MORPHOMETRIC ANALYSIS AND CONDITION FACTOR OF FRESHWATER PRAWN, *Macrobrachium lamarrei* (CRUSTACEA - DECAPODA) FROM THE GOMTI RIVER, LUCKNOW, UTTAR PRADESH, INDIA

ABSTRACT

The present investigations on morphometric analysis and condition factor of freshwater prawn, *Macrobrachium lamarrei* (in both sexes) from The Gomti river, Lucknow, Uttar Pradesh, India. The freshwater prawn, locally known as "Jhinga" was the subject of this study. Prawn samples had been collected in different months of both sexes, and a close relation between their length and weight were observed. The morphometric analysis showed that females ranged from 31-57 mm in length, with their weight ranges from 0.31-1.39g, which are larger than the males (21- 36mm) with their higher weight range (0.13- 0.49g). A high correlation coefficient was observed in males (R^2 = 0.808) and females (R^2 = 0.881) separately. There were significant differences in the condition factors of males and females at P = .05. The lowest condition factor (CF) value for the males was observed in January (CF= 1.06) and highest in September (CF= 1.52), while in the females CF was the highest value in January (CF=0.82) and the lowest one in March (CF=0.75). The sex ratio of male: female (1.0: 2.10) was found, indicating that females are significantly greater in number than males.

Keywords: Freshwater prawn, *Macrobrachium sp.*, Length-weight relationship, Morphometric analysis, condition factor, The Gomti river

1. INTRODUCTION

Crustaceans are an important component of the aquatic ecosystem. The shrimps, prawns, lobsters and crabs are a good source of protein for humans [17]. Crustacean Fisheries is an important growing industry of the world [15]. Nowadays more and more emphasis has been given to freshwater prawn culture across the globe [45, 54]. Similar freshwater prawns like *Macrobrachium lamarrei* and *Macrobrachium dayanum* an "untapped resource", are promising candidate for aquaculture having various advantages over marine prawn species as well as "Scampy" *Macrobrachium rosenbergii* [59].

The examination of the length- weight relationship plays a crucial role in the field of prawn biology. This investigation holds practical significance as it enables the evaluation of prawn growth in various environmental conditions [10]. The work on various crustaceans including freshwater prawn has also highlighted the importance of length-weight relationship analysis and condition factors to establish correlations among populations from different areas [47, 50]. Furthermore, clarifying the morphometric analysis in aquatic animals, specifically fish, holds significant importance in fisheries and aquaculture [33]. It aids to determining the mean weight corresponding to a given length and also provides variations in growth rate of a specific species in different environmental conditions [2].

The CF (Condition Factor) of fish reveals