



# Diet composition of Duckbill sleeper *Butis butis* (Hamilton, 1822) living in some coastal regions in the Mekong Delta, Vietnam

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**Abstract.** This study was carried out in four sites along the coastline, including Duyen Hai - Tra Vinh, Tran De - Soc Trang, Dong Hai - Bac Lieu and Dam Doi - Ca Mau, to provide data on the diet composition of *Butis butis* – a commercial fish in the Mekong Delta, Vietnam. Seven hundred fifteen individual fish (412 females and 303 males) were collected monthly using trawl nets from March to August 2019. The study results showed that *Butis butis* was a carnivore ingesting *Acetes* spp., small fish, molluscs, *Uca* spp., and others (fish scale and detritus). The fish diet composition was affected season (Pseudo-F=13.07, df=1, p=0.001) and site (Pseudo-F=2.37, df=3, p=0.03) but not sex (Pseudo-F=1.45, df=1, p=0.24). *Acetes* spp. (Z=-3.96, df=1, p<0.001), small fish (Z=-4.09, df=1, p<0.001), other (Z=7.05, df=1, p<0.001) contributed to the seasonal variation of diet composition. The spatial variation of diet composition was contributed by *Acetes* spp. (8.59, df=3, p=0.35). The diet composition was not regulated by the interaction sex × site (Pseudo-F=0.21, df=3, p=0.98) season × sex (Pseudo-F=0.06, df=1, p=0.96) and site × season (Pseudo-F=0.63, df=1, p=0.69). The findings are the basis for further studies on cultivating this fish in the future.

**Key Words:** Bac Lieu, Ca Mau, diet composition, goby, Soc Trang, Tra Vinh.

**Introduction.** Diet composition is essential to understand fish trophic interactions within a community (Blaber 2000; Silva-Garay et al 2018; Zhang et al 2018; Eduardo et al 2020; Syafei et al 2020; Soe et al 2021) and varies with the day-night pattern (Grabowska & Grabowski 2005; Carman et al 2006). The fish's diet also changes with the season and site (Brush et al 2012; Dinh et al 2017; Dinh et al 2020; Tran et al 2021). However, the understanding of the diet composition of gobies living in the Mekong Delta, Vietnam (VMD), where they have been overfishing (Trinh & Tran 2012; Tran et al 2020b), is limited. Consequently, the study of diet composition of gobiid species is needed and the results can support the understanding of fish adaptation and its conservation.

*Butis butis* (Hamilton, 1822) occurs mainly in the coastal and estuarine regions (Nguyen 2005; Yokoo et al 2006; Larson et al 2008; Gill & Hoese 2011; Huang et al 2013) and is one of the species with high nutritional value (Nguyen 2000). Some data on its biology and ecology have been documented like distribution (Tran et al 2013; Tran et al 2020), reproductive traits (Dinh & Le 2017) and morphometric variations (Phan et al 2021). Albeit the fish population has been subjected to overfishing (Dinh 2018b), there is no data on its food and feeding habits. Therefore, this study was conducted to provide data on fish diet composition.

## Material and Method

**Fish Collection and Analysis.** Specimens of *Butis butis* (Figure 1) were caught using trawl nets at four sites in VMD: Duyen Hai – Tra Vinh (TV), Tran De - Soc Trang (ST), Dong Hai - Bac Lieu (BL) and Dam Doi - Ca Mau (CM) (Figure 2). Fish with different sizes

were collected randomly and monthly from March to August 2019. These sites are represented by semi-tidal and the average annual temperature of 27°C (Le et al 2006). After catching, fish samples were fixed with 10% formalin solution and shipped to the laboratory. Fish sex was differentiated using the genital spines (triangle in males and oval in females) (Dinh & Le 2017) that were identified based on external morphological features described by (Tran et al 2013).



Figure 1. The image of *Butis butis* caught from Tran De - Soc Trang (total length = 12,1 cm).  
Source: authors' personal archive

