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The Species of *Rastrelliger branchysoma* (Bleeker, 1851) from Chaung Tha Coastal Area, Morphometric Relationships and Meristic Characteristics

July Moe[1]*
[1]Department of Marine Science, Pathein University, Pathein, Ayeyarwady Division, Myanmar

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Contact
*July Moe
julymoe4796@gmail.com (JM)

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Abstract
Rastrelliger branchysoma collected from the Chaung Tha Coastal Area were used to analyze morphometric relationships and meristic studies. This study described the morphometric relationships, including the length-length relationship and meristic counts, of *R. branchysoma*. The result showed that twelve morphometric characters were measured to assess their relationship with the total length, and six meristic counts were also recorded. The correlation coefficient (r) was analyzed with the independent variable (total length) and the dependent variable (other morphometric parameters). Significantly high positive correlations were observed between the total length and most body measurements. The maximum total length of *R. branchysoma* recorded in the present study was 26.1 cm at Chaung Tha. Morphometric and meristic studies will provide knowledge on morphometric and meristic features that could be useful for species identification and stock assessment.

Keywords: Meristic, morphometric, *Rastrelliger branchysoma*, Chaung Tha Coastal Area, Myanmar

1. Introduction

Short mackerel, *Rastrelliger branchysoma,* belongs to the Family Scombridae. It is also locally known as Pa-La-Lan. Distinguishing characteristics of *Rastrelliger branchysoma* are very long gill rakers, a fusiform body, and feathery gill rakers, eyes with adipose eyelid, as described by Jordon and Dickerson in 1908. Short mackerel is widely distributed in the temperate waters of the Atlantic, Indian, and Pacific Oceans and adjacent seas (Carpenter and Niem, 2001). The effective and selective fishing gears for this species are purse seine and gill net (Dharmawan et al., 2022).

Morphometric and meristic characteristics studies play a role in understanding taxonomy, systematics, fish biology, and fisheries science. Morphometrics is the measurement of various body parts like total length, fork length, standard length, eye diameter, head length, head depth, first dorsal fin length, second dorsal fin length, pelvic fin length, pectoral fin length, anal fin length, and body depth (Rahmat, 2011).

Meristic is the count of dorsal spine, dorsal fin ray, pelvic fin ray, pectoral fin ray, anal fin ray, gill raker, lateral line, and node (Afini et al., 2016). Morphometric and meristic studies provide useful information for identifying population variation, supporting taxonomic classification, and informing sustainable fishery management.

The present study aimed to investigate the morphometric and meristic characteristics of *Rastrelliger branchysoma* in the Chaung Tha Coastal Area, to determine relationships between morphometric characters and linear regression equations, and to establish baseline data for future studies on stock assessment and population dynamics of fish.

2. Materials And Methods

2.1. Study Area and Sample Collection

Rastrelliger branchysoma caught by gill net and purse seine were sampled from the Chaung Tha Coastal Area, Pathein

Township, Ayeyarwady Region (Fig. 1) from June to December 2024. For the taxonomic, morphometric, and meristic studies, 100 individuals of *Rastrelliger branchysoma* were randomly collected from the Chaung Tha Coastal Area.

2.2. Morphometric and Meristic Analysis

Species identification followed the classification and nomenclature systems described by Carpenter and Niem (2001). Morphometric measurements and meristic counts were studied by the following methods: Lowe-McConnell (1971) and Rahmat (2011). Twelve morphometric characters: total length (TL), standard length (SL), fork length (FL), head length (HL), head depth (HD), body depth (BD), eye diameter (ED), first dorsal fin length (FDL), second dorsal fin length (SDL), pectoral length (PecL), pelvic length (PevL), and anal length (AL). Morphometric characteristics were measured to the nearest 0.1 cm using the measuring board. *Rastrelliger branchysoma* meristic characters were counted, namely: dorsal spines (DS), dorsal soft fin rays (DFR), lower gill rakers (LGR), upper gill rakers (UGR), anal finlets (AF), and dorsal finlets (DF).

