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Short Communication

The Hooghly croaker, *Panna heterolepis* Trewavas, 1977: Identification through morphometric and meristic characteristics

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As morphometric information for Hooghly croaker *Panna heterolepis* Trewavas, 1977 is absent in the most extensively accessed and world's largest online database for fishes (FishBase); this study was undertaken to provide the complete informative description on morphometric relationships and meristic counts of various fin rays. A total of 200 individuals were sampled from the Bay of Bengal (Bangladesh) during July 2018 to June 2019, using several traditional fishing gears. Meristic counts were computed using a magnifying glass. Body weight (BW) and several length measurements were taken through an electronic balance and digital slide calipers for each individual. LWRs (Length-weight relationships) were calculated as: $W = a \times L^b$. All LWRs and LLRs (length-length relationships) were found significant with $r^2 \geq 0.919$ ($p < 0.0001$) and 0.928 ($p < 0.001$), respectively. BW *vs.* TL and TL *vs.* SL were the best fitted models for LWRs and LLRs, respectively. Fin formula was: dorsal, D. 43–55 (VIII–X+i/34–44); pectoral, P. 15-17 (i/14–16); pelvic, Pv. 6 (I/5); anal, A. 7–10 (II/5–8); and caudal, C. 17–19 (ii/15–17). These results will a) make a vital contribution for species identification in the marine and coastal waters of Bangladesh and adjoining countries, and b) provide information for Fish Base.

[**Keywords**: Bangladesh, Bay of Bengal, Meristic, Morphometric, *Panna heterolepis*]

Introduction

Bangladesh harbour a huge amount of open waterbodies like rivers, freshwater marshes, estuaries, and an extensive coastline of ~710 km. Together with vast water resources, Bangladesh is rich with various fish and other aquatic species. The southern marine and coastal region of Bangladesh is blessed with a high abundance of fishes that can be caught commercially to contribute to the national economy[1-5]. The Hooghly croaker, *Panna heterolepis*, which belongs to the family Sciaenidae, is a tropical demersal fish that inhabits in coastal waters while the juveniles thrive in mangrove swamps. This sciaenid is found abundantly in India and Bangladesh[6-8]. This species is a popular food item and is fairly common in the commercial catch to be marketed fresh or dried/salted.

Morphometric characteristics and meristic counts are important for the identification, classification, and for genetic studies of fish species[9-15] because variation in meristic appearance has been undoubtedly demonstrated in many fish species[16]. Further, morphometric based identification perform a dynamic role in research, being used to compare population structure, and fisheries stock assessments[17-22]. Furthermore, studies based on morphometric and meristic characters are faster and practical than molecular studies, therefore can be applied on field[20].

Morphometric and meristic studies of many aquatic species have been done from Bangladesh in the past[23-34]. However, many studies[5,9,35-38] were conducted region wide on *P. heterolepis*, but none of these studies covered morphometric and meristic traits together. Thus, current study explores the morphometric relationships and meristic counts of *P. heterolepis* collected from marine waters of Bangladesh.

Materials and Methods

Present study was carried out in the Bay of Bengal (21º77′ N; 89º55′ E), Khulna region, Bangladesh. A total of 200 individuals of *P. heterolepis* (Fig. 1) were collected during July 2018 to June 2019 *via* different local gears.

Each fresh sample was immediately chilled with ice in the field and preserved in buffered formalin. Meristic counts were done with the help of a magnifying glass. Wet body weight (BW) was recorded with 0.01 g precision and body lengths were measured to the nearest 0.01 cm accuracy (Fig. S1).

To calculate LWRs, the formula $W = a \times L^b$ was used; where, W is the body weight (BW, g), L is one of ten different lengths (cm), and a and b are regression parameters. Furthermore, 95 % confidence limit (CL) of a and b and the coefficient of determination (r^2) were

assessed. Extreme outliers were omitted from the regression[39]. To ensure that the *b* values in the regression analyses were substantially diverse from the isometric value, a *t*-test was used[40]. All length-length relationships (LLRs) were assessed by linear regression analysis[29]. The best models were selected from LWRs and LLRs, depending on the highest r^2 values.

