

ALLOMETRY VARIATION IN MORPHOMETRICS OF *GLOSSOGOBIOUS SPARSIPAPILLUS* CAUGHT ALONG HAU RIVER, FROM CAN THO TO SOC TRANG PROVINCES

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ARTICLE INFO	ABSTRACT
Received: 25/01/2021	This study provides data on allometric variation in morphometrics of <i>Glossogobius sparsipapillus</i> in the Mekong Delta. A collection of 355 individuals, comprising 155 females and 200 males, was collected from Cai Rang in Can Tho province and Long Phu in Soc Trang province between January and December 2020 for morphological analysis. Statistic analyses showed that fish total length (<i>TL</i>) had strong relation with standard length (<i>SL</i>), body height (<i>BH</i>) and head length (<i>HL</i>) due to significant values of the regressions, e.g., $SL = aTL^b$, $HL = aTL^b$ and $BD = aTL^b$ ($r^2 > 0.666$ for all cases). The slope values (<i>b</i>) of <i>TL-SL</i> and <i>TL-HL</i> regressions show <i>A-</i> and <i>I</i> in males but <i>I</i> and <i>A+</i> in females, respectively; but <i>b</i> of <i>TL-HL</i> regression shares the same pattern between genders (<i>A-</i>). It indicates that fish sex can be determined from the <i>TL-SL</i> and <i>TL-BH</i> regressions. Fish maturation can be estimated from three regressions as <i>b</i> values display <i>I</i> in mature but <i>A</i> in immature one. The <i>TL-HL</i> and <i>TL-BH</i> regressions can be used in order to evaluate when and where fish are caught since <i>b</i> values change with different seasons and locations. The findings show that we can use <i>SL</i> and <i>BL</i> to determine fish gender; <i>SL</i> , <i>BL</i> and <i>HL</i> to confirm when and where fish are caught and when fish reaches maturity.
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BIẾN ĐỔI ĐẶC ĐIỂM HÌNH THÁI Ở LOÀI *GLOSSOGOBIOUS PARSIPAPILLUS* PHÂN BỐ Dọc SÔNG HẬU, TỪ CẦN THƠ ĐẾN SÓC TRĂNG

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THÔNG TIN BÀI BÁO	TÓM TẮT
Ngày nhận bài: 25/01/2021	Nghiên cứu này cung cấp dữ liệu về biến đổi đặc điểm hình thái của loài <i>Glossogobius sparsipapillus</i> ở Đồng bằng sông Cửu Long. Một tập hợp 355 cá thể, gồm 155 cá cái và 200 cá đực, được thu thập từ Cái Răng, tỉnh Cần Thơ và Long Phú, tỉnh Sóc Trăng từ tháng 1 đến tháng 12 năm 2020 để phân tích hình thái. Các phân tích thống kê cho thấy chiều dài tổng (<i>TL</i>) của cá có mối quan hệ chặt chẽ với chiều dài chuẩn (<i>SL</i>), chiều cao cơ thể (<i>BH</i>) và chiều dài đầu (<i>HL</i>) do các giá trị r^2 cao của các phép hồi quy, ví dụ $SL = aTL^b$, $HL = aTL^b$ và $BD = aTL^b$ ($r^2 > 0,666$ cho mọi trường hợp). Các giá trị độ dốc (<i>b</i>) hồi quy <i>TL-SL</i> và <i>TL-HL</i> cho thấy <i>A-</i> và <i>I</i> ở đực nhưng <i>I</i> và <i>A+</i> ở cái tương ứng; trong khi đó <i>b</i> của hồi quy <i>TL-HL</i> cho cùng kết quả ở hai giới tính (<i>A-</i>). Nó chỉ ra rằng giới tính cá có thể được xác định từ các hồi quy <i>TL-SL</i> và <i>TL-BH</i> . Sự thành thực của cá có thể được ước tính từ ba hồi quy khi giá trị <i>b</i> hiển thị <i>I</i> ở cá trưởng thành nhưng <i>A</i> ở cá chưa trưởng thành. Các hồi quy <i>TL-HL</i> và <i>TL-BH</i> có thể được sử dụng để đánh giá thời gian và địa điểm đánh bắt cá vì các giá trị <i>b</i> thay đổi theo các mùa và địa điểm khác nhau. Kết quả cho thấy chúng ta có thể sử dụng <i>SL</i> và <i>BL</i> để xác định giới tính cá; <i>SL</i> , <i>BL</i> và <i>HL</i> để xác nhận thời điểm, địa điểm đánh bắt cá và thời điểm cá trưởng thành.
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1. Introduction