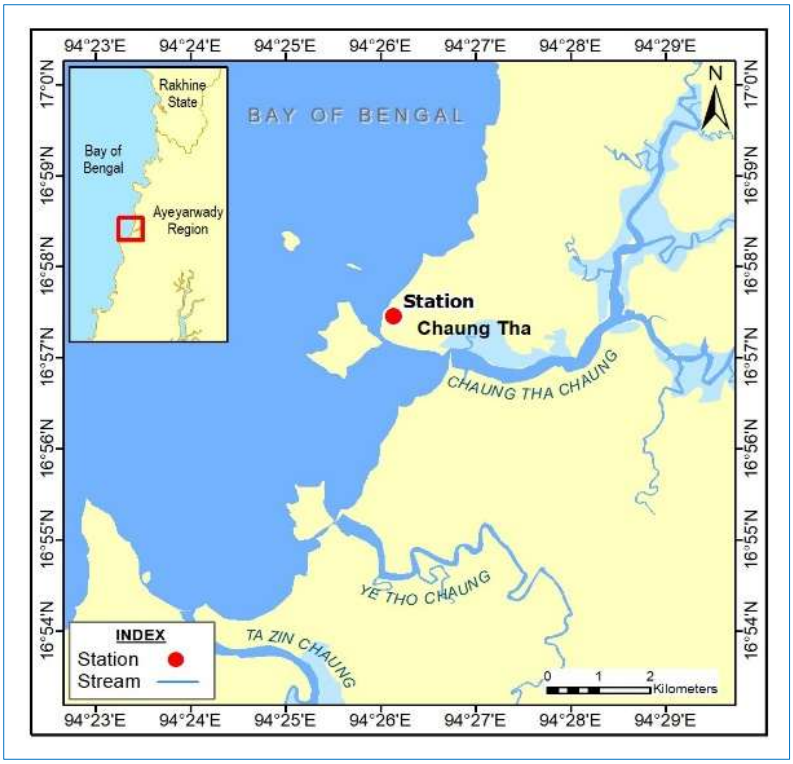

Fig. 1. Study area of Chaung Tha Coastal Area

2.3. Statistical Analysis

Statistical calculations such as mean, standard deviation, and correlation coefficient for the relationship between total length (or head length and all other morphometric) and meristic characters, the regression coefficient was calculated by using the following formula:

$$Y = a + bX \quad (1)$$

where; Y is the dependent variable (other morphometric parameters), a ' is the intercept, b' is the regression slope, and X is the independent variable (total length and head length). Two-sample t-tests at a 5% level of significance ($p<0.05$) were used to assess morphological variations using the method by Masood et al. (2024).

3. Results and Discussion

Rastrelliger branchysoma, belonging to the Family Scombridae, were investigated and identified based on morphometric and meristic characteristics from the Chaung Tha Coastal Area. Short mackerel body compressed, with the greatest body depth. Head length is less than or the same as the body depth. Mouth oblique and gill raker very long, visible when the mouth is opened, 15 to 20 on the lower limb of the first gill arch; numerous bristles on the longest gill raker. The first dorsal spine is shorter than the second, and the second dorsal fin is concave. The origin of the anal is slightly behind that of the second dorsal.

Fig. 2. Morphological Characteristics of *Rastrelliger branchysoma*

Pectoral triangular, longer than ventral. Eye diameter is 28.55 % of the head length. The head is 21.55% of the total length. The length of the head is less than the body depth in most of the samples. Body depth is 22.89 % of total length. The ratio of head length to greatest body depth is 1:1. The ratio of fork length to greatest body depth is always 4:1, and head length to greatest depth is 1:1 (Goutham and Mohanraju, 2015).

Back blue-green, flanks silver with a golden tint; 1 or 2 rows of small, dark spots on sides of dorsal-fin bases, narrow dark longitudinal bands on the upper part of the body (golden in fresh specimens), and a black spot-on body near the lower margin of pectoral fins; dorsal fins yellowish with black tips, caudal and pectoral fins yellowish; other fins dusky.

Table 1. Morphometrics measurements of *Rastrelliger branchysoma* from Chaung Tha Coastal Area

No	Characteristics	Range (cm)	Mean± SD
1	Total length (TL)	18 - 28	24.55±2.24
2	Standard length (SL)	16.5 - 26	22.59±2.15
3	Fork length (FL)	15 - 24	20.53±2.16
4	Head length (HL)	5 - 6.5	5.87 ±0.37
5	Head depth (HD)	3.7 - 5.9	5.1 ± 0.44
6	Body depth (BD)	5.2 - 6.7	6±0.38
7	Eye diameter (ED)	1.4 - 1.9	1.66 ±0.13
8	First dorsal length (FDL)	2.1 - 3.3	3±0.28
9	Second dorsal length (SDL)	2.4 - 3.5	3.16 ±0.27
10	Pectoral length (PecL)	2.6 - 3.4	2.91 ± 0.18
11	Pelvic length (PevL)	2.4 - 3.3	2.82± 0.22
12	Anal length (AL)	2.7 - 3.3	2.98±0.18

3.1. Morphometric Measurements of Rastrelliger branchysoma

Twelve morphometric characters of *Rastrelliger branchysoma* were measured, and the mean and standard deviation were calculated. Table 1 states the mean and standard deviation for the morphometrics of *R. branchysoma* from the Chaung Tha Coastal Area. The total length of *R. branchysoma* in the present study ranged from 18 to 28 cm (mean ± SD = 24.55 ± 2.24 cm). The length of the head is almost the same as or less than the body depth in most of the samples. Pelvic origin anterior to dorsal fins, with pelvic slightly smaller than or equal to pectorals. The morphometric measurements of *Rastrelliger brnachysoma* collected from the Chaung Tha Coastal Area are comparatively narrow-bodied. Gill-rakers are long and numerous, feather-like, and visible when the mouth is opened. Two dorsal, the first spinous.

