra*	85	2	2.35
6. *Melanoides tuberculata*	85	12	14.12
7. *Terebia granifera*	85	1	1.18
8. *Adamietta housei*	85	2	2.35
9. *Clea (Anentome) helena*	85	4	4.71
10. *Clea (Anentome) scalarina*	85	1	1.18
Bivalvia			
11. *Scaphula pinna*	85	6	7.06
12. *Limnoperna siamensis*	85	30	35.29
13. *Hyriopsis khoratensis*	85	4	4.71
14. *Scabies crispata*	85	4	4.71
15. *Ensidens dugasti*	85	1	1.18
16. *Lens pallegoixi*	85	1	1.18
17. *Lens comptus*	85	7	8.24
18. *Corbicula fluminea*	85	64	75.29
19. Heterodonta *order indet.*	85	1	1.18

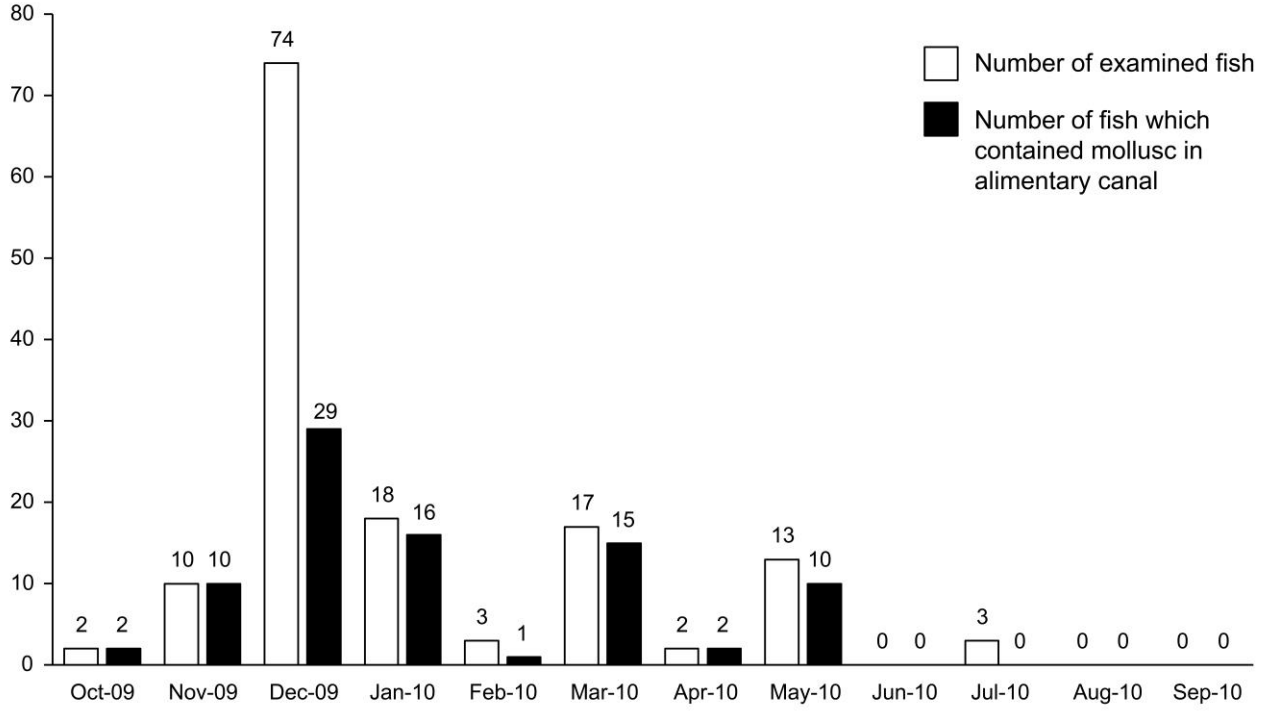

FIGURE 3. Number of fish examined and the number of fish which contained molluscs in their alimentary canal in this study.

TABLE 3. List of nominal taxa of molluscs that were reported from alimentary canal of *Helicophagus leptorhynchus*, G= Gastropods and B=bivalves.

