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Condition Factor and Length-Weight Relationship of Monsoon River Prawn *Macrobrachium malcolmsonii malcolmsonii* (H. Milne-Edwards, 1844) (Palaemonidae) in Lower Indus River

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Abstract.- *Macrobrachium malcolmsonii malcolmsonii* is one of the commercially important prawn species in Pakistan and it is second largest and fastest growing among the *Macrobrachium* species. The present study was conducted in the lower Indus River at Thatta district, Pakistan, from April to June 2011 to document the growth parameters. A total of 109 specimens were collected from commercial catches at the local landing sites for the present analysis and body length (total length, TL) and weight (BW) were taken for all specimens. The TL for males and females ranged from 9.7-26.2 cm and 8.4-21 cm, respectively indicating males were generally larger than females. The coefficient *b* values of length-weight relationships (LWR) were 2.74 for males and 3.04 for females indicating isometric growth in females but negative allometric for males suggesting that female prawns were comparatively in better condition than males of the same population. The LWR analysis showed a highly significant correlation in both sexes ($r^2 > 0.90$, $p < 0.001$). The relative condition factor *K* for both males and females were computed as 0.61±0.18 and 0.86±0.46, respectively, suggesting that *M. m. malcolmsonii* in lower Indus River were in good condition. However, females recorded better condition than males which may be attributed to reproduction and the occurrence of ovigerous females. This paper presents the first report on the growth of *M. m. malcolmsonii* from the Indus River.

Key words: *Macrobrachium malcolmsonii malcolmsonii*, condition factor, length-weight relationship, Indus River/

INTRODUCTION

Palaemonid prawns are important economic resources in the world's crustacean fishery (Mantelatto and Barbosa, 2005; Hossain *et al*., 2012). The largest genus, *Macrobrachium*, Bate 1848, (Palaemonidae) is distributed throughout the tropical and subtropical zones of the world (Holthuis, 1980) and comprises most of the commercially important freshwater prawns. The genus also comprises the culturable species of the palaemonid prawns.

Macrobrachium m. malcolmsonii (H. Milne-Edwards, 1844), commonly known as the monsoon river prawn is the second-largest after the Giant river prawn *M. rosenbergii* and is a fast growing prawn which is widely distributed throughout the Indian subcontinent (Hossain *et al*., 2012). It is also reported from single locality of Sri Lanka (Johnson, 1973).

The *M. m. malcolmsonii* is one of the commercially important species in Pakistan and also considered to be a very potential aquaculture candidate (Gopal Rao *et al*., 1986). Previously, some studies were conducted on the aquaculture of *M. m. malcolmsonii* using seed sourced from the wild (Yaqoob, 2008). However, no studies have been conducted on the growth and length-weight relationships (LWR) in this species especially in the lower Indus River, Pakistan.

The establishment of a relationship between weight and length is important for establishing production and biomass estimations of a species (Anderson and Gutreuter, 1983; Safran, 1992; Petrakis and Stergiou, 1995; Dulcic and Kraljevic, 1996). In addition, LWRs are also important in fisheries management for comparative growth studies and for both applied and basic in the assessment of species populations (Pitcher and Hart, 1982; Moutopoulos and Stergiou, 2002). On the other hand, condition factors compare the well-

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being of an animal and are based on the assumption that the heavier an animal is at a given length, the better the condition (Abowei and George, 2009; Deekae and Abowei, 2010). Moreover, condition factors reflect the recent physical and biological circumstances and fluctuate due to interactions among feeding conditions, parasitic infections and physiological factors (Le Cren, 1951).

This paper presents the first report on the growth of *M. m. malcolmsonii* from the Indus River and aims to clear the length-weight relationship and condition factor of *M. m. malcolmsonii*. Therefore, the present study provides baseline information for the growth of this species from the lower Indus River. The data and information will go a long way in supporting the management initiatives for the sustainability of this freshwater prawn as well as other species in Pakistan and the wider Indus River.

MATERIALS AND METHODS

Samples were taken from local fishermen catch at Thatta fish landing site (Latitude: 24° 43' 53" N and Longitude 67° 58' 37" E) (Fig. 1) during April through June 2011. A total of 109 specimens were used for this study. The specimens were immediately transferred to ice box to keep them fresh and were transported to the laboratory for further examination. In the laboratory, specimens were sexed, body length measured and body weight recorded on a weighing balance. Sexes were determined by the presence or absence of appendix masculina on the second pleopod for male and female, respectively (Mantelatto and Barbosa, 2005). Total length was measured from tip of the rostrum to the tip of the telson to the nearest 0.01 cm (FAO, 1981) using a calipers. Body weight of each individual was recorded to the nearest 0.01 g on an electronic digital balance (Ohaus precision-GT400).

Length–weight relationships were calculated from the equation adapted by Le Cren (1951) $W = aL^b$, where W is the total weight in grams, L is the total length in centimeters, a is coefficient related to body form and b is an exponent indicating isometric growth when equal to 3.0. The parameters a and b were estimated by linear regression on the log transformed equation: $\log W = a + b \log L$.

Fig. 1. Map showing the sampling site of lower Indus River at Thatta district, where *M. malcomsonii* was captured for the present study.

