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LENGTH – WEIGHT RELATIONSHIP AND CONDITION FACTOR OF *PUNTIUS CONCHONIUS* (ROSY BARB) WITH SPECIAL REFERENCE TO MATURITY IN FEMALES

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ABSTRACT

This study portrays the monthly fluctuation in growth pattern, relationship between Length, weight, and condition factor of female *Puntius chonchonius*. The relationships between Total (TL), Fork length (FL), Standard length (SL), Body depth (BD) and Body weight (BW) indicated isometric type of growth. The current work revealed that cube law is not followed by considered fish completely. Related departure from cube law due to the influence of environmental conditions like food and physiological constraints has been observed. The results also indicated significant correlation between length-weight and length-length relationships. The present study increases our knowledge on the relationships between body size, weight, and condition of *P. conchonius*. This information would be useful to induce adequate system for the conservation of this specie in the rivers of Pakistan.

KEY WORDS: Length-weight, Length-length, *P. conchonius*, Rosy barb, Condition factor, Sindh, Pakistan.

INTRODUCTION

Fresh to brackish-water bodies of Sindh Pakistan own *Puntius. conchonius* (Hamilton, 1822) along with a variety of other species (Khan *et al.,* 2011). This specie is commonly known as Rosy barb but also familiar as *tit punti* in Bangladesh, *pathia* in India, *poti* in Nepal and *thith pethiya* in Sri Lanka and one of the most popular aquarium fish in Asian countries due to its striking colour patterns (Froese & Pauly, 2011). In recent decades most of the species are going to the verge of extinction due to the different ecological changes in natural habitat. Growth, survival and reproduction are greatly influenced by physical and biological circumstances, feeding and parasitic infection. Length-Weight relationship and condition factor are basic quantitative parameters to determine the well-being of fish species. These are key tools in both types of fishery management, applied and basic (Pitcher & Hart, 1982).

Although many researchers have been worked on length-weight and length-length relationship of fresh water fishes (Ahmed *et al.,* 2012, Shoaib *et al.,* 2009, Shafi *et al.,* 2013, Zafar *et al.,* 2003) but adequate information is still lacking for most of the fresh water species including *P. conchonius* from Pakistan.

MATERIALS AND METHODS

Fish sampling and measurement: A trial of six months has been carried out from July to Dec. Monthly specimen were collected by traditional fishing gears i.e., cast net and seine net from various fresh water bodies of Sindh, Pakistan. Identification of specie was based on Kullander *et al.* (1999). Only female fish were considered under this research trial. Specimens were sexed by visual inspection following Dobriyal *et al.* (2007) and a total of 216 females *P. chonchonius* was captured. After preserving in ice, packed and transported to the laboratory, where measured for Total length (TL), Fork length (FL), Standard length (SL) and Body depth (BD) with the help of a digital slide caliper nearest to 0.01cm and Body weight (BW) with a digital balance to the nearest 0.01g accuracy.

Estimation of length-weight relationships and condition factor: By considering the length an independent variable, Length-weight relationship is calculated for each individual fish by using formula described by Pauly and Gayanilo (1997).

$$W = aL^b$$

where the '*W'* is the body weight in g and '*L'* is the total length in cm. Condition factor (K) was also calculated by the given formula:

$$K = W/w$$

where '*W'* is observed body weight and '*w'* is predicted weight from A Bee computer software released by ICLARM.

Statistical analyses: Statistical analyses were executed by using Minitab 16.1. Total length was regressed against SL, FL, BWT and BD. Data was then verified for consistency of variance. All statistical analyses were considered significant at 95% ($p<0.05$).

RESULTS

The ratio of gravid and non-gravid female *P. chonchonius* was found to be 138:78 in the whole catch of six months. Monthly statistics showed that maximum mean values for TL, SL, FL, BWT and BD in mature females were observed in the month of Sept. as 8.84 cm, 6.80 cm, 7.74 cm, 11.39 g and 3.07 cm, while minimum as 7.31 cm, 5.54 cm, 6.30 cm, 7.01 g and 2.42 cm, respectively in the month of July (Table 1a).

The result was same for non-gravid females as maximum values for TL (8.37cm), SL (6.38 cm), FL (7.36 cm), BWT (9.04 g) and BD (2.62 cm) were obtained in Sept., however difference was found in case of minimum values which were observed in the month of Aug. as 5.22 cm, 6.00 cm, 5.02 g and 2.15 cm, respectively for SL, FL, BWT and BD, except TL (6.97 cm) which was found minimum in Dec. (Table 1b).