Nominal taxa of molluscs	Vidthayanon (1999), Chao Praya River	Vidthayanon (1999), Mun River June-July	Jiwyam and Tippadara (2009), Mekong River, NongKhai March-May 2006	Grudpan et al. (2016) Mun River, Ubon Ratchathani February 2008-February 2009	This study, Chi River, Maha Sarakham, October 2009-September 2010
1 *Filopaludina sumatrensis speiosa* (G)	-	-	-	-	✓
2 *Mekongia sphaericula sphaericula* (G)	-	-	-	✓	-
3 *Mekongia sphaericula spiralis* (G)	-	-	-	-	✓
4 *Anulotaia lagrandierei* (G)	-	-	-	✓	-
5 *Bithynia siamensis goniomphalos* (G)	-	-	-	-	✓
6 *Pachydrobia crooki* (G)	-	-	-	✓	-
7 *Pachydrobia zilchi reducta* (G)	-	-	-	✓	-
8 *Lacunopsis munensis* (G)	-	-	-	✓	-
9 *Stenothyra* sp. (G)	-	-	-	-	✓
10 *Stenothyra basisculpta* (G)	-	-	-	✓	-
11 *Stenothyra ovalis* (G)	-	-	-	✓	-
12 *Thiara scabra* (G)	-	-	-	-	✓
13 *Melanoides tuberculata* (G)	-	-	-	✓	✓
14 *Tarebia granifera* (G)	-	-	-	-	✓
15 *Adamietta housei* (G)	-	-	-	-	✓
16 *Clea (Anentome) helena* (G)	-	-	-	✓	✓
17 *Clea (Anentome) scalarina* (G)	-	-	-	-	✓
18 *Clea (Anentome) spinosa* (G)	-	-	-	✓	-
19 *Clea* sp. (G)	-	-	-	✓	-
20 unidentified small gastropod	✓	-	-	-	-
1 *Scaphula pinna* (B)	-	-	-	✓	✓
2 *Limnoperna siamensis* (B)	-	-	-	✓	✓
3 *Hyriopsis khoratensis* (B)	-	-	-	-	✓
4 *Scabies crispata* (B)	-	-	-	✓	✓
5 *Harmandia munensis* (B)	-	-	-	✓	-
6 *Ensidens dugasti* (B)	-	-	-	✓	✓
7 *Lens pallegoixi* (B)	-	-	-	-	✓
8 *Physunio* sp. (B)	-	✓	-	✓	-
9 *Lens comptus* (B)	-	-	-	✓	✓
10 *Corbicula leviscula* (B)	-	-	-	✓	-
11 *Corbicula moreletiana* (B)	-	-	-	✓	-
12 *Corbicula tenuis* (B)	-	-	✓	-	-
13 *Corbicula fluminea* (B)	-	✓	-	-	✓
14 Heterodonta *Order indet.* (B)	-	-	-	-	✓
15 unidentified small bivalves	✓	-	-	-	-

downstream in September (Thapanand-Chaidee, 2008). This can be assumed that most fish may not consume during migration to upstream of the Chi River in December. Almost all *H. leptorhynchus* that were collected during March to May 2010 contained molluscs in their alimentary canal (n = 32, but only 27 individuals contained mollusc materials in the alimentary canals). In May 2010, all females (n = 7) contained eggs in their ovaries, with sizes ranging from 27.1 to 53.3 cm for SL (31.2 to 59.2 cm for TL), whereas the report from the Mun River, the mature female ranging from 33 to 54 cm TL (Kulabtong et al., 2012).

Melanoides tuberculata were found to be prevalent food items of *H. leptorhynchus* at the beginning of the rainy season (May), which is a period where more organic and inorganic matter flowed down from upstream through agricultural and urban areas, which has negative effect on many mollusc species in river's substratum, whereas *M. tuberculata* can be resistant in low dissolved oxygen condition and poor-quality habitat impacted by human activities (Wingard et al., 2008; Van Damme, 2014). This occurrence is similar in pattern to the result from the study at the Mun River, which found that *M. tuberculata* is consumed during June and July 2008 (Grudpan et al., 2016).