Five or six finlets behind the dorsal and anal. Caudal deeply forked. Pectorals are short and pointed with a broad base. Wardiatno et al. (2021) recorded that the mean total length of mackerel obtained was 187.8 mm, 212.7 mm, and 273 mm from Ketapang, Bangka, and Bintan locations. Viboonkit et al. (2022) found the maximum total length of *R. branchysoma* in the upper and middle Gulf of Thailand. Jayasankar et al. (2004) reported high component loadings for the area encompassing depth between the origin of the anal fin and that of the second dorsal fin and caudal peduncle depth in the same species from India. *Rastrelliger kanagurta* and *R. branchysoma* share similar morphological characters but show differences in head-related variables and the anterior part of the body. Such head-related differences would normally suggest the influence of habitat differences between the populations (Palma and Andrade, 2002).

3.2. Linear Regression Measurement of Rastrelliger branchysoma

The relationship between the morphometric indices and total length (TL) of *Rastrelliger branchysoma* was best described by the linear regression equations, and there is a direct relationship between total body length and different morphometric indices. The estimated regression equations for various morphometric characteristics as a function of TL are given in Table 2. The regression analysis was performed between the independent variables TL and the dependent variables FL, SL, HL, BD, ED, FDL, SDL, PecL, PevL and AL were shown in Figs. 3-5.

Table 2. Linear regression analysis for the combined sex of *Rastrelliger branchysoma* from the Chaung Tha Coastal Area

Study area	Characters	a	b	r	t	Linear equation
Chaung Tha Area	SL/TL	-0.99	0.95	0.99	82.23*	SL= -0.99+ 0.95TL
	FL/TL	-2.5	0.93	0.97	17.34*	FL= -2.5+ 0.93TL
	HL/TL	2.11	0.15	0.92	10.02*	HL= 2.11+ 0.15TL
	BD/TL	2.1	0.16	0.91	9.26*	BD= 2.1+ 0.16TL
	ED/TL	0.4	0.05	0.87	7.39*	ED= 0.4+ 0.05TL
	FDL/TL	0.22	0.11	0.89	8.63*	FDL= 0.22+ 0.11TL
	SDL/TL	0.46	0.1	0.89	8.58*	SDL= 0.46+ 0.1TL
	PecL/TL	1.49	0.05	0.68	3.98*	PecL= 1.49+ 0.05TL
	PevL/TL	0.8	0.08	0.82	6.09*	PevL= 0.8+ 0.08TL
	AL/TL	1.54	0.05	0.72	4.43*	AL= 1.54+ 0.05TL

There is a positive relationship between FL, SL, HL, BD, ED, FDL, SDL, PecL, PevL, AL and TL. Moreover, the calculated value of the correlation coefficient 'r' of those relationships indicated a medium to high degree of correlation between the investigated variables. A strong positive linear relationship was observed between FL/ TL, SL/TL, and HL/TL. This means that the fish increases in FL, SL, and HL perfectly at the same rate as TL. FL/TL and SL/TL are strongly related in Chaung Tha. The moderate positive linear relationship was observed between BD/TL, ED/TL, FDL/TL, SDL/TL, and PevL/TL. This means that BD and HL are increasing moderately. Furthermore, all the *Rastrelliger branchysoma* fins grow moderately with TL. All body parameters show high correlation with total length and head length. The regression coefficient (b) was found to be significant in the morphometric analysis, with total length serving as the independent variable. There was a significant difference in each character of the measured *R. branchysoma*

based on total length after being analysed using a t-test with a value of $P < 0.05$. According to Darlina et al. (2011), the mean sample size of *R. brachysoma* (8.0 ± 3.10 SD) differed significantly (t-test, t = 0.5547, P < 0.05).