The Linecheek tank goby *Glossogobius sparsipapillus* was originally described by Akihito & Meguro [1]. It is one of three species of the genus *Glossogobius* recorded from brackish to freshwater in the Mekong Delta [2]-[4]. This goby displays isometric growth in Soc Trang, downstream of Hau river [5]. The species is a multiple spawner based on testis and ovarian histological description [6], [7] and a carnivore based on the relative gut length analysis [8]. Some morphometric and meristic characteristics of *G. sparsipapillus* caught from different places along the coastline in the Mekong Delta are reported by Nguyen et al. (2020) [4]. However, these authors did not verify whether fish sex can be determined based on morphometric data and their fish collection was collected from some estuarine and coastal regions in the Mekong Delta. This study aims to test whether this goby's allometry change with gender, fish size, season, and sampling site variables based on a new collection of *Glossogobius sparsipapillus* from Hau River in Can Tho and Soc Trang provinces.

2. Material and methods

2.1. Sampling and morphological analysis

Fish was collected monthly along the Hau river from Cai Rang, Can Tho (CRCT, Site 1, 10°00'26.9 "N 105°48'37.5 "E) to Long Phu, Soc Trang (LPST, Site 2, 9°44'58.5 "N 106°04'09.9"E) from January to December 2020 using gill nets (Figure 1). Sampling was conducted in the dry season (from January to May) and the wet season (from June to December). The rainfall at the sampling sites was usually low in the dry season and high in the rainy season, with approximately 400 mm precipitation per month [9]. Taxonomic identification was based on external morphology described by Akihito & Meguro [1].

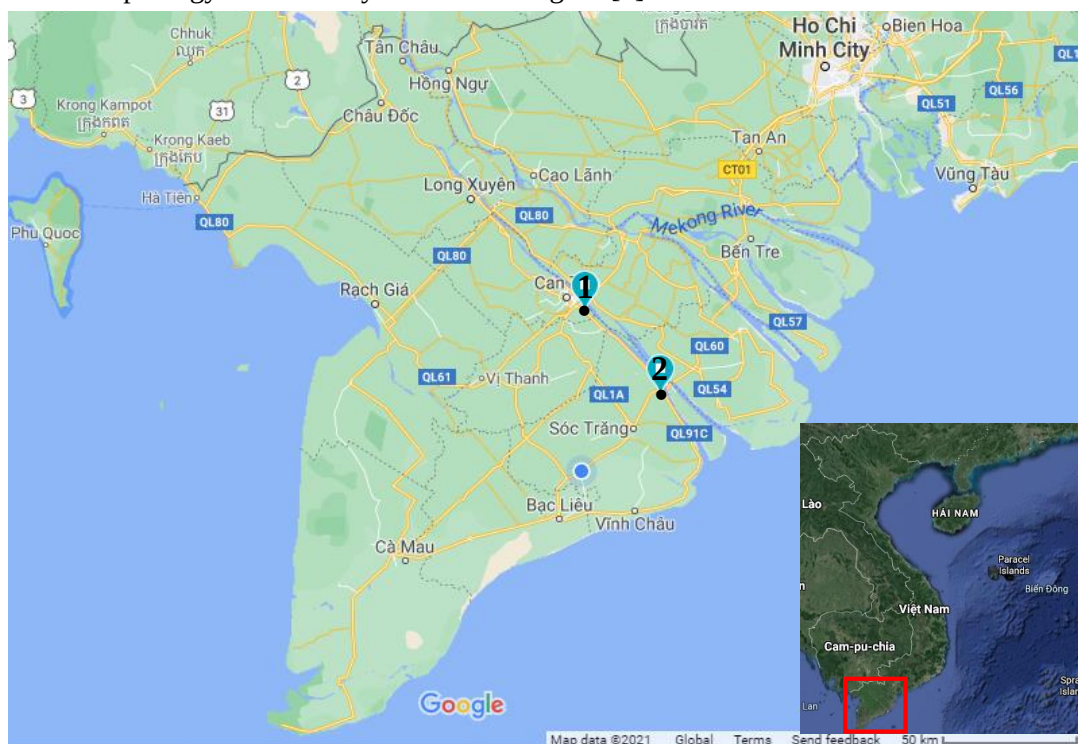


Figure 1. Map showing sampling sites in the Mekong Delta
(1: Cai Rang, Can Tho and 2: Long Phu, Soc Trang; Source: Google Map)

