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MORPHOMETRY OF BENGAL EYED TURTLE *MORENIA PETERS* (ANDERSON 1879)

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Abstract: The study on the morphology of Bengal eyed turtle, *Morenia petersi* (Anderson, 1879) was made between January 1997 and December 2000 in Narayanganj, Chandpur, Manikganj, Dhaka and Madaripur Districts of Bangladesh. The mean weight of adult male was 640.6 ± 165.4 g and of female 794.5 ± 194.89 g. The length and width of carapace as well as those of the plastron and the height of the shell varied with the body weight of the turtle. The percentage of hard parts of the body weight of *M. petersi* was 35.9 ± 1.3% and soft parts was 64.3 ± 1.2%, respectively.

Key words: Morphometry, Bengal eyed turtle

INTRODUCTION

Freshwater turtles have long been captured by the people for food, pet animals and in China as raw materials of traditional medicine (Chen *et al.,* 1993). Freshwater turtles are favoured for their supposed medicinal value and are consumed as food (Sandra and Daniela, 2000). They have long been associated with human either in myths, as a food sources, as ornaments or as traditional medical ingredient (Rashid and Khan, 2000). Turtles are consumed by a group of people for its delicacy and the exploitation has increased significantly in the present decade (Rao, 1987). Turtles and their eggs are the major source of protein in many parts of the world and provide the gourmet food with turtle soup and terrapin stew (Goin and Goin, 1971). The Hindu and tribal consume turtles as a source of protein (Rao, 1986).

The turtle meat is highly valuable and sold at BDT 1100 per kilogram (FoB price) and BDT 200 - 600 per Kg in the local markets in different months. Shells are dried up and are sold BDT 150 - 225 per Kg (Traders wholesale price), soft parts of carapace (locally called badhi) are dried up and sold BDT 800 per Kg (FoB Price) [Hossain, 2000]. According to Export Promotion Bureau of Bangladesh (1980 – 2000) a huge quantity (estimated 3164.24 tons) of turtles are exported from Bangladesh and earned BDT 7, 80,00,000 per year. Therefore, the turtles play an important role in socioeconomic status of Bangladesh. Other than the use of human food, different byproducts are extracted from turtle fats, carapace, plastron and eggs which are also used for treatment, making handicrafts, etc. (Michael and Grey, 2000).

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The wetlands of Bangladesh are inhabited by Chelonian fauna that can maintain ecological balance and control water quality (Hossain and Sarker, 1995). Major species of freshwater turtles control the growth of aquatic weeds and other floating vegetations and maintain healthy aquatic environment for wildlife and fish (Philip *et al.* 1998). Freshwater turtles perform a valuable service as scavengers in the tanks, rivers and stagnant water and thus keep the aquatic systems free from pollution (Rao 1987). Scientists like Boulenger (1890), Chaudhury (1912), Fugler (1984), Barua and Islam (1986), Hossain and Sarker (1994 and 1995), Whitaker and Andrews (1997), Vogt and Benitez (1997) and Rhodin (2001) worked on morphometry, ecology and trend of trade of the selected freshwater turtle.

In this research Bengal eyed turtle *M. petersi* was selected to study its morphometry and biometry to ascertain the growth ratio in relation to body weight. Experience will demonstrate the feasibility of using captive breeding as a tool to assist turtle conservation and farm management.

MATERIAL AND METHODS

Morphometric study of length, width of carapace as well as those of the plastron and the height of shell and weight measurements were made at Baidder Bazar, Sonargoan upazila; Bot-toli, Jamtoli and Ghudara ghat of Narayanganj district; Matlab Bazar (bridgeghat), Matlab upazilalocal markets, Kaliatoli Bazar, Koiar-pool turtle market of Haziganj upazila and Chandpur sadar turtle market under Chandpur district; Patkeel Bazar, Kadambari beel of Madaripur district; Zitka bazar, Sebalaya local market, Gopinathpur sadar turtle market of Manikganj district; Mirpur section 10 and Ghudaraghat No 1, Tipu sultan Road, Uttara Section 12 & 14 and Kamalapur turtle export centre, Sham Bazar and Laxmi bazar turtle market under Dhaka district.

