

FIRST DATA OF GOBY FISH IN TIEN HAI WETLAND NATURE RESERVE, THAI BINH PROVINCE

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Abstract. Gobiiformes is the second diverse order of fish, with more than 2000 species in the world, and 99 species in Vietnam. Many of them are commercially economic important. To understand goby fish diversity in a mangrove forest, three surveys were conducted in March, July, and August 2019 from Tien Hai Wetland Nature Reserve, Thai Binh Province. Based on morphology, a total of 25 species in 3 families of goby fish were determined in the study area. Of which, one is an endangered species (*Bostrychus sinensis*) as the CR category, and a number of new records were found, including one species for Vietnam (*Wuhanlinigobius polylepsis*), 5 species for northern Vietnam, and 9 species for the study area. Regarding the distribution pattern, the fauna from the study area shared much with those from others where mangroves and estuaries present, implying the importance of these ecosystems for goby fish. Furthermore, the maximum number of these shared goby species is 16, showing a diverse and unique characteristic of this fauna. These findings will be important information for further fish diversity conservation and fisheries exploitation in the study area.

Keywords: distribution, Gobiiformes, mangrove forest, new records, Northern Vietnam.

1. Introduction

Mangroves are considered to have an important function to the ecosystem, human, and species on earth [1], and are home to a large variety of fish and other aquatic organisms [2]. Tropical estuarine fish are inextricably linked with mangroves [3], implying the importance of an estuarine mangrove system for fish. A number of fish belonging to Gobiiformes [4] inhabit mangroves due to a high proportion of mud in surficial sediments [4, 5]. However, this scenario is still unclear in Vietnam, where estuarine mangroves are abundant.

Tien Hai Wetland Nature Reserve is one of the two core areas of the Red River Delta Biosphere Reserve, where many types of habitats are available, including estuarine mangroves. Previous works have reported fish from the Ba Lat estuary and

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Xuan Thuy National Park, which is located on the right side of the Ba Lat estuary. Nguyen Huu Duc *et al.* (2019) listed a total of 563 fish species in the Red River, and many of them are distributed in the estuary and mangroves [6]. However not much data are available for gobies in the Tien Hai Wetland Nature Reserve. Therefore, the present study aims to elucidate the diversity of goby fish associated with this estuarine mangrove, which will be valuable for fish conservation and fisheries development in the study area.

2. Content

2.1. Materials and methods

Fish were collected using hand fishing nets (2 mm mesh aperture) and eight-hole fishing nets (2 cm mesh aperture) in March, July, and August 2019 at 5 stations (TH1-TH5) from the Tien Hai Wetland Nature Reserve, Thai Binh province (Figure 1). All collected specimens were fixed in 8-10% formalin, and then were transferred to 70% ethanol, and deposited at the Department of Zoology, Faculty of Biology, Hanoi National University of Education.

Counting and measurement methods followed Nakabo (2002) [7] and Nguyen Van Hao (2005) [8]. When possible, goby fish were identified using available keys in the following references: Mai Dinh Yen (1978) [9], Nguyen Van Hao (2005) [8], Tran Dac Dinh *et al.* (2013) [10] and Kimura *et al.* (2018) [11]. The list of fish was ordered in accordance with Nelson *et al.* (2016) [4].