This study also reported that *L. siamensis* was consumed during the dry season from November to March (Table 1). This occurrence is similar in pattern to the result from the Mun River that has been reported by Grudpan et al. in 2016. The mussels attached their byssus to solid substrata (Morton, 1973) and form dense aggregation (ca. 10,000–80,000 individual m^{-2}) (Morton, 1975). A biological study of *Limnoperna fortunei* in China revealed that mussels reproduce at least one or twice per year, with spawns during September to November when water temperature ranges

TABLE 4. List of molluscan species from the Chi River.

Nominal taxa of molluscs	Brandt (1974)	This study	Kongim et al. (2005)	Jeratthitikul et al. (2021)	Pfeiffer et al. (2021)	Kongim et al. (2023)	Zieritz et al. (2020)	Prasankok (2019)	Jeratthitikul et al. (2022)
Mekongia sphaericula spiralis	✓	✓	-	-	-	-	-	✓	-
Filopaludina (F.) sumatrensis speiosa	✓	✓	-	-	-	-	-	-	-
Pila virescens	✓	-	-	-	-	-	-	-	-
Pachydrobia munensis	✓	-	-	-	-	-	-	-	-
Brotia (B.) citrina	✓	-	-	-	-	-	-	-	-
Bithynia siamensis goniomphalos	-	✓	-	-	-	-	-	-	-
Stenothyra sp.	-	✓	-	-	-	-	-	-	-
Thiara scabra	-	✓	-	-	-	-	-	-	-
Melanoides tuberculata	-	✓	-	-	-	-	-	-	-
Tarebia granifera	-	✓	-	-	-	-	-	-	-
Adamietta housei	-	✓	-	-	-	-	-	-	-
Clea (Anentome) helena	-	✓	-	-	-	-	-	-	-
C. (Anentome) scalarina	-	✓	-	-	-	-	-	-	-
Limnoperna siamensis	✓	✓	-	-	-	-	-	-	-
Pilsbryoconcha exilis	-	-	-	-	-	-	-	-	✓
Hyriopsis khoratensis	✓	✓	✓	✓	✓	✓	✓	-	-
Chamberlainia somsakpanhi	-	-	✓	-	-	✓	-	-	-
Scabies crispata	✓	✓	✓	-	-	-	-	-	-
Bineurus mouhoti	-	-	✓	-	-	-	-	-	-
Pseudodon cambodjensid	✓	-	-	-	-	-	-	-	-
Physunio modelli	-	-	-	-	✓	-	✓	-	-
Lens eximius	✓	-	-	-	✓	-	✓	-	-
L. inornatus	-	-	✓	-	-	-	-	-	-
L. pallegoixi	-	✓	✓	-	✓	-	-	-	-
L. comptus	-	✓	-	-	-	-	-	-	-
Sinomytilus hamandi	✓	-	-	-	-	-	-	-	-
Scaphula pinna	-	✓	-	-	-	-	-	-	-
Ensidens dugasti	-	✓	-	-	-	-	-	-	-
E. ingallsianus	-	-	✓	-	-	-	-	-	-
E. sagittarius	-	-	-	-	-	-	✓	-	-
Corbicula fluminea	-	✓	-	-	-	-	-	-	-
Heterodonta *Order indet.*	-	✓	-	-	-	-	-	-	-
	11	**19**	**7**	**1**	**4**	**1**	**4**	**1**	**1**

16–21 °C and 16–17 °C during January to February in Southern China (Morton, 1977, 1982; Ricciardi, 1998).

Corbicula fluminea is the major food item found in gut content of *H. leptorhynchus* (frequency of occurrence 75.99%), and found throughout the year, which is the same result as the study from the Mun River by Grudpan et al. (2016). This occurrence may be due to this bivalve species having a broad tolerance range to abiotic factors, such as it tolerates to water temperature between 2 °C and 30 °C in the wild condition, and between 2 °C and 34 °C in laboratory (Castaneda et al., 2018). The mussel prefers sandy substrates, at slow-flowing and shallow water section (Schmidin and Baur, 2007). Biotic factors include its high ability as a filter feeder and reproduction (William and McMahon, 1989; Musig et al., 2012).