Morphometric analysis: A total of 200 *Morenia petersi* (♂= 100 and ♀ = 100) were used for morphometric analysis. Curve carapace was measured from tip of nuchal shield to end of pygal and curve plastron width measured from middle of inframarginal shield left to right side. Straight plastron was measured from the tip of intergular to end of anal shield. The shell height was measured with taxonomic board in perpendicular way. For convenience of statistical analysis, the males and females were separated into weight group for the study of frequency distribution. The relationship between the body weight and surface area of carapace and plastron was considered. The distribution of number and percentage of males and females were determined.

The relationship between length and weight of turtles was determined with a view to know growth ratio by means of regression analysis using least square

methods from the original data at confidence level 95%. The regression co-efficient and correlation co-efficient were applied by means of 't'-statistic at 5% level of probability. The estimated weight was plotted against the corresponding length, width and shell height to obtain a linear curve distribution. Growth rate of various morphometric characters in relation to body weight of turtles was determined using the standard methods. For biometric study turtles were dissected and measured them on the basis of three categories i.e. hard parts (Carapace and plastron), soft parts (forelimbs, hindlimbs, neck, liver, heart and digestive tract) and other soft parts (blood, spleen and residue). Percentage of different organs in relation to body weight was also calculated.

Sex determination: Bengal eyed turtles were captured from nature and also collected from export centers and local markets to identify their sex. Male *M. petersi* was smaller in size and possessed a comparatively longer tail with thick base. Male also possessed white band on the top of the tail, while female possessed yellow band.

Data analysis: Data were analyzed by Excel and SPSS (Version 10.00) for all the statistical analysis. Data relating to the various body measurements of *M. petersi* and the significance of correlation co-efficient has been examined with the help of 't' statistics. Regression analysis between two sexes was made to find out the relationship and difference by means of different parameters. The difference between sets of data for given parameters were subjected to analysis of variance (ANOVA).

RESULTS AND DISCUSSION

The turtle is commonly known as Haldhi kaitta or Yellow turtle. The carapace of the turtle is domed with a low keel, marginals un-serrated, nuchal and vertibrals are broader than long. Axillary scutes large, plastron narrow, notched posteriorly. Digits are well developed, tail short, carapace is yellowish green, olive or gray black. The vertebral and coastal with green or yellow spots. Vertebral 1 -V with green stripes and 'U' shaped marks, and coastal typically having pale green circles and looped lines. Plastron is yellow or orange with black blotches on the axillary scutes and some of adjacent marginal. Nine ring like yellow markings on the vertebral and coastal shields. The head is olive with three yellow stripes on each side, one above the eyes, and other one over the jaws and one behind the eyes.

Morphometric measurements of 100 males and 100 females of *M. petersi* were calculated in the study areas. The weight of males varied from 376 to 950g (mean 640.6 ± 165.4g) and females 375 to 1130g (mean 794.5 ± 194.8g). The weight of females was larger than males on an average (Table 1).

Table 1. Morphometric measurements of *M. petersi*

Parameters	Male (n = 100)		Female (n = 100)	
	Range	Mean ± SD	Range	Mean ± SD
Body Weight (BW) g	376 - 950	640.6 ± 165.4	375 - 1130	794.5 ± 194.8
Curve Carapace Length (CCL) cm	15.1 - 22.1	18.9 ± 1.4	15.1 - 23.0	19.9 ± 1.6
Curve Carapace Width (CCW) cm	13.3 - 20.8	16.5 ± 1.2	16.2 - 23.9	22.1 ± 1.9
Plastron Length (PL) cm	12.2 - 19.1	14.6 ± 1.8	12.4 -19.1	15.8 ± 2.1
Plastron Width (PW) cm	8.5 - 14.2	11.6 ± 1.5	8.8 - 14.9	11.9 ± 1.2
Straight Shell Height (SSH) cm	6.4 - 8.8	7.43 ± 0.5	6.5 - 10.0	7.7 ± 0.6
Surface area of carapace (cm^2)	214.4 - 444.2	313.5 ± 52.7	245 -550	443.2 ± 64.5
Surface area of plastron (cm^2)	105.4 - 271.2	171.3 ± 38.6	114 - 269	189.3 ± 35.7