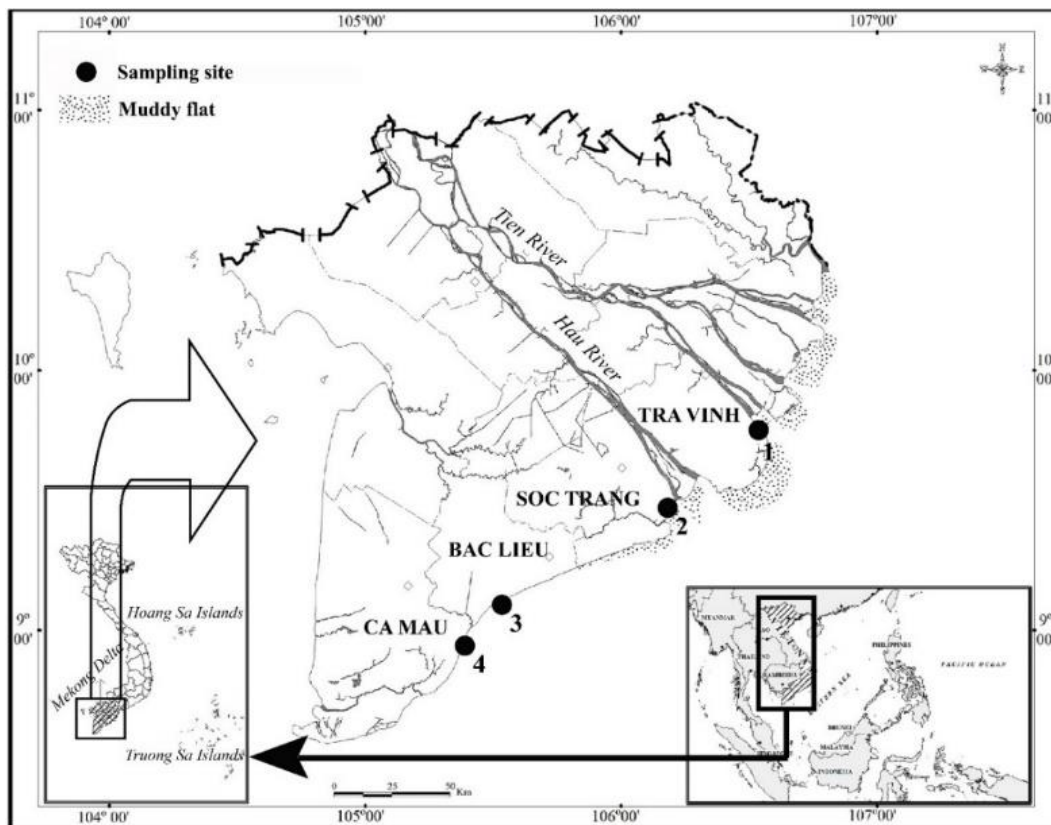


Figure 2. Sampling points in the Mekong Delta (●: sampling point; 1: Duyen Hai - Tra Vinh; 2: Tran De - Soc Trang; 3: Dong Hai - Bac Lieu and 4: Dam Doi - Ca Mau).  
Source: adapted from Dinh (2018a)

**Diet composition.** Three hundred eight individuals (166 males and 142 females) with stomach contents out of 715 fish specimens (412 males and 303 females; Table 1) were used to determine the prey items, which were identified up to the lowest taxon under a stereomicroscope (Nguyen et al 2013). The stomach contents were quantified by food item occurrence as  $\%O_i = 100 \times O_i / N$  (where  $O_i$ : number of fish consuming food item  $i^{th}$  and  $N$ : total number of fish examined) (Hynes 1950) and food item gravimetric method as  $\%W_i = 100 \times W_i / W_{total}$  ( $W_i$ : weight of food item  $i^{th}$ ,  $W_{total}$ : weight of all food items) (Hyslop 1980). A combination of food item occurrence and weight known as food item biovolume or preponderance index was used to determine the diet composition was

calculated as  $\%V_i = (100 \times O_i \times W_i) / (\sum O_i \times W_i)$  ( $V_i$ : percentage of biovolume prey  $i^{th}$ ) (Natarajan & Jhingran 1961; Hyslop 1980).

**Data analysis.** The prey biovolume was used to verify if fish diet composition varied with sex, season, and site using PRIMER v.6.1.11 with PERMANOVA+ v.1.0.1 (Anderson et al 2008). diet composition man-Whitney U test was applied to observe if gender and season generated statistically significant differences regarding diet composition. Kruskal Wallis H test was used to verify if there were statistically significant differences between various locations regarding diet composition. All tests were set at  $p < 5\%$ .

## Results and discussion

**General diet composition of *Butis butis*.** A total of 308 individuals (166 males and 142 females) with stomach contents out of 715 fish specimens (412 males and 303 females) were used to determine diet composition of fish. Results are shown in Table 1.