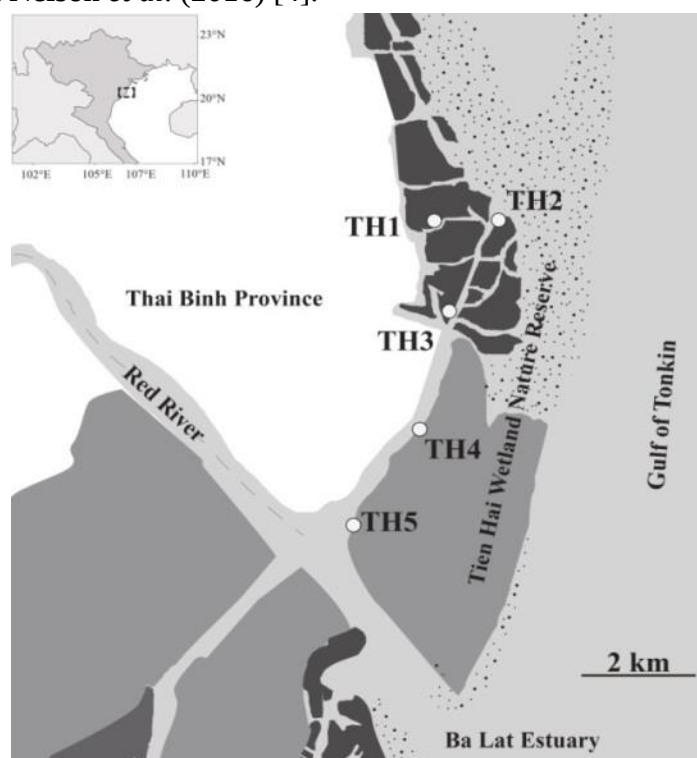


Figure 1. A diagram showing where goby fish were collected from Tien Hai Wetland Nature Reserve, Thai Binh Province

2.2. Results and discussion

* Species composition

Based on 506 individuals (4.7-155.0 mm standard length, SL), a total of 25 species in 19 genera, 3 families of goby fish were determined from the study area (Table 1). A number of species from Butidae, Gobiidae, and Oxudercidae were 3, 9, and 13, respectively (Table 1). This is the first intensive list of goby fish from the study area. Of 25 species collected in the area, *Bostrychus sinensis* is listed in Vietnam's Red Data Book (2007) as the CR category [12]. From the current study, there were several new records, including one species for Vietnam (i.e., *Wuhanlinigobius polylepis*) (Figure 2), 5 species for northern Vietnam (i.e., *Acentrogobius moloanus*, *Glossogobius aureus*, *Eugnathogobius illothus*, *Gobiopterus chuno* and *Wuhanlinigobius polylepis*) (Figure 2) and 9 species for the study area (i.e., *Acentrogobius moloanus*, *Aulopareia unicolor*, *Glossogobius aureus*, *Eugnathogobius illothus*, *Gobiopsis macrostoma*, *Gobiopterus chuno*, *Pseudogobius javanicus*, *Pseudogobius masago* and *Wuhanlinigobius polylepis*) (Figure 2) if compared with the recent work of Nguyen Huu Duc *et al.* (2019) [6].

* Notes on the distribution pattern of goby fish collected from the study area

When we compare the current data with several works conducted from mangroves and estuaries in Vietnam, some interesting points could be found (Table 2). The current goby fauna shared much with other study areas where mangroves and estuaries present. Of 25 recorded species from the present study area, 10 to 16 shared species could be found from 8 others (Table 1). Only two goby species were shared between the current area and Phu Long mangrove forest without estuaries in Cat Ba Island. Four and five shared goby fish species could be found in Thu Bon estuary and the Gianh River, respectively because true mangroves are not distributed in the two sites. Besides, the Sai Gon River and Bung Binh Thien are freshwater, different from current sites, thus the shared goby fish are relatively low, with 2 to 3 species (Table 2).

Amongst 25 recorded species from the current area, four species could be found in more than 10 study areas (Table 2). The distributional range of three species (*B. butis*, *B. koilomatodon*, and *G. giuris*) in Vietnam has been recently reported in Ta Thi Thuy *et al.* (2020) [13]. This finding indicates that the goby fauna from the Tien Hai Wetland Nature Reserve would have been diverse and driven by the system of mangroves and estuaries. Several new records additionally support the above figure. Initially, present results could suggest further studies in other sites to understand the biodiversity of fish in these habitats, which will be very valuable data for exploitation and conservation.