The surface area of carapace and plastron as well as the height of the shell of males and females increased in relation to body weight (Table 1). From the regression equation (y = a + bx), it is evident that the body weight and surface area of carapace and plastron of male *M. petersi* were strongly correlated (y = 0.2719x + 142.4, R^2 = 0.9612 and y = 0.218x + 34.03, R^2 = 0.911) respectively and the regression lines were linearly fitted (Fig. 1a-b). Whereas, the relationship between the body weight and shell height of male was moderately correlated (y = 0.002x + 6.164, R^2 = 0.7838) and the regression line did not maintain linearity, it means the increase of body weight might not increase the shell height (Fig.1 c). The body weight and surface area of carapace and plastron, and even the shell height of female *M. petersi* were strongly correlated (y = 0.3166x + 195.28, R^2 = 0.8925 and y = 0.1449x + 79.44, R^2 = 0.8285, and y = 0.0027x + 5.8375, R^2 = 0.8008) and the regression lines were linearly fitted (Fig. 2 a-c).

The percentage of biometric parameters i.e. length and width of carapace, plastron and the shell height were estimated by the mean values of males and females. The average body weight of males and females *M. petersi* was 44.6% and 55.4%, respectively in relation to their body weight. The length of carapace of males was 48.7% and females was 51.3%. Carapace width of males was 42.7% and females was 57.3%. Plastron length of males was 48% and females 52%. Plastron width of males was 49.4% and females was 50.6%, shell height of males was 49% and females was 51%.