Gender determination was based on the shape of genital papilla, which is a triangle in males and an oval in females [10]. The morphometric and meristic characteristics were followed the description of Daud et al. [11]: total length (*TL*, from the mouth to the tail tip), standard length (*SL*, from the mouth to the position between body and tail), head length (*HL*, from the mouth to the gill cover), and body depth (*BD*, maximum distance from dorsal fin to fish belly).

2.2. Data analysis

The allometric growth of each morphometric dimension related to the total length (*TL*) was calculated by the equation $Y = aTL^b$, where *Y* is the morphometric dimension (*SL*, *HL* and *BD*), *a* is the intercept, and *b* is the slope of regression [12]. The growth patterns of morphometric variables were determined by comparing the slopes and isometric value of one using t-tests. The morphometric variable was categorized into positive allometry (*A+*) if the slope was significantly higher than one, negative allometry (*A-*) if the slope markedly lower than one, and isometry (*I*) if the slope was equal to one. T-test was also used to confirm if *b* change with gender, fish size, season, and sampling site variables. The SPSS software v21 was used for data analysis. All tests were set at reliability $P < 0.05$.

3. Results and discussion

Data analysis of 355 individual fish caught from CRCT and LPST showed that morphological characteristics of *Glossogobius sparsipapillus* were various in accordance with sampling season, sampling location, sex, and age group. This goby showed a positive relationship between *TL* and *SL*, *TL* and *BH*, and *TL* and *HL* since these regressions' determination values were high ($r^2 > 0.666$ for all cases, Tables 1 - 4).

As shown in Table 1, the growth pattern of males and females varied with *SL* and *BL*, but not *HL*. In particular, *SL* and *BH* of males increased faster than those in females as the slope values (*b*) of *TL-SL* and *TL-BH* regressions of this species displayed *I* and *A+* in males but *A* and *I* in females, respectively. In contrast, *HL* shared the same growth pattern with gender due to a similar growth type (*I*). It indicated that fish gender could be determined from *SL* and *BH*. Likewise, the use of morphometric characteristics in gender differentiating was found in *Heterotis niloticus* [13] and *Zacco koreanus* [14].

Table 1. The relationship between *TL* and *SL*, *BH* and *HL* of male and female *Glossogobius sparsipapillus*

Dimension	t	P	Type	b	SE _b	a	SE _a	n	r ²	F	P	ts	P
Female													
SL	50.033	0.000	A-	0.916	0.018	0.963	0.042	155	0.942	2503.305	0.000	-4.667	1.975
BH	17.561	0.000	I	0.953	0.054	0.138	0.018	155	0.666	308.390	0.000	-0.870	1.975
HL	31.790	0.000	A-	0.914	0.029	0.300	0.020	155	0.868	1010.579	0.000	-2.966	1.975
Male													
SL	64.472	0.000	I	0.974	0.015	0.835	0.030	200	0.954	4156.589	0.000	-1.733	1.972
BH	28.705	0.000	A+	1.188	0.041	0.077	0.008	200	0.805	823.957	0.000	4.585	1.972
HL	32.482	0.000	A-	0.935	0.029	0.290	0.020	200	0.841	1055.091	0.000	-2.241	1.972

Likely, a difference in fish morphology from immature to mature was found in the present study. Specifically, the mature *SL* and *HL* of mature fish increased faster than those in the immature one as fish grew because *b* values of *TL-SL* and *TL-HL* regressions showed *I* in the mature group but *A-* in the immature one (Table 2). The reverse case was found in *BH* since *b* value of the *TL-BH* regression was *A+* in the immature group but *I* in mature one. It revealed that *SL*, *BH*, and *HL* increased in the same level with *TL* as fish grew in the mature group, but not in the immature one; and these morphological characteristics can be considered as a tool in fish maturity determination.