Results

The body of *P. heterolepis* is slender. The mouth is large, oblique, and supraterminal and the head bears a rounded snout. The body color is brownish, pertaining lighter on belly with yellowish fins (Fig. 1). Dark margins are present on the dorsal and anal fins. The dorsal fin has a low notch with weak spines and the second anal spine is also weak. The body is covered with small ctenoid scales, but the head is with cycloid scales. The morphometric measurements of *P. heterolepis* are presented in Figure S1. The fin formula of *P. heterolepis* is: dorsal, D. 43 – 55 (VIII – X + i/34 – 44); pectoral, P. 15-17 (i/14 – 16); pelvic, Pv. 6 (I/5); anal, A. 7 – 10 (II/5–8); caudal, C. 17 – 19 (ii/15 – 17) (Fig. 2). All the meristic counts of *P. heterolepis* are presented in Table S1.

In this study, TL ranged from 11.0 to 34.5 cm (mean ± SD = 19.36±3.84 cm) and BW varied from 9.02 to 298.26 g (mean ± SD = 61.25±40.93 g). All morphometric relationships are shown in Table 1. The regression parameters (*a* and *b*) and the significance values are shown in Table 2. Based on r^2 values of LWRs, BW *vs.* TL and BW *vs.* SL were the fittest models among the 10 equations. All LLRs were also highly correlated with r^2 values ≥ 0.928 (Table 3). According to r^2 values of LLRs, TL *vs.* SL and TL *vs.* PcL were the fittest models among 9 equations.

Fig. 1 — Photograph of *Panna heterolepis* collected from the Bay of Bengal, Bangladesh

Discussion

Data on morphometric characters as well as meristic counts for *P. heterolepis* is limited in

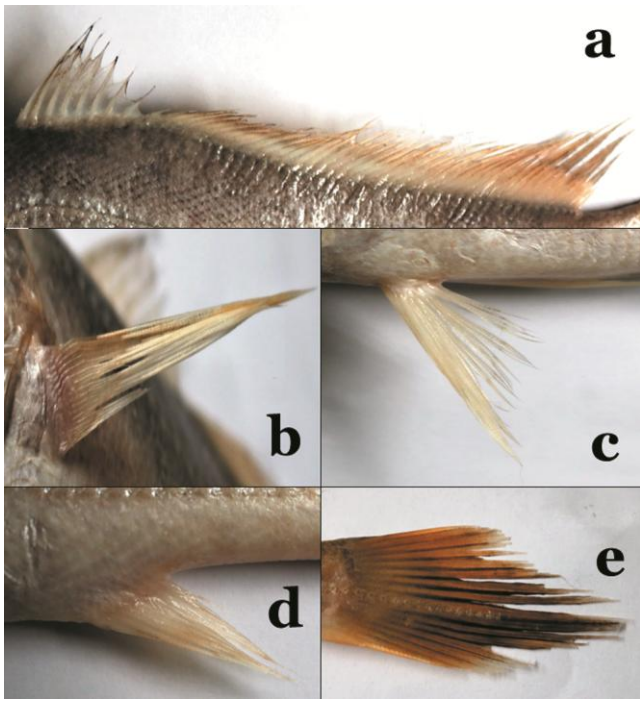

Fig. 2 — Different fins of *Panna heterolepis*: (a) dorsal, (b) pectoral, (c) pelvic, (d) anal, and (e) caudal fin

Table 1 — Morphometric measurements of *Panna heterolepis* Trewavas, 1977 captured from the Bay of Bengal, Bangladesh