Table 1.  
Number of *Butis butis* collected from four studied sites

Sampling time*	Duyen Hai, Tra Vinh				Tran De, Soc Trang				Dong Hai, Bac Lieu				Dam Doi, Ca Mau			
	Total fish		Number of fish with empty stomach		Total fish		Number of fish with empty stomach		Total fish		Number of fish with empty stomach		Total fish		Number of fish with empty stomach	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Mar-19	20	21	12	15	19	21	10	14	22	10	13	6	10	17	4	13
Apr-19	11	19	6	10	16	14	10	6	17	28	4	9	10	9	7	3
May-19	15	15	10	9	13	11	7	5	10	17	2	2	10	17	4	4
Jun-19	11	18	4	5	9	22	3	7	4	20	1	9	24	10	6	5
Jul-19	13	17	5	5	13	17	4	5	13	17	5	5	9	6	-	-
Aug-19	7	23	7	8	7	23	7	8	13	17	4	5	7	23	7	8
Sum	77	113	44	52	77	108	41	45	79	109	29	36	70	82	28	33

\*Dry season: March to May; Wet season: June to August

Stomach content analysis indicated that this species fed five main prey categories: *Acetes* spp., small fish, molluscs, *Uca* spp., and others (e.g., fish scales and detritus). *Acetes* spp., others, and small fish occurred in the highest relative frequency of 52,05%, 21,64%, and 23,56%, respectively, while *Uca* spp. and Molluscs made up the lowest occurrence frequency (1,37%). Regarding prey weights, the *Acetes* spp made up the largest share (62,30%), followed closely by small fish (34,44%), whereas the smallest value was found in *Uca* ssp (0,47%) (Table 2). Regarding the biovolume, the goby ingested mainly *Acetes* spp. (62,3%) followed by small fish (34,4%), but rarely on Molluscs (0,9%) and *Uca* spp. (0,5%) (Table 2). As comprising *Acetes* spp., small fish, molluscs, *Uca* spp., and others (fish scale and detritus), *Butis butis* was observed a carnivore, feeding mainly on *Acetes* spp., followed by small fish, as they reached the highest occurrence, weight, and biovolume. Likewise, *Glossogobius giuris* (Islam 2004; Achakzai et al 2015), *Glossogobius aureus* (Nguyen & Tran 2018) and *Glossogobius sparsipapillus* (Tran et al 2021) were carnivores consuming mainly *Uca* spp., *Acetes* spp. and small fish. *Periophthalmodon septemradiatus* was also a carnivore but consumed mostly ants (Dinh et al 2020). Crustaceans were consumed mainly by *Parachaeturichthys ocellatus* – a carnivore in India (Panicker 2020). *Proterorhinus marmoratus* in southern Slovakia was a carnivore feeding mainly amphipod (Adámek et al 2007). Contractary, *Pseudapocryptes elongatus* (Tran 2008) and *Parapocryptes serperaster* (Khaironizam & Norma-Rashid 2000; Dinh et al 2017) fed mainly detritus and diatoms, which were omnivores. The omnivorous category was also found in *Boleophthalmus boddarti* (Ravi

2013; Dinh 2015), but it fed primarily on diatoms and nematodes. This indicated that the fish diet composition varied with the food availability.

Table 2.  
Percentage of occurrence, weight, and biovolume of food items of *Butis butis*

Percentage	Food items				
	<i>Acetes spp.</i>	Small fish	Molluscs	<i>Uca spp.</i>	Others
Occurrence	52.05	23.56	1.37	1.37	21.64
Weight	62.30	34.44	0.85	0.47	1.94
Biovolume	62.3	34.4	0.9	0.5	1.9

**The influence of sex, season, and location on diet composition.** The occurrence, weight, and biovolume of food items of males and females in different seasons and sites were presented in Table 2.

The PERMANOVA analyses showed that fish diet composition varied with the season ( $Pseudo-F_{season}=13,07$ ,  $p<0.001$ ). *Acetes spp.* ( $Z=-3.96$ ,  $df=1$ ,  $p<0.001$ ), small fish ( $Z=-4.09$ ,  $df=1$ ,  $p<0.001$ ), other preys ( $Z=7.05$ ,  $df=1$ ,  $p<0.001$ ) contributed to the seasonal variation of diet composition. Unlike *Glossogobius sparsipapillus* (Tran et al 2021), the variation in detritus input, influenced by the high rainfall in the wet season (Nedeco 1993), affected the diet composition of *Butis butis*. Similarly, the diet composition of *Boleophthalmus dussumieri* living in India also varied with season variable since it fed mainly fish eggs in premonsoon but nematodes in postmonsoon (Mutsaddi & Bal 1969; Rathod & Patil 2009). This characteristic was also found in *Periophthalmus barbarus* in Nigeria as it fed detritus primarily in the wet season and algae in the dry one (Udo 2002). *Boleophthalmus boddarti* in India (Ravi 2013) and *Periophthalmodon septemradiatus* in VMD (Dinh et al 2020) also showed seasonal diet composition changes.