Juveniles of *Hyriopsis khoratensis* was found in gut content of *H. leptorhynchus* during March to May 2010 (Table 1; Fig. 5C, D), this may be due to the period of spawning and posterior wing development during growth stage. According to the study on ontogenetic variation of *Hyriopsis myerstana* by Kovitvadhi et al. (2006), the juvenile' s shell begins to form posterior wing at age 140 days (ca. 5 months). It might be assumed that *H. khoratensis* has the development stage closely similar to their congener. If this hypothesis is correct, juvenile *H. khoratensis* probably settled the free-living life during November 2009. In June, August, and September 2010, there was no collected fish specimens. This might be due to the period of migration downstream or the difficulty for fishing in the period of high water levels and strong turbidity of water currents during flooding season.

The non-marine aquatic molluscs of Thailand that was reported in 1974 composed of 286 species of gastropods and 95 species of bivalves, but only 11 species were reported from the Chi River (Brandt, 1974). These species comprise five gastropods (including; *Mekongia sphaericula spiralis*, *Filopaludina (Filopaludina) sumatrensis speciosa*, *Pila polita* (recently, Ng et al. (2020) arranged the new name as *Pila virescens*), *Pachydrobia munensis*, *Brotia (Brotia) citrina*), and 6 bivalves (*Limnoperna siamensis*, *Hyriopsis (Hyriopsis) bialatus* (recently, Zieritz et al. (2020) and Pfeiffer et al. (2021) described as *Hyriopsis khoratensis*), *Scabies crispata*, *Pseudodon cambodjensis*, *Physunio eximius* (the name "*Contradens eximius*" was used by Zieritz et al. (2020) and the most update name in Pfeiffer et al. (2021) as *Lens eximius*) and *Sinomytilus harmandi*) (Table 4). Extensive studies