Measurements	Min (cm)	Max (cm)	Mean ± SD	95 % CL	% TL
TL (Total length)	11.0	34.5	19.36 ± 3.84	18.82 - 19.90	100.00
SL (Standard length)	8.3	28.2	15.07 ± 3.13	14.64 - 15.51	81.74
HL (Head length)	2.3	6.5	4.04 ± 0.77	3.94 - 4.15	18.84
PrDL (Pre-dorsal length)	2.3	6.9	4.09 ± 0.84	3.97 - 4.21	20.00
PoDL (Post-dorsal length)	7.9	25.4	13.91 ± 3.29	13.46 - 14.37	73.62
PcL (Pectoral length)	2.6	6.8	4.19 ± 0.76	4.08 - 4.29	19.71
PvL (Pelvic length)	2.7	7.5	4.43 ± 0.92	4.30 - 4.56	21.74
AnsL (Anus length)	5.6	14.9	9.42 ± 1.90	9.16 - 9.68	43.19
PrAnL (Pre-anal length)	6.5	15.7	10.47 ± 1.89	10.21 - 1073	45.51
PoAnL (Post-anal length)	7.1	19.7	11.55 ± 2.39	11.21 – 11.88	57.10
BW (Body weight)	9.02*	298.26*	61.25 ± 40.93	55.54 - 66.96	-

Min - minimum; Max - maximum; SD - standard deviation; CL - confidence limit for mean value; and * - weight in g

Table 2 — Descriptive statistics and estimated parameters of the length-weight relationships of *Panna heterolepis* Trewavas, 1977 from the Bay of Bengal, Bangladesh

Equation	Regression parameters		95 % CL of *a*	95 % CL of *b*	r^2	GT
	a	*b*				
$BW = a \times TL^b$	0.0075	3.001	0.0062 – 0.0090	2.938 – 3.063	0.978	I
$BW = a \times SL^b$	0.0193	2.927	0.0165 – 0.0226	2.868 – 2.986	0.979	A-
$BW = a \times HL^b$	0.8867	2.941	0.7606 – 1.0338	2.831 – 3.051	0.933	A-
$BW = a \times PrDL^b$	1.1359	2.743	0.9680 – 1.3329	2.629 – 2.857	0.919	A-
$BW = a \times PoDL^b$	0.0543	2.630	0.0457 – 0.0645	2.560 – 2.692	0.969	A-
$BW = a \times PcL^b$	0.4788	3.298	0.4182 – 0.5482	3.203 – 3.392	0.959	A+
$BW = a \times PvL^b$	0.7000	2.922	0.6146 – 0.7972	2.834 – 3.010	0.956	A-
$BW = a \times AnsL^b$	0.0969	2.821	0.0801 – 0.1171	2.736 – 2.906	0.956	A-
$BW = a \times PrAnL^b$	0.0400	3.069	0.0309 – 0.0517	2.958 – 3.179	0.938	I
$BW = a \times PoAnL^b$	0.0465	2.887	0.0388 – 0.0558	2.812 – 2.962	0.967	A-

See Table 1 for abbreviation; *a* and *b* are the regression parameters of LLRs; CL - confidence limits; r^2 - coefficient of determination; GT - growth type; 'A-' – negative allometric; 'A+' – positive allometric; and I - isometric

Table 3 — The estimated parameters of the length-length relationships ($y = a + b \times x$) of *Panna heterolepis* Trewavas, 1977 from the Bay of Bengal, Bangladesh

Equation	Regression parameters		95 % CL of *a*	95 % CL of *b*	r^2
	a	*b*			
$TL = a + b \times SL$	1.6880	1.177	1.4055 – 1.9706	1.159 – 1.196	0.988
$TL = a + b \times HL$	-0.2871	4.858	-0.9242 – 0.3500	4.700 – 5.010	0.951
$TL = a + b \times PrDL$	1.3400	4.400	0.6200 – 2.0599	4.231 – 4.576	0.928
$TL = a + b \times PoDL$	3.3848	1.148	2.9579 – 3.8118	1.118 – 1.178	0.967
$TL = a + b \times PcL$	-1.5854	5.001	-2.0521 – -1.1187	4.892 – 5.111	0.988
$TL = a + b \times PvL$	1.1413	4.111	0.6322 – 1.6504	3.999 – 4.223	0.963
$TL = a + b \times AnsL$	0.5694	1.995	0.1352 – 1.0037	1.949 – 2.039	0.975
$TL = a + b \times PrAnL$	-1.3730	1.980	-2.0232 – -2.0229	1.919 – 2.041	0.954
$TL = a + b \times PoAnL$	0.9744	1.592	0.6580 – 1.2909	1.566 – 1.619	0.986