Table 1. List of goby fish in Tien Hai Wetland Nature Reserve, Thai Binh Province

No.	Scientific name	SL (mm)	Month (2019)			Station (TH)				
			Mar.	Jul.	Aug.	1	2	3	4	5
	Butidae									
1	<i>Bostrychus sinensis</i> Lacepède, 1801	38.8-140.2	x				x	x		
2	<i>Butis butis</i> (Hamilton, 1822)	57.7-97.2	x		x		x		x	
3	<i>Butis koilomatodon</i> (Bleeker, 1849)	23.3-54.5	x	x			x		x	
	Gobiidae									

4	<i>Acentrogobius moloanus</i> (Herre, 1927)	44.0-63.9			x			x		
5	<i>Acentrogobius viridipunctatus</i> (Valenciennes, 1837)	47.0-92.5		x	x		x	x		
6	<i>Apocryptodon madurensis</i> (Bleeker, 1849)	44.8-64.9			x			x		
7	<i>Aulopareia unicolor</i> (Valenciennes, 1837)	39.9-64.1	x	x	x		x	x		
8	<i>Glossogobius aureus</i> Akihito & Meguro, 1975	133.9		x			x			
9	<i>Glossogobius giuris</i> (Hamilton, 1822)	78.7-155.0	x		x	x	x		x	
10	<i>Glossogobius olivaceus</i> (Temminck & Schlegel, 1845)	49.4-95.1	x	x	x	x	x	x	x	
11	<i>Gobiopsis macrostoma</i> Steindachner, 1861	63.3		x			x			
12	<i>Psammogobius biocellatus</i> (Valenciennes, 1837)	46.0-49.8			x					x
	Oxudercidae									
13	<i>Acanthogobius flavimanus</i> (Temminck & Schlegel, 1845)	52.7-58.8			x			x		
14	<i>Boleophthalmus pectinirostris</i> (Linnaeus, 1758)	24.4-93.7	x	x	x	x	x	x		x
15	<i>Eugnathogobius illois</i> (Larson, 1999)	17.8-31.8	x		x			x		x
16	<i>Gobiopterus chuno</i> (Hamilton, 1822)	12.5-14.0			x	x		x		
17	<i>Mugilogobius abei</i> (Jordan & Snyder, 1901)	13.0-25.5	x		x	x	x	x	x	x
18	<i>Odontamblyopus rubicundus</i> Keith, Hadiaty, Busson & Hubert, 2014	155.6			x			x		
19	<i>Periophthalmus modestus</i> Cantor, 1842	4.7-49.5	x	x	x	x	x	x	x	x
20	<i>Pseudogobius javanicus</i> (Bleeker, 1856)	17.0	x				x			
21	<i>Pseudogobius masago</i> (Tomiya, 1936)	18.4	x				x			
22	<i>Scartelaos histophorus</i> (Valenciennes, 1837)	61.3-112.5			x	x				x
23	<i>Tridentiger barbatus</i> (Günther, 1861)	45.7-65.2	x	x			x		x	
24	<i>Tridentiger trigonocephalus</i> (Gill, 1859)	52.3	x				x			
25	<i>Wuhanlinigobius polylepis</i> (Wu & Ni, 1985)	13.0-14.0			x			x		

Table 2. Co-occurrence of goby fish from the current study and several areas in Vietnam