Table 1a. Monthly descriptive statistics of total length (TL), standard length (SL), fork length (FL), body weight (BWT) and body depth (BD) of gravid female *Puntius conchonius*.

Months	TL (cm)			SL (cm)			FL (cm)			BWT (g)			BD (cm)		
	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min
July	7.31	9.50	6.00	5.54	7.50	4.50	6.30	7.80	5.00	7.01	16.20	3.34	2.42	3.60	1.80
Aug.	8.04	9.50	6.50	6.08	740	4.80	7.13	8.30	5.30	7.78	12.92	4.23	2.63	3.40	2.10
Sept.	8.84	9.60	6.50	6.80	7.50	4.80	7.74	7.90	5.30	11.39	14.88	4.26	3.07	3.60	2.00
Oct.	8.29	9.50	6.70	6.25	7.40	4.90	7.47	8.30	6.20	8.53	10.76	4.27	2.48	3.40	2.10
Nov.	7.86	9.30	6.50	5.89	7.20	4.90	7.02	8.10	5.30	7.08	10.86	4.28	2.51	3.20	2.10
Dec.	8.58	9.5	6.9	6.60	7.6	5.1	7.56	8.2	6.1	10.48	8.92	5.29	2.87	3.60	2.30

Table 1b. Monthly descriptive statistics of total length (TL), standard length (SL), fork length (FL), body weight (BWT) and body depth (BD) of Non-gravid female *Puntius conchonius*.

Months	TL (cm)			SL (cm)			FL (cm)			BWT (g)			BD (cm)		
	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min
July	7.08	9.20	5.90	5.34	7.20	4.50	6.19	7.60	5.50	5.85	12.80	3.07	2.30	3.30	1.80
Aug.	7.03	8.90	6.10	5.22	6.70	4.50	6.00	7.80	5.00	5.02	10.82	3.01	2.50	2.90	1.90
Sept.	8.37	9.50	6.30	6.38	7.40	4.70	7.36	8.30	5.10	9.04	13.92	3.19	2.62	3.40	2.00
Oct.	7.75	8.90	6.20	5.89	6.80	6.10	6.76	7.80	5.10	7.05	10.76	3.28	2.51	3.20	1.90
Nov.	7.40	8.90	6.20	5.42	6.70	4.60	6.54	7.70	5.20	5.79	10.86	3.19	2.46	3.20	1.90
Dec.	6.97	8.5	6.2	5.17	6.7	4.6	6.01	7.8	5.2	5.03	8.96	3.29	2.15	2.60	1.80

The length-weight relationship of female *P. chonchonius* was based on value of slope 'b'. Monthly mean values of slope 'b' ranged from 2.78 to 3.54 (gravid) and from 2.79 to 3.38 (non-gravid) (Table 2). This value was found maximum in Dec. (b = 3.54) and Oct. (b = 3.38) for gravid and non-gravid respectively. Mean values of condition factor 'K' were ranged from 0.987 (Dec.) to 0.997 (Sept.), while in case of non-gravid female ranges were 0.988 (Nov.) to 0.995 (July) (Table 2).

All the body parameters were regressed against independent variable. The relationships and regression equations computed from data for female *P. chonchonius* are presented in Table 3 (Figs. 1 and 2). A significant relationship was found between all parameters as represented by the value of p (P = .000).

DISCUSSION

The study of length-weight relationship portrays the environmental conditions of an aquatic ecosystem in which the fish exist, as it is an established tool in understanding the general well- being and growth forms of a fish population in a certain period of time. Basheer *et al.* (1993) opined that it depends upon, state of maturity, sex, between different populations of species, availability of food, life stage and other physiological factors.

Table 2. Monthly fluctuations in values of coefficient of correlation (r), coefficient of determination (r^2), value of intercept (a), value of slope (b) and condition factor (K) of gravid and non-gravid female *P. chonchonius*.