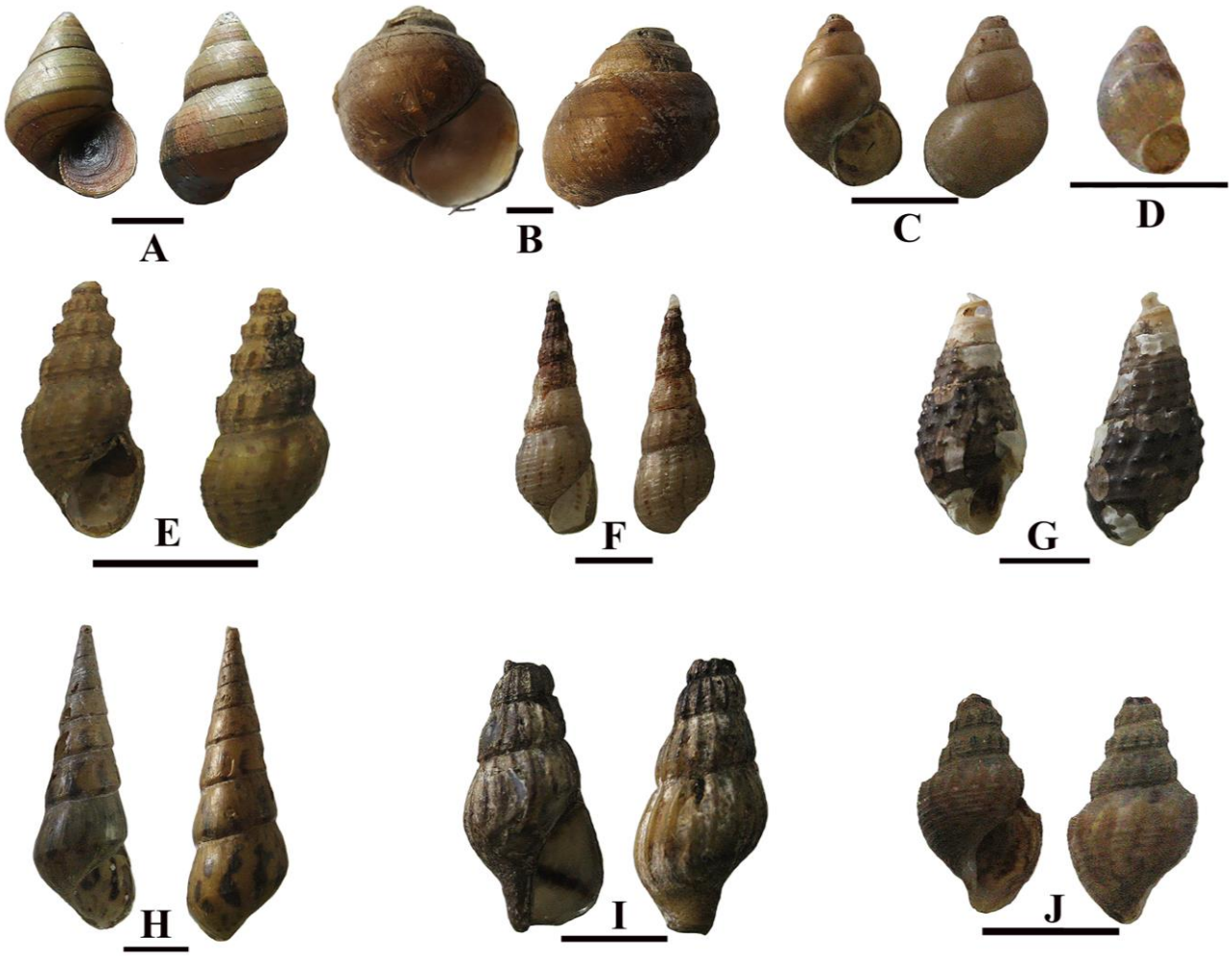

FIGURE 4. A. *Filopaludina (Filopaludina) sumatrensis speciosa*, **B.** *Mekongia sphaericula spiralis*, **C.** *Bithynia (Digoniostoma) siamensis goniomphalos*, **D.** *Stenothyra* sp., **E.** *Thiara scabra*, **F.** *Melanoides tuberculata*, **G.** *Tarebia granifera*, **H.** *Adamietta housei*, **I.** *Clea (Anentome) helena*, **J.** *C. (A.) scalarina*. Scale bars = 5 mm.

on systematics, phylogeny, and biogeography of freshwater molluscs in Thailand have been done since 2015. The current reports and information of many genera were updated, including *Chamberlainia* Simpson, 1900 (Kongim et al., 2015, 2023; Goncalves et al., 2022), *Hyriopsis* Conrad, 1853 (Bolotov et al., 2017; Jeratthitikul et al., 2021a; Pfeiffer et al., 2021; Konopleva et al., 2023), *Pilsbryoconcha* Simpson, 1900 (Jeratthitikul, 2022), *Bineurus* Simpson, 1900 (Konopleva et al., 2021), *Lens* Simpson, 1900 (Pfeiffer et al., 2021), *Physunio* Simpson, 1900 (Pfeiffer et al., 2021), *Ensidens* Frierson, 1911 (Pfeiffer et al., 2021), *Namkongnaia* Jeratthitikul et al., 2021 (Jeratthitikul et al., 2021b), *Pila* Röding, 1798 (Ng et al., 2020), *Thaiconcha* Bolotov et al., 2020 (Konopleva et al., 2021). Based on these references, there were 18 species reported from the Chi River. Consumed molluscan species found in alimentary canal of *H. leptorhynchus* that caught from the Chi River is 19 species (Table 4).

CONCLUSIONS

1. Alimentary canal contents of *H. leptorhynchus* from the Chi River, Maha Sarakham Province examined during October 2009 to September 2010 comprise 10 species of gastropods and 9 species of bivalves.
2. The results from this study reveal more species diversity of freshwater molluscan species in the Chi River than formerly recorded.
3. *Helicophagus leptorhynchus*'s foraging habit provides good materials for studies the species diversity of mollusc in all habitat types of the river system, especially, in the deep part of river channel.