Table 2. The relationship between TL and SL, BH and HL of immature and mature *Glossogobius sparsipapillus*

Dimension	t	P	Type	b	SE _b	a	SE _a	n	r ²	F	P	ts	P
Immature													
SL	42.075	0.000	A-	0.882	0.021	1.034	0.051	132	0.931	1770.286	0.000	-5.619	1.978
BH	21.808	0.000	A+	1.125	0.052	0.089	0.011	132	0.784	475.568	0.000	2.404	1.978
HL	28.046	0.000	A-	0.861	0.031	0.338	0.024	132	0.857	786.582	0.000	-4.484	1.978
Mature													
SL	71.022	0.000	I	0.976	0.014	0.836	0.027	223	0.958	5044.168	0.000	-1.714	1.971
BH	23.541	0.000	I	1.042	0.044	0.111	0.012	223	0.714	554.192	0.000	0.955	1.971
HL	35.993	0.000	I	0.953	0.026	0.278	0.018	223	0.854	1295.515	0.000	-1.808	1.971

Regarding the sampling site, *Glossogobius sparsipapillus*' morphological characteristics were also varied. Indeed, BH and HL shared the same level in increasing in CRCT – freshwater region (I: isometric pattern) but changed around allometric type (A+/-) in LPST – salinization in the dry season. It suggested that the environment can regulate fish morphometrics. It suggested that we could use BL and HL as two indicators in estimating fish' location.

Table 3. The relationship between TL and SL, BH and HL of *Glossogobius sparsipapillus* in two sampling sites

Dimension	t	P	Type	b	SE _b	a	SE _a	n	r ²	F	P	ts	P
CRCT													
SL	40.594	0.000	A-	0.920	0.023	0.954	0.052	159	0.912	1647.910	0.000	-3.478	1.975
BH	15.086	0.000	I	0.889	0.059	0.163	0.023	159	0.589	227.597	0.000	-1.881	1.975
HL	28.383	0.000	I	1.012	0.036	0.238	0.020	159	0.836	805.596	0.000	0.333	1.975
LPST													
SL	81.890	0.000	A-	0.963	0.012	0.858	0.024	196	0.972	6705.905	0.000	-3.083	1.972
BH	31.702	0.000	A+	1.186	0.037	0.078	0.007	196	0.837	1004.991	0.000	5.027	1.972
HL	37.118	0.000	A-	0.873	0.024	0.335	0.018	196	0.876	1377.709	0.000	-5.292	1.972

Like a temporal variable, the variation in morphological characteristics of this goby was also regulated by seasons. The BH increased faster than TL in the dry season as b value of TL-BH regression fell into A+ pattern, but in the wet season, BH and TL share a similar level in increase when fish grew because of I category (Table 4). The reversed case was found in HL, whereas SL showed the same growth level in both dry and wet seasons (Table 4). It seems that morphometrics was regulated by seasons and used to estimate when fish was caught.

Table 4. The relationship between TL and SL, BH and HL of *Glossogobius sparsipapillus* in dry and wet seasons

Dimension	t	P	Type	b	SE _b	a	SE _a	n	r ²	F	P	ts	P
Dry													
SL	54.575	0.000	A-	0.957	0.018	0.874	0.036	113	0.964	2978.415	0.000	-2.389	1.981
BH	19.686	0.000	A+	1.164	0.059	0.081	0.011	113	0.775	387.520	0.000	2.780	1.981
HL	24.736	0.000	I	0.983	0.040	0.263	0.024	113	0.845	611.878	0.000	-0.425	1.981
Wet													
SL	60.115	0.000	A-	0.943	0.016	0.901	0.034	242	0.937	3613.776	0.000	-3.563	1.970
BH	24.314	0.000	I	0.997	0.041	0.125	0.012	242	0.710	591.159	0.000	-0.073	1.970
HL	39.865	0.000	A-	0.915	0.023	0.299	0.016	242	0.868	1589.199	0.000	-3.696	1.970

Note: different letters in each category represented the significant difference

4. Conclusion

Glossogobius sparsipapillus displayed sexual, intraspecific, and seasonal variation in allometry. We can use *SL* and *BH* to determine fish gender and use *SL*, *BH*, and *HL* to confirm collecting site and fish maturity.

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