See Table 1 for abbreviation; *a* and *b* are the regression parameters of LWRs; CL - confidence limits; r^2 - coefficient of determination

literature. This study represents the first thorough morphometric information (LWRs and LLRs) and meristic counts of *P. heterolepis*, which should facilitate the correct identification.

Meristic counts appear to be favorable and easy to assess, and maximum counts can be done from live fish. In this study, 8-10 spine fin rays were found in dorsal fin, which is similar to Shafi & Quddus[41], Talwar & Jhingran[7], and Rahman[6], but the branched fin rays exceeded their findings. In this study, pectoral fins had 15-17 fin rays with 1 unbranched ray, which is also similar to Rahman[6]. Observed pelvic (I/5) and anal fin-ray counts (II/5-7) were identical to those of Shafi & Quddus[41], Talwar & Jhingran[7], and Rahman[6]. Caudal fin rays (ii/15-17) were in agreement with Shafi & Quddus[41]. Hence, meristic counts are inadequate to distinguish among different populations or stocks of the same species.

In general, morphometric and meristic data collection is a tedious process[42]. For this reason, a representative number of samples and individuals (n = 200) from small to large body sizes were collected for observation. However, absence of fish smaller than 11.0 cm TL during the study period may reflect selectivity of fishing gear, low market price, or the commercial fishers are not operating where young fish live[29,31,32,35-37]. Present study reported a length of 28.2 cm SL, which is higher than the findings (21.4 cm) of Sasaki[34] but similar to Sabbir *et al.*[37]. The SL (81.74 %) was the highest percentage of TL, opposite of PcL (19.71 %). The mean body weight was found to be 61.25±40.93 g, though the maximum weight was 298.26 g. Low mean weight with a high maximum BW ('skewing') reflected the presence of few large fishes in the sampling site.

According to Carlander[43], the *b* values of LWRs may differ between 2.0 to 4.0, whereas Froese[39] reported the value ranging from 2.5 to 3.5. In this study, the obtained *b* values from relationships between BW and 10 different lengths of *P. heterolepis*

were within the range of 2.630 – 3.298. Sabbir *et al.*[37] also reported negative allometric growth for *P. heterolepis* population based on year-round data. However, within the same species, the *b* values can differ due to one or more factors, such as differences in growth across body-parts, gender, physiological condition, gonadal development, food availability, preservation methods, and due to variation in observed lengths of the collected specimens[32], which are not examined in this study. The LWRs, TL and PrAnL showed isometric growth; PcL showed positive allometric growth; and the other body parts showed negative allometric growth.

However, lack of sufficient literature prevents thorough comparisons with current findings. The study also found the fittest model among the equations for several length types based on the coefficient of determination (r^2).

Conclusion

The study describes morphometric information, *i.e.*, LWRs and LLRs, along with meristic counts and the findings should be valuable to fishery biologists to (a) identify *P. heterolepis* and (b) to instigate stock assessment in the Bay of Bengal, Bangladesh.

Supplementary Data

Supplementary data associated with this article is available in the electronic form at http://nopr.niscair.res.in/jinfo/ijms/IJMS_50(06)502-506_SupplData.pdf

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Conflict of Interest

The authors declare that they have no conflict of interest for this study.

Author Contributions

WS, MYH & MAR: Conceived the concept. MAR, MAI & MNK: Collected and analyzed the data. AAC, MRH & ZM: Software analysis. WS & MAR: Wrote and edited the manuscript.

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