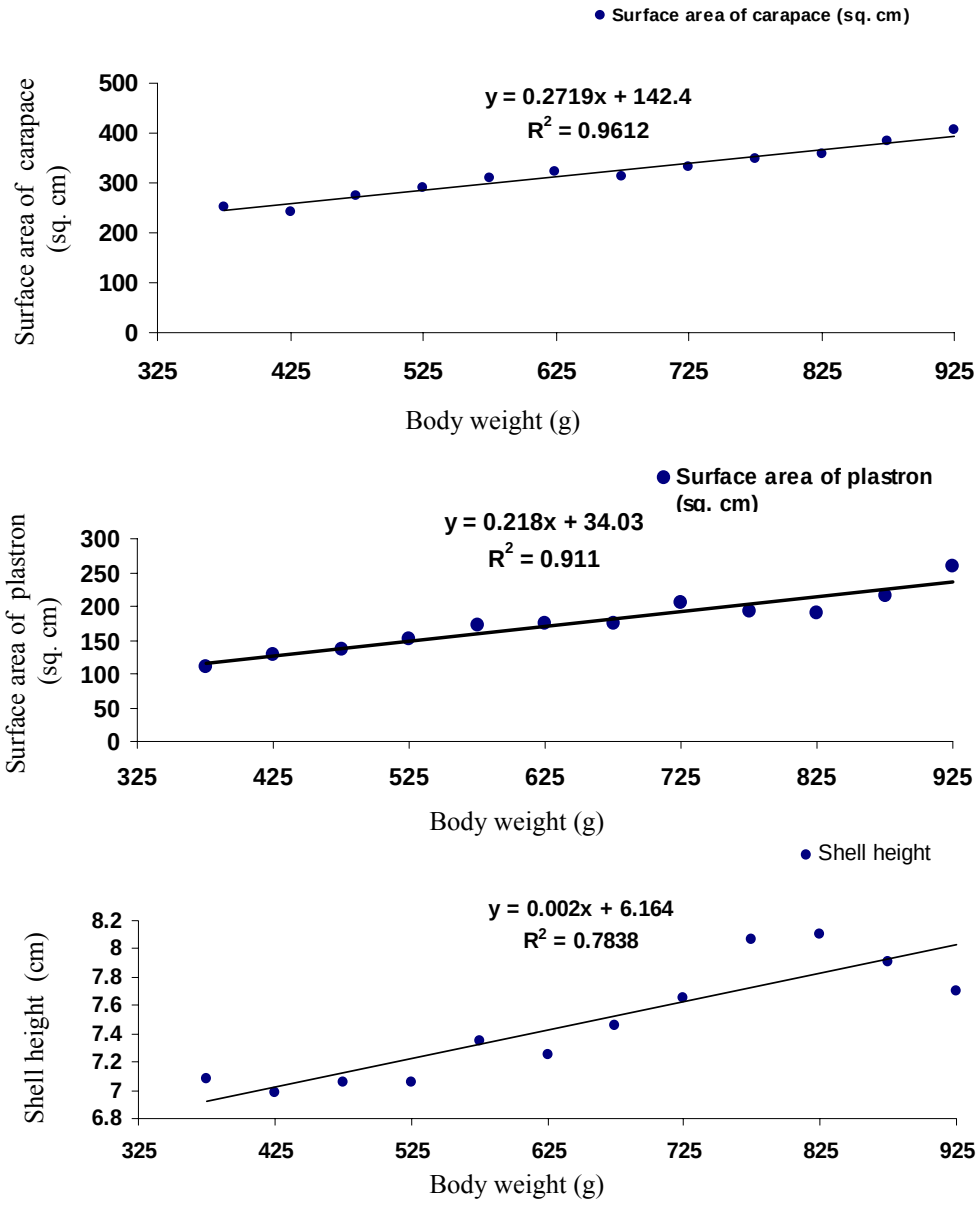

Fig. 1. Regression lines of male *M. petersi* : (a) Surface area of carapace on body weight (b) Surface area of plastron on body weight (c) Shell height on body weight

The reliability of the above equations would be seen to be high from the co-efficient of correlation (R) values in all the cases. The data pertaining to correlation co-efficient of body weight and carapace, plastron, and the shell height of both males and females *M. petersi* in Table 2 furnish an idea that the characteristics are highly correlated and their values are significant.