Months	n		r	r^2	CI of r	Coefficient a	Coefficient b	95% Confidence interval		Value of K
								a	b	
July	32	*G	0.97	0.95	0.92-0.99	$0.008^{(0.392)}$	$3.34^{(0.197)}$	0.00-0.01	2.92-3.76	0.990
		**N	0.98	0.97	0.96-0.99	$0.008^{(0.287)}$	$3.28^{(0.147)}$	0.00-0.01	2.96-3.60	0.995
Aug.	41	G	0.97	0.94	0.94-0.98	$0.008^{(0.318)}$	$3.23^{(0.153)}$	0.00-0.01	2.92-3.55	0.993
		N	0.97	0.94	0.91-0.99	$0.011^{(0.397)}$	$3.06^{(0.204)}$	0.00-0.02	2.62-3.51	0.992
Sept.	38	G	0.98	0.97	0.97-0.99	$0.007^{(0.253)}$	$3.33^{(0.116)}$	0.00-0.01	3.08-3.57	0.997
		N	0.98	0.97	0.95-0.99	$0.008^{(0.315)}$	$3.27^{(0.152)}$	0.00-0.01	2.94-3.58	0.994
Oct.	39	G	0.97	0.95	0.94-0.98	$0.004^{(0.342)}$	$3.52^{(0.162)}$	0.00-0.00	3.18-3.85	0.994
		N	0.98	0.96	0.93-0.99	$0.006^{(0.408)}$	$3.38^{(0.200)}$	0.00-0.01	2.93-3.82	0.993
Nov.	38	G	0.91	0.83	0.82-0.95	$0.022^{(0.499)}$	$2.78^{(0.242)}$	0.00-0.06	2.28-3.28	0.988
		N	0.95	0.91	0.82-0.98	$0.013^{(0.645)}$	$2.99^{(0.323)}$	0.00-0.04	2.25-3.74	0.988
Dec.	25	G	0.92	0.86	0.80-0.97	$0.005^{(0.812)}$	$3.54^{(0.378)}$	0.00-0.02	2.73-4.35	0.987
		N	0.92	0.85	0.67-0.98	$0.021^{(0.837)}$	$2.79^{(0.431)}$	0.00-0.15	1.77-3.82	0.989

*G= Gravid, **N= Non gravid, r= Coefficient of correlation, r^2= Coefficient of determination, K= Condition factor

Table 3. Regression analysis of female *P. chonchonius* for various body parameters.

	Relation	Regression equation	R-Sq	R-Sq (adj)	Value of P
Gravid	BWT (g) versus TL (cm)	BWT (g) = - 18.54 + 3.328 TL (cm)	88.0%	87.9%	0.000*
	BD (cm) versus TL (cm)	BD (cm) = - 0.8209 + 0.4315 TL (cm)	88.6%	88.6%	0.000*
	BD (cm) versus BWT (g)	BD (cm) = 1.618 + 0.1258 BWT (g)	94.8%	94.7%	0.000*
	FL (cm) versus TL (cm)	FL (cm) = 0.1205 + 0.8703 TL (cm)	92.6%	92.6%	0.000*
	SL (cm) versus TL (cm)	SL (cm) = - 0.9766 + 0.8784 TL (cm)	97.4%	97.4%	0.000*
Non-gravid	BWT (g) versus TL (cm)	BWT (g) = - 13.78 + 2.703 TL (cm)	92.5%	92.4%	0.000*
	BD (cm) versus BWT (g)	BD (cm) = 1.510 + 0.1403 BWT (g)	90.9%	90.8%	0.000*
	BD (cm) versus TL (cm)	BD (cm) = - 0.5313 + 0.3940 TL (cm)	90.7%	90.6%	0.000*
	FL (cm) versus TL (cm)	FL (cm) = - 1.275 + 1.042 TL (cm)	97.0%	97.0%	0.000*
	SL (cm) versus TL (cm)	SL (cm) = - 0.2673 + 0.7865 TL (cm)	94.5%	94.4%	0.000*

*Significant

According to Zafar *et al.* (2003), an ideal value of regression coefficient 'b' of a fish should be close to 3.0 however the cube law does not grasp well throughout the life and the weight gain may not be constantly cube of its length. A value significantly higher or smaller than 3.0 denotes allometric growth (Wootton, 2012). Both the gravid and non-gravid females revealed significant differences in the value of 'b' in this species. Value of 'b' (Table. 2) ranged from 2.78 to 3.54 (gravid) and from 2.79 to 3.38 (non-gravid) and showed both negative and positive allometric growth in the whole period of research trial instead of an isometric type of growth. Torres (1991) also suggested the value of 'b' in the range of 2.5 to 3.5, while 2.5–3.5 was suggested by Ali *et al.* (2002). Table 2 shows that the allometric coefficients vary among months for both levels of maturity in *P. chonchonius*. The similar result was observed by Hossain *et al.* (2006) for *Mystus vittatus* who observed different values of 'b' in different months.