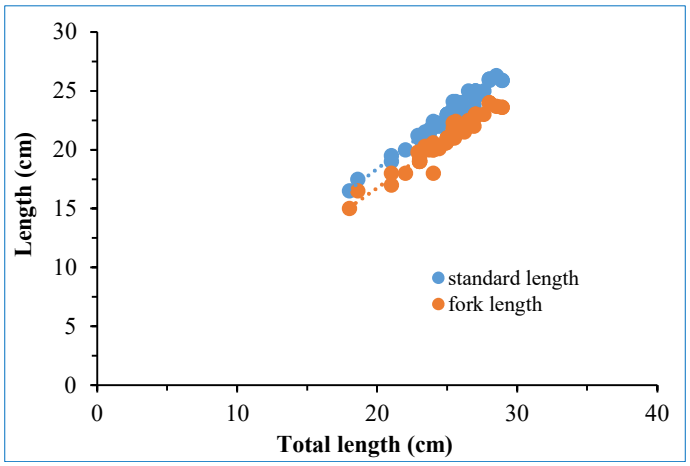

Fig. 3. Length- length relationship of *Rastrelliger branchysoma* from Chaung Tha Coastal Area

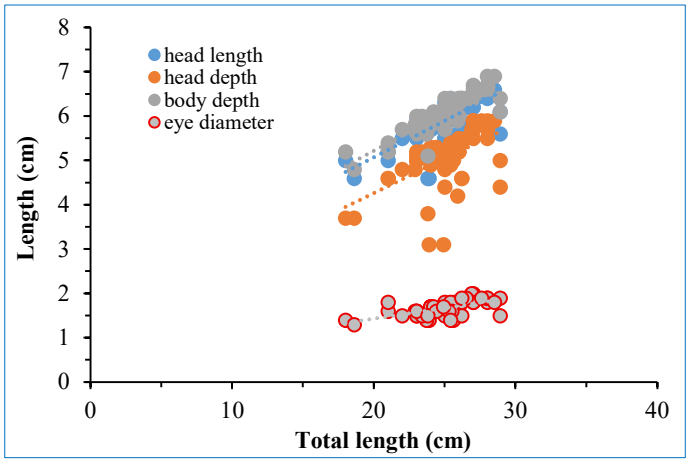

Fig. 4. Length- length relationship of Rastrelliger branchysoma from Chaung Tha Coastal Area

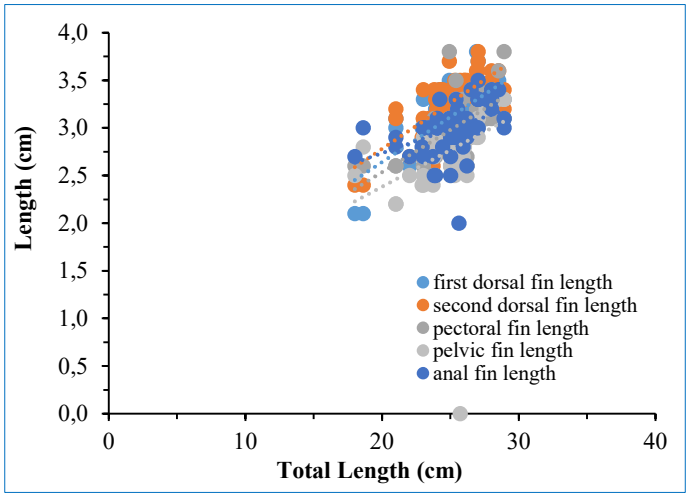

Fig. 5. Length- length relationship of *Rastrelliger branchysoma* from Chaung Tha Coastal Area

3.3. Meristics of *Rastrelliger branchysoma*

The meristic characters calculation results show that there were 12 soft rays and 9 to 11 hard spines on the dorsal fins (Table 3). The first dorsal spine counts appear to be variable. The dorsal spines are 9 to 11, and the mean is 9.12±0.39. The fin rays vary from 12, and the dorsal finlets and anal fin rays from five to six. Considerable variations of the gill-raker counts on the upper limb in *R. branchysoma* are 15 to 20, and the mean is 19.08±0.7. Those values for the lower limb are 30 to 35 and 30.4±1.37. Similar result show that the gill rakers very long, visible when mouth is opened, 30 to 44 in numbers on lower limb of first gill arch; gill rakers on upper limb arch 15 to 21; first dorsal fin spine 9 to 10; first dorsal fin rays 12; second dorsal fin and anal fins each followed by 5 finlets (Bhendarkar et al., 2014).

Table 3. Meristics of *Rastrelliger branchysoma* from the Chaung Tha Coastal Area

Characteristics	Chaung Tha Coastal Area	
	Range	Mean± SD
DS	9 -11	9.12±0.39
DFR	12	12±0
LGR	15 - 20	19.08±0.7
UGR	30 - 35	30.4±1.37
DFL	5 - 6	5.12±0.33
AFL	5 -6	5.12±0.33

4. Conclusions

Analysis of the morphometric relationship and meristic characteristics of *Rastrelliger branchysoma* from the Chaung Tha Coastal Area can indicate the growth pattern and provide the baseline data for future research on stock differentiation. This morphological information will support further studies as well as be helpful for the management and assessment of *Rastrelliger kanagurta*.

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