The relative condition factor Kn for males and females was separately calculated according to Le Cren (1951) $Kn = W/ a L^b$ equation adapted as $Kn = W/\hat{W}$, where W is observed weight and $\hat{W}$ is estimated weight as determined from length-weight equations.

All the statistical analysis was performed using Microsoft Excel Add-in DDXL. Additionally, the statistical significance level of r^2 and the b-value for male and female populations were tested by simple t-test.

RESULTS AND DISCUSSION

Out of total of 109 specimens, 62 were males and 47 were females. The minimum and maximum length (TL) for males and females were 9.7-26.2 and 8.3-21 cm, respectively (Table I). The maximum TL of *M. m. malcolmsonii* in present study was larger than maximum length reported

Table I.- Descriptive statistics on length (cm) and weight (g) of *M. malcolmsonii* from lower Indus River.

Sex (n)	Measurements	Minimum	Maximum	Mean±STD	Confidence level
Male (62)	Length (cm)	9.7	26.2	18.52±4.30	1.09
	Weight (g)	11.5	195	101.2±59.35	15.07
Female (47)	Length (cm)	8.1	21	14.14±3.4	0.9
	Weight (g)	9	118.9	39.3±24.52	7.1

Note: n, sample size; STD, Standard deviation

Table II.- Descriptive statistics and estimated parameters of length–weight Relationships ($W = aL^b$) for female and male of *M. malcolmsonii* from lower Indus River.

Sex	No.	Total length (cm)	$W = aL^b$			r^2	t_s
		Min-Max	10^a	b	95% CL of b		
Males	62	9.7-26.2	0.0029	2.97	2.73-3.20	0.97	(P < 0.001)
Females	47	8.4-21	0.0098	3.04	2.59-3.49	0.94	(P < 0.001)

Min & Max, minimum and maximum; a, intercept; 10a, anti log of a, intercept; b, slope; CL, confidence level slope; r2, coefficient of determination

Table III.- Descriptive statistics of condition factor Kn for male and female *M. malcolmsonii* in lower Indus River

Sex	No	type	Min	Max	Mean±STD	95. 0% CL
Males	62	TL	0.33	0.99	0.61±0.18	0.09
Females	47	TL	0.3	1.8	0.87±0.46	0.26

No, number of samples; Min & Max, minimum and maximum; STD, standard deviation

from Bangladesh (TL = 16 cm) and India (TL = 20.3 cm) (Shafi and Quddus, 1975; Khan *et al*., 2009) suggesting that the species probably attained larger sizes in the lower Indus River or that the exploitation pressure in this area was fairly low allowing the species to grow to larger sizes. However, better environmental conditions in the habitat of the lower Indus River and higher food abundance may also account for the larger sizes caught in these habitats. Furthermore, males were significantly larger and heavier than females; similar results were reported by Hossain *et al*. (2012) for the same species in the River Ganges. These differences in TL among species can be attributed to sexual dimorphism and similar observations have been reported in many other *Macrobrachium* species (Mossolin and Bueno, 2002; Fransozo *et al*., 2004; Mantelatto and Barbosa, 2005).

The length-weight relationships of males and females are given in Table II. The calculated exponent *b* values of male and female are 2.97 and 3.04, respectively; the *b* values of male *M. m. malcolmsonii* indicate negative allometric growth while the female values indicate isometric growth. All the coefficients *b* calculated in this study were within the expected range of 2.5-3.5 (Pauly and Gayanilo, 1997). The functional regression *b* value represents the body form, and it is directly related to the weight which is influenced by ecological factors such as temperature, food supply, spawning conditions as well as sex, age, fishing time and area and fishing vessels (Ricker, 1973). Hossain *et al*. (2012) recorded negative allometric growth in males (2.92) and females (2.81) from the Ganges River, Bangladesh. The allometric *b* of the male population is in agreement to similar results recorded in the Ganges River, Bangladesh (Hossain *et al*., 2012). On the other hand, the Isometric *b* (3.04) for females recorded in present study, are not in agreement with Hossain *et al*. (2012) results and such differences may be attributed to differences in ecological conditions of the habitats or differences

among the physiology of animals, or both (Le Cren, 1951). Nevertheless, the size ranges and size classes of both studies were different. The value of coefficient of determination r^2 for male and female *M. m. malcolmsonii* were 0.97 and 0.94 respectively, which were highly significant (<0.001). The coefficients of determination for both male and female populations were > 0.90.

The mean values of relative condition factor Kn calculated for both males and females were 0.61±0.18 and 0.86±0.46, (Table III), suggesting that females were in better condition than males. Similar results were observed in *M. malcolmsonii* in Ganges River, Bangladesh (Hossain *et al*., 2012). Minimum and maximum values for male and female populations are computed as 0.33-0.99 and 0.3-1.8. The overall results suggest that *M. m. malcolmsonii* in the lower Indus River are in good condition. Moreover, several other studies have also reported sex specific differences in Kn with females showing better condition than males of the same population (Deekae and Abowei, 2010). These sex specific differences are attributed to reproductive seasons and/or the presence of ovigerous females (Hossain *et al*., 2012) since there was a large number of ovigerous females in the samples used for the present study.

This study is the first to report the basic information on the length-weight relationships and condition of *M. m. malcolmsonii* from Indus River and goes a long way in providing the much needed information for the design of sound harvest strategies for this species in the lower Indus River as well as for other neighboring fisheries for sustainable fishery management.

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