All values of condition factor K in both gravid and non-gravid female (*P. conchonius*) were recorded close to 1, while opposite trend was observed in some other fishes.

The current work revealed that cube law is not followed by studied fish completely. Related departure from cube law due to the influence of environmental conditions like food and physiological constraints has been observed by Sunder *et al.* (1984) and Singh and Gupta (2008).

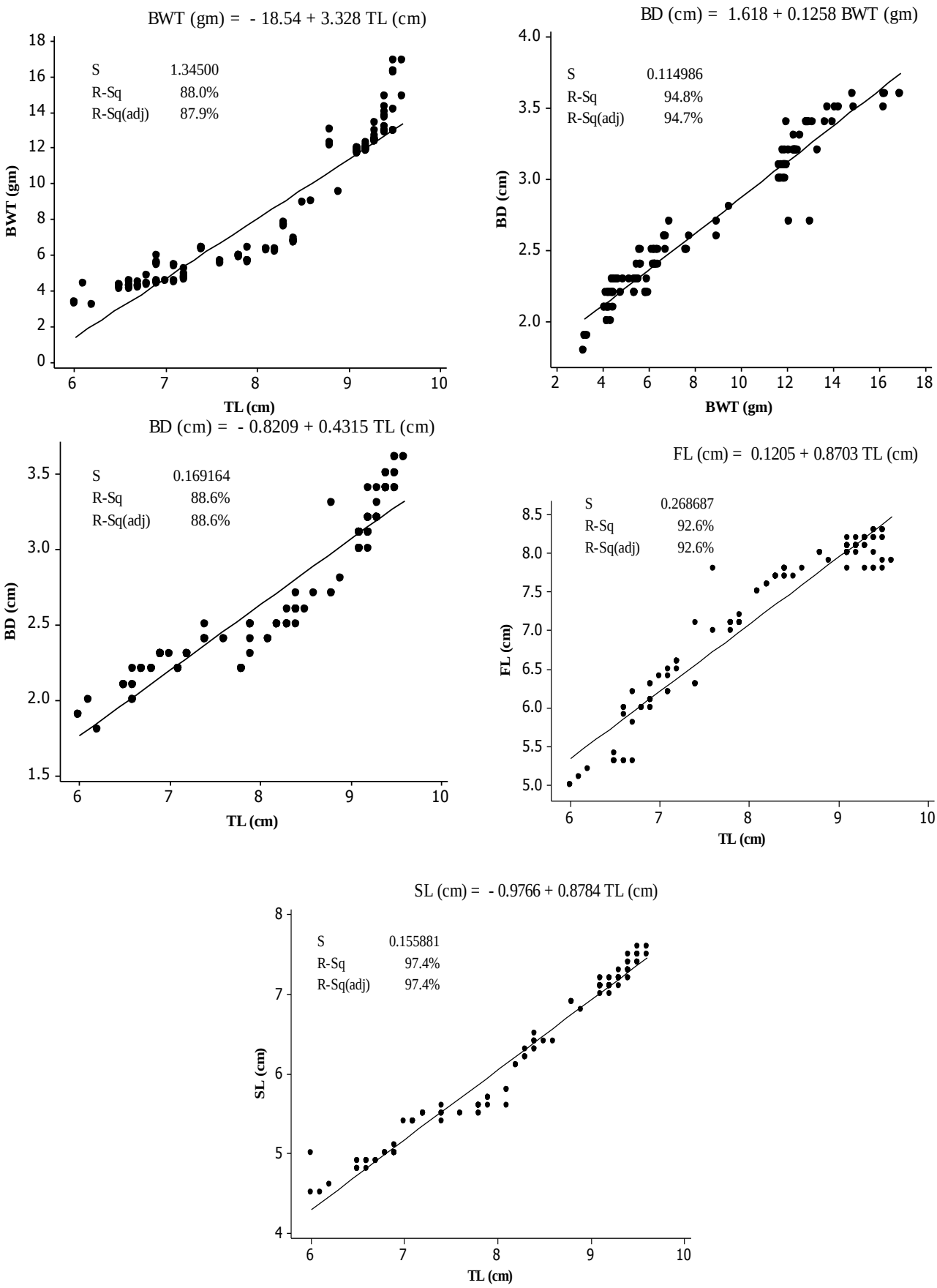

Fig. 1. Graphical representation of Regression analysis between 3a: body weight (BWT) and total length (TL), 3b: body depth (BD) and total length (TL), 3c: body depth (BD) and body weight (BWT), 3d: fork length (FL) and total length (TL) and 3e: standard length (SL) and total length (TL) of gravid female *P. chonchonius*.