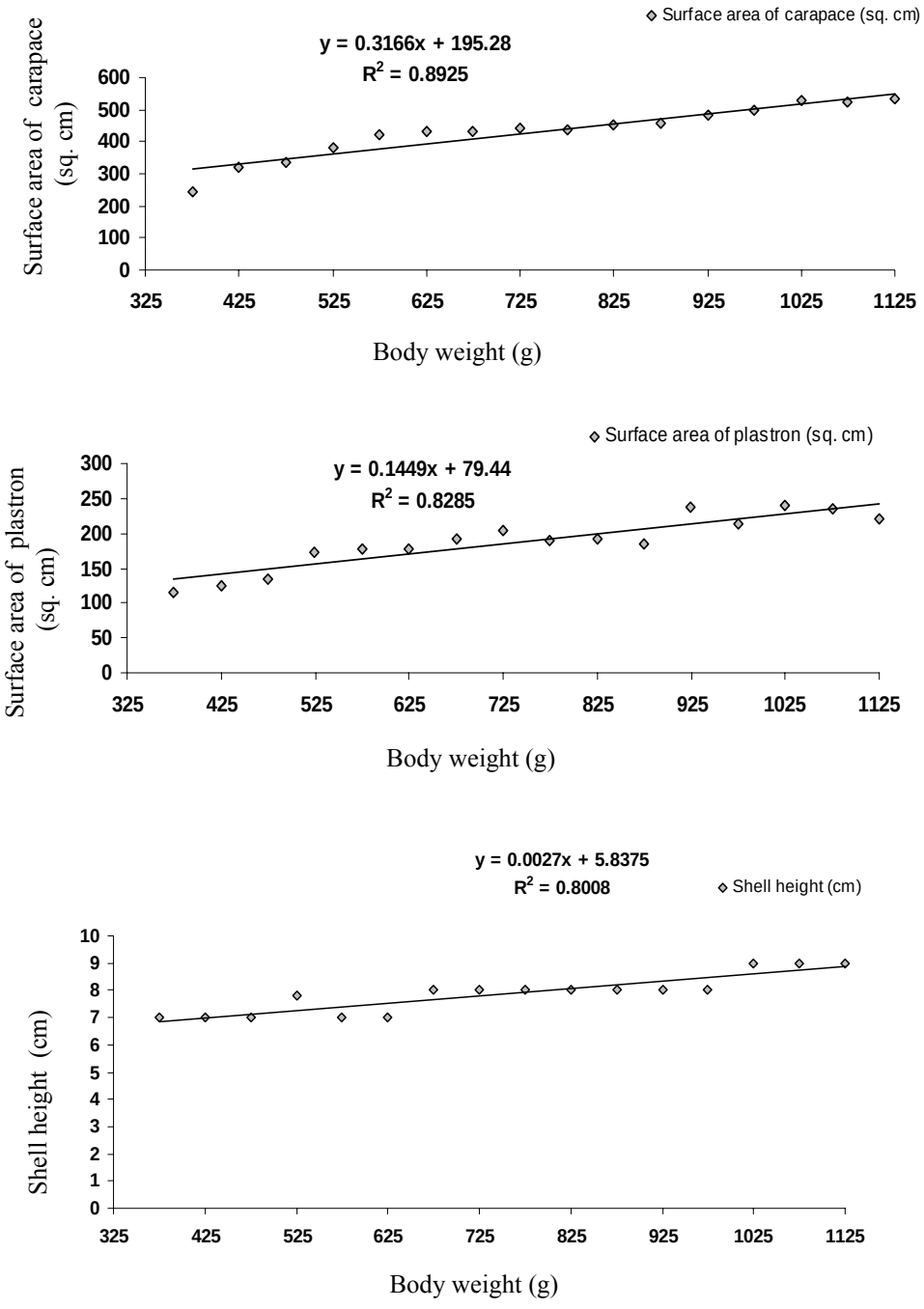

Fig. 2. Regression lines of female *M. petersi* : (a) Surface area of carapace on body weight (b) Surface area of plastron on body weight (c) Shell height on body weight

Biometric analysis of *M.petersi* showed that the weight varied from 550 to 650g (mean: 594.7 ± 28.9g). The hard parts varied from 196 to 242g (mean: 213.9 ± 15.4g) and soft parts from 352 to 410 g (mean: 380.7 ± 17.0g). The percentage of hard parts was 35.9 ± 1.3% and soft parts 64.3 ± 1.2% (Table 3). The relationship between hard parts and soft parts was positively correlated and statistically significant ($r = 0.58$, $n = 15$, $t = 2.6$, $p < 0.05$). Of the hard parts, the carapace weight was (70.9%) and it was always 2.4 times higher than weight of plastron (29.1%) and the ratio was 7:3. The weight of digestive tract was the highest of all other soft parts of the turtles.

Table 2. The correlation co-efficient (R) of body weight with length, width of carapace and plastron and shell height of *M. petersi*

Parameters	Correlation coefficient (R)	" t'- statistic" calculated value	Statistical inference	p %
BW : CL ♂	0.836	15.10	Significant	0.01
BW : CL ♀	0.883	18.34	Significant	0.01
BW : CW ♂	0.793	12.76	Significant	0.01
BW : CW ♀	0.773	16.10	Significant	0.01
BW : PL ♂	0.910	21.80	Significant	0.01
BW : PL ♀	0.852	16.00	Significant	0.01
BW : PW ♂	0.619	15.24	Significant	0.01
BW : PW ♀	0.369	3.93	Significant	0.01
BW : SH ♂	0.716	10.15	Significant	0.01
BW : SH ♀	0.720	10.30	Significant	0.01
BW ♂ : BW ♀	0.946	28.90	Significant	0.00

Note: Body weight (BW), Carapace Length (CL), Carapace Width (CW), Plastron Length (PL), Plastron Width (PW), Shell Height (SH).