Table 3.  
Percentage of occurrence, weight, and biovolume of food items of *Butis butis* according to sex, season and site

Percentage	Category	Food items				
		<i>Acetes spp.</i>	Small fish	Molluscs	<i>Uca spp.</i>	Others
Occurrence	Male	53.66	21.95	1.46	2.44	20.49
	Female	50.00	25.63	1.25	0.00	23.13
Weight	Male	63.35	33.92	0.31	0.82	1.60
	Female	60.93	35.12	1.56	0.00	2.38
Biovolume	Male	63.35	33.92	0.31	0.82	1.60
	Female	60.93	35.12	1.56	0.00	2.38
Occurrence	Dry season	45.00	17.73	2.27	0.91	34.09
	Wet season	62.50	32.64	0.00	2.08	2.78
Weight	Dry season	75.56	16.40	2.55	0.37	5.13
	Wet season	55.66	43.49	0.00	0.51	0.34
Biovolume	Dry season	75.56	16.40	2.55	0.37	5.13
	Wet season	55.66	43.49	0.00	0.51	0.34
Occurrence	Duyen Hai, Tra Vinh	55.26	20.18	0.88	1.75	21.93
	Tran De, Soc Trang	45.00	24.00	0.00	2.00	29.00
	Dong Hai, Bac Lieu	67.57	18.92	1.35	0.00	12.16
	Dam Doi, Ca Mau	41.56	32.47	3.90	1.30	20.78
	Duyen Hai, Tra Vinh	66.45	28.31	1.76	0.38	3.10
Weight	Tran De, Soc Trang	56.88	40.97	0.00	0.72	1.44
	Dong Hai, Bac Lieu	80.92	18.21	0.07	0.00	0.80
	Dam Doi, Ca Mau	51.22	46.20	0.84	0.55	1.19
	Duyen Hai, Tra Vinh	66.45	28.31	1.76	0.38	3.10
Biovolume	Tran De, Soc Trang	56.88	40.97	0.00	0.72	1.44
	Dong Hai, Bac Lieu	80.92	18.21	0.07	0.00	0.80
	Dam Doi, Ca Mau	51.22	46.20	0.84	0.55	1.19

Diet composition of this goby also changed with site ( $Pseudo-F_{site}=2,37, p=0.03$ ), but not sex ( $Pseudo-F=1.45, df=1, p=0.24$ ). The spatial variation of diet composition was influenced by *Acetes* spp. ( $8.59, df=3, p=0.35$ ). The diet composition was not affected by the interaction sex  $\times$  site ( $Pseudo-F=0.21, df=3, p=0.98$ ), season  $\times$  sex ( $Pseudo-F=0.06, df=1, p=0.96$ ), and site  $\times$  season ( $Pseudo-F=0.63, df=1, p=0.69$ ).

Both males and females in both seasons and sites fed mainly *Acetes* spp., small fish, but rarely *Uca* spp., Molluscs and others. The variation of food availability influenced the diet composition of *Butis butis*. A spatial variation in diet composition was also found: *Parapocryptes serperaster* feeding mainly diatoms in Malaysia (Khaironizam & Norma-Rashid 2000) and detritus in VMD (Dinh et al 2017). Variation in diet composition caused by location was also found in some other gobies living in and out of VMD. For example, *Periophthalmus argentilineatus* ingested mainly amphipods and copepods in Zanzibar but polychaetes in Tanzania (Kruitwagen et al 2007). *Boleophthalmus boddarti* fed primarily fish eggs and nematodes in India (Ravi 2013) but diatoms in VMD (Dinh 2015). *Periophthalmodon septemradiatus* in VMD also showed spatial variation in diet composition due to the differences in the proportion of *Dolichoderus* sp. and detritus among five sites (Dinh et al 2020).

**Conclusion.** *Butis butis* was a generalist feeder, feeding mainly on *Acetes* spp., small fish, and others. Its diet composition was influenced by season and location and not by sex. *Acetes* spp., small fish, and other prey contributed to the seasonal variation of diet composition. *Acetes* spp. contributed to the spatial variation of diet composition. The diet composition was not affected by the interaction sex  $\times$  site, season  $\times$  sex, and site  $\times$  season. Regarding the prospects for further research, it would be worthwhile to analyze the fish by the degree of intestinal filling, average weight, fattening rate. This would help studies on cultivating this fish in the future.

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