No.	Species name	Ba Che-Tien Yen River [14]	Ha Long Bay [11]	Bach Dang estuary [15]	Phu Long mangroves, Hai Phong [16]	Van Uc estuary, Hai Phong [17]	Red River [6]	Boi and Day Rivers [18]	Ma River [19]	Gianh River [20]	Thua Thien Hue [21]	Thu Bon estuary [22]	Can Gio Mangroves [23]	Sai Gon River [24]	Bung Binh Thien, An Giang [25]	Mekong Delta [10]	Co Chien estuary, Ben Tre [26]	Total
1	<i>B. sinensis</i>	x	x	x		x	x	x	x		x							9
2	<i>B. butis</i>	x	x	x		x	x	x	x		x	x	x	x		x	x	14
3	<i>B. koilomatodon</i>	x	x	x		x	x	x	x				x			x	x	11
4	<i>A. moloanus</i>										x			x		x		3
5	<i>A. viridipunctatus</i>	x	x		x	x	x	x			x		x			x	x	11
6	<i>A. madurensis</i>		x				x	x	x									5
7	<i>A. unicolor</i>		x													x		3
8	<i>G. aureus</i>							x		x	x	x	x	x	x	x		8
9	<i>G. giuris</i>	x		x		x	x	x	x	x	x	x	x		x	x	x	14
10	<i>G. olivaceus</i>	x	x			x	x	x		x		x						8
11	<i>G. macrostoma</i>		x										x			x		3
12	<i>P. biocellatus</i>		x		x	x	x			x	x					x		7
13	<i>A. flavimanus</i>	x		x		x	x	x									x	7

14	<i>B. pectinirostris</i>	x				x	x	x	x								6
15	<i>E. illotus</i>														x		1
16	<i>G. chuno</i>														x		1
17	<i>M. abei</i>		x				x	x	x						x		5
18	<i>O. rubicundus</i>			x		x	x	x	x				x			x	8
19	<i>P. modestus</i>	x	x			x	x										5
20	<i>P. javanicus</i>		x									x			x		3
21	<i>P. masago</i>														x		1
22	<i>S. histophorus</i>	x	x	x		x	x					x			x	x	9
23	<i>T. barbatus</i>			x		x	x	x	x			x					7
24	<i>T. trigonophalus</i>	x	x	x			x	x	x	x							7
25	<i>W. polylepis</i>																0
Total		11	14	9	2	13	16	14	10	5	7	4	10	3	2	15	7



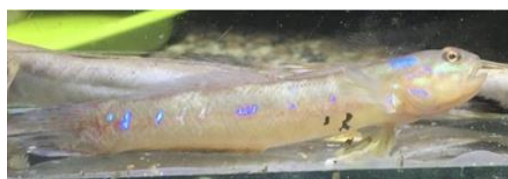
1. *Bostrychus sinensis*



2. *Butis butis*



3. *Butis koilomatodon*



4. *Acentrogobius moloanus*



5. *Acentrogobius viridipunctatus*



6. *Apocryptodon madurensis*



7. *Aulopareia unicolor*



8. *Glossogobius aureus*



9. *Glossogobius giuris*



10. *Glossogobius olivaceus*



11. *Gobiopsis macrostoma*



12. *Psamogobius biocellatus*



13. *Acanthogobius flavimanus*



14. *Boleophthalmus pectinirostris*



15. *Eugnathogobius illotus*



16. *Gobiopterus chuno*



17. *Mugilogobius abei*



18. *Periophthalmus modestus*



19. *Odontamblyopus rubicundus*



20. *Pseudogobius javanicus*



21. *Pseudogobius masago*



22. *Scartelaos histophorus*



23. *Tridentiger barbatus*



24. *Tridentiger trigonocephalus*



25. *Wuhanlinigobius polylepsis*

Figure 2. Photos of goby fish collected from Tien Hai Wetland Nature Reserve (1-25)

3. Conclusion

The present paper revealed that from three surveys in 2019, a total of 25 species of 19 genera in three families of goby fish were recorded in the Tien Hai Wetland Nature Reserve. The Oxudercidae was the dominant family in the research area with the number of species and genus being 13 and 11, respectively. It is important to note that *Bostrychus sinensis* is listed in Vietnam's Red Data Book (2007), and *Wuhanlinigobius polylepsis* is a new record for ichthyofauna of Vietnam. In addition, this study adds 5 species for northern Vietnam and 9 species for the research area. The goby fauna in this mangrove forest is diverse and unique as shared species with other study areas are not high.

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