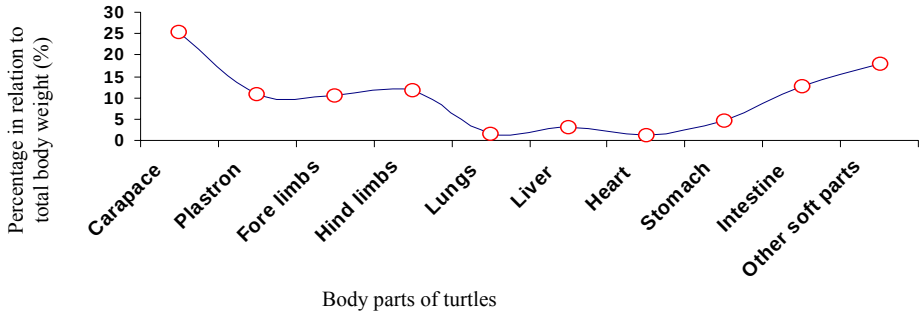

Fig. 3. Percentage of different organs of *M. petersi* in relation to body weight.

The present study revealed that the longest Curve Carapace Length (CCL) of male *M. petersi* was 22.1 cm and Curve Carapace Weight (CCW) 20.8 cm, Plastron Length (PL) 19.1 cm, Plastron Width (PW) 14.2 cm and the Shell Height

Table 3. Biometric measurements (rate of growth of different body parts) of *M. petersi* in relation to the body weight (n = 15)

	Weight of different organs (g)										Percentage (%)	
Body weight of turtles (g)	Carapace	Plastron	Fore limb	Hind limb	Lung	Liver	Heart	Stomach	Intestine	Others (residue)	Hard parts	Soft parts
580	150	60	62	70	10	17	6	27	73	105	36.2	63.8
605	155	62	65	75	12	18	8	29	78	103	35.9	64.1
600	150	62	65	78	10	20	7	30	78	100	35.3	64.7
550	142	56	60	65	8	17	7	25	70	100	36.0	64.0
585	158	64	64	67	8	17	7	25	75	100	37.9	62.1
640	165	70	68	72	10	19	8	30	78	120	36.7	63.3
550	138	62	52	60	10	21	7	27	73	100	36.1	63.7
650	168	72	68	78	10	20	8	28	88	110	36.9	63.1
590	140	60	60	68	10	20	10	30	72	120	33.9	66.1
575	140	62	62	68	8	18	9	28	72	108	35.1	64.9
580	145	62	63	70	8	17	8	26	74	107	35.7	64.3
630	170	72	68	75	10	20	9	28	78	100	38.4	64.6
620	158	70	63	72	9	20	9	30	72	117	36.8	63.2
575	140	60	62	72	10	20	7	29	75	100	34.8	65.2
590	138	58	64	70	9	20	9	28	74	120	33.2	66.8

(SH) 8.8 cm (n = 100). Incase of female the CCL was 23.0 cm, CCW 23.9 cm, PL 19.1 cm, PW 14.9 cm and the SH was 10.0 cm. The Body Weight of male was 950 g and female 1130 g [n = 200 (♂= 100 and ♀ = 100)]. Smith (1931) mentioned that the longest CL of male *M. petersi* was 18.3 cm, CW 8.5 cm, SH was 5.5 cm and the CL of female was 12.8 cm, CW 12.5 cm and SH 8.2 cm. But he did not mention their BW. Frazier (1997) stated that the CCL was 20.2 cm, SCL 17.6 cm, CCW 17.3 cm and SCW 12.2 cm but he did not mention about the sex and body weight. Whereas, Das (1995) observed that the longest CL of *M. petersi* was 20.0 cm. Rashid and Swingland (1997) stated that the mean CL of large male was 17.9 cm, CW 14.8 cm, PL 10.8 cm, SH 7.0 cm and BW was 718.4 g (range 592–820 g). Shrestha (1995) mentioned that the male was 17.5 cm and female 27.5 cm and Rashid and Khan (2000) stated the body weight was between 1-2 Kg. Shafi and Quddus (1977) mentioned that the maximum weight of *M. petersi* was 4500 g (4.5 kg/10 lbs). Whereas, during the present study it was found that the maximum weight of *M. petersi* was 1130 g.

The present study revealed that mean body weight (BW) of females was slightly higher than males. The female was higher domed and had relatively shorter tails with the vent under carapace and unserrated posterior rim. This findings is semiliar to the findings of Rashid and Swingland (1997), Das (1995) and Smith (1931).

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