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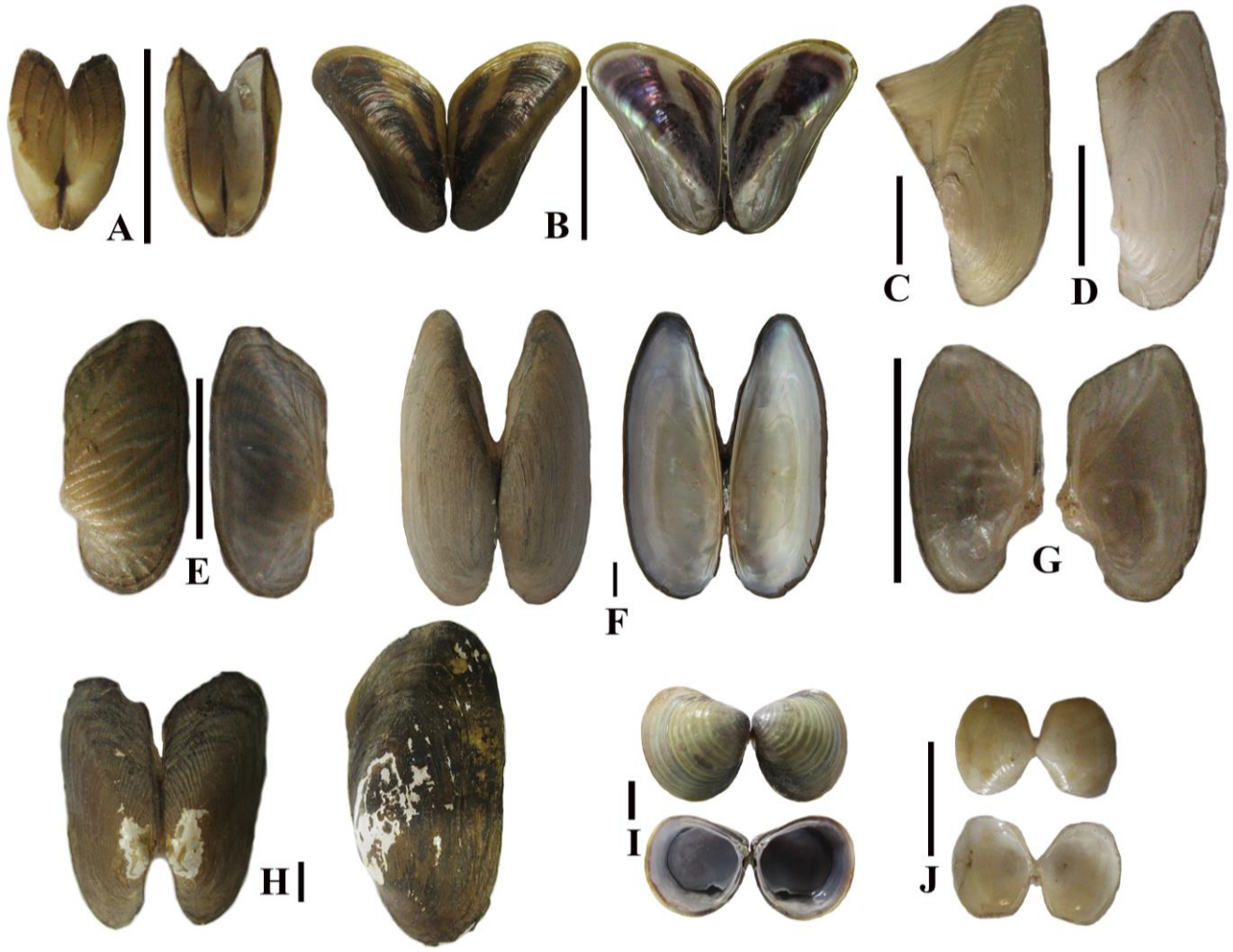

FIGURE 5. A. *Scaphula pinna*, **B.** *Limnoperna siamensis*, **C.** *Hyriopsis khoratensis*, **D.** *H. khoratensis*, early stage, **E.** *Scabies crispata*, **F.** *Ensidens dugasti*, **G.** *Lens pallegoixi*, **H.** *Lens comptus*, **I.** *Corbicula fluminea*, **J.** Heterodonta *order indet*. Scale bars = 5 mm.

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