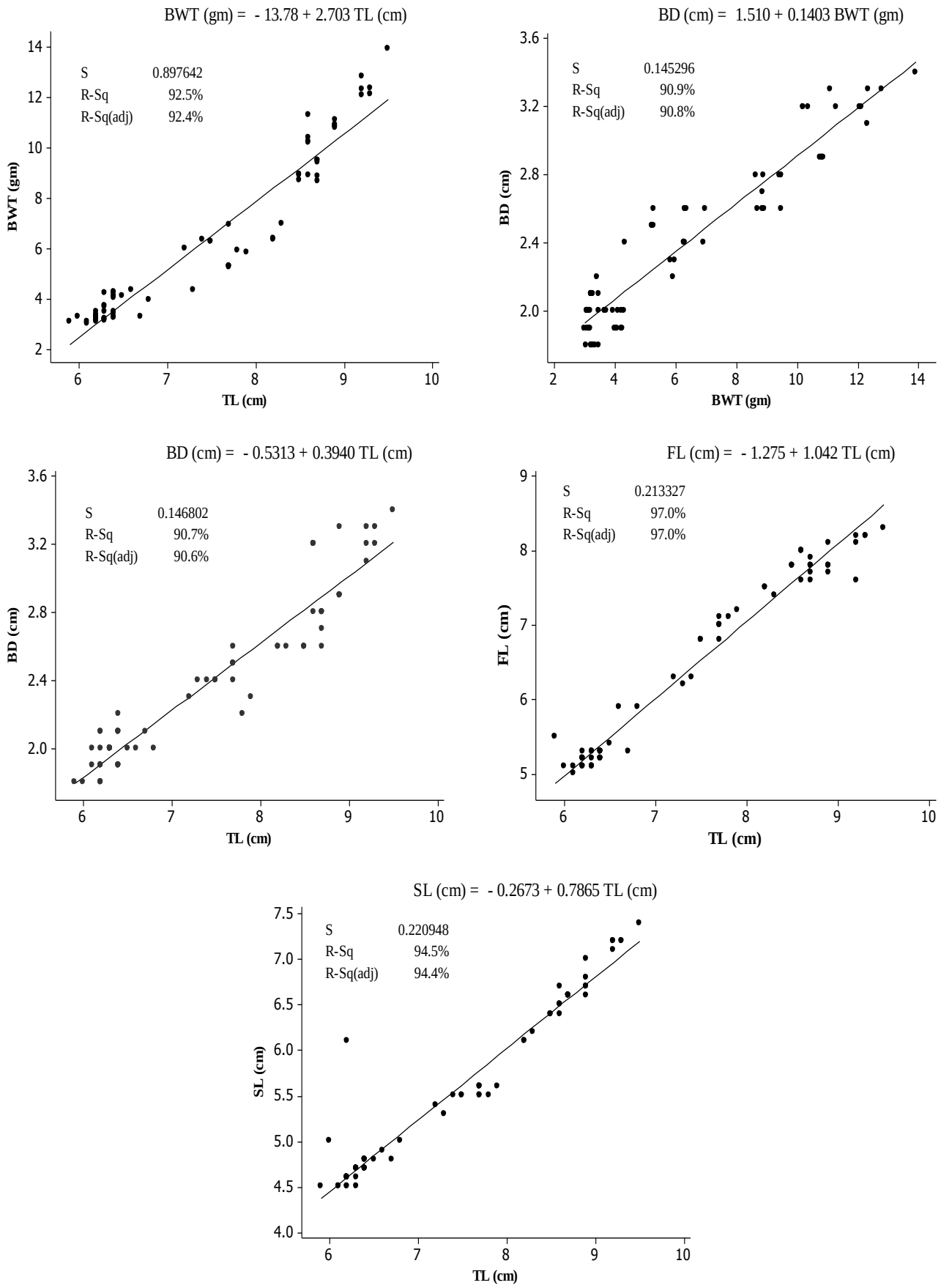

Fig. 2. Graphical representation of Regression analysis between 3a: body weight (BWT) and total length (TL), 3b: body depth (BD) and total length (TL), 3c: body depth (BD) and body weight (BWT), 3d: fork length (FL) and total length (TL) and 3e: standard length (SL) and total length (TL) of Non-gravid female *P. chonchonius*.

REFERENCES

Ahmed, Z.F., M.Y. Hossain and J. Ohtomi. (2012). Modeling the growth of silver hatchet chela *Chela cachius* (Cyprinidae) from the Old Brahmaputra River in Bangladesh using multiple functions. *Zool. Stud*., 51: 336-344.

Ali, M., A. Salam and M. Anas. (2002). Weight-Length Relationship and Relative Condition of *Oreochromis mossambicus*, an Exotic Fish Species, in River Indus, Pakistan. *Pakistan J. Zool.*, 34(2): pp. 125-128.

Basheer, V.S., A.A. Khan and I.A. Sidiqqui. (1993). Length-weight relationship of *Channa punctatus* (Bloch) from the river Yamuna. *Advances in Limnology*, 241-246.

Dobriyal, A.K., P.K. Bahuguna, S.P. Uniyal and H.K. Joshi. (2007). Sexual dimorphism in the cyprinidae fish *Puntius conchonius* (Ham-Buch). *Journal of Bombay Natural History Society*, 104(2): 225-226.

Froese, R. and D. Pauly (Eds.). (2011). Fish Base. World Wide Web electronic publication, http://www.fishbase.org, version (02/2011).

Hossain, M.Y., Z.F. Ahmed, P.M. Leunda, S. Jasmine, J. Oscoz and R. Miranda. (2006). Condition, length-weight and length-length relationships of the Asian striped catfish *Mystus vittatus* (Bloch, 1794) (Siluriformes: Bagridae) in the Mathabhanga River, Southwestern. *Bangladesh. J. Appl. Ichthyol*., 22: 304-307.

Khan, A.M., Z. Ali, S.Y. Shelly, Z. Ahmad and M.R. Mirza. (2011). Aliens; a catastrophe for native freshwater fish diversity in Pakistan. *J. Anim. Plant Sci*., 21: pp. 435-440.

Kullander, S.O., F. Fang, B. Delling and E. Ehlander. (1999). The fishes of the Kashmir Valley, pp. 99-168 In: *River Jehlum, Kashmir valley, impacts on the aquatic environment*. (Linhart Nyman eds.).

Pauly, D. and F.C.J.R. Gayanilo. (1997). ABee: A computer program to estimate the coefficients of length- weight relationship from length frequency and sample bulk weight data. ICLARM Software Philippines.

Pitcher, T.J. and P.J. Hart. (1982). *Fisheries Ecology*. Chapman and Hall, London.

Shafi, S., A.R. Yousuf and M. Parveen. (2013). Length-Weight relationship and breeding biology of (*Puntius conchonius*). (Hamilton, 1822) from Dal Lake, Kashmir, *International Journal of Innovative Research and Development*, 2(2): 299-312.

Shoaib, M., M. Nasir, F. Ameer and G. Karim. (2009). Length-Weight Relationship Of Major Carps (*Catla catla, Labeo rohita*) and Common Carp (*Cyprinus carpio*) in Ponds Fertilized By Different Fertilizers Pakistan. *J. Entomol. Karachi*, 24(1&): 49-58.

Singh, N. and P.K. Gupta. (2008). Length-weight relationship and condition factor of *Gambusia holbrooki* (Giard) in Nainital lake (Uttrakhand), *India. J. Inland Fish. Soc. India*, 40(1): 82-85.

Sunder, S., K. Kumar and H.S. Raina. (1984). Food and feeding habits and length weight relationship of *Cyprinus carpio specularis* of Dal Lake, Kashmir. *Indian J. Fish*., 31(1): 90-99.

Torres, F.J.R. (1991). Tabular data on marine fishes from southern Africa: Part I: Length-weight relationships. *Fishbyte*, 9(1): 50-53.

Wootton, R.J. (2012). *Ecology of teleost fishes*. Chapman and Hall, London.

Zafar, M., Y. Mussaddeq. S. Akhter and A. Sultan. (2003). Weight-length and condition factor relationship of Thaila, *Catla catla* from Rawal Dam Islamabad, Pakistan. *J. Biol. Sci*., 6(17): 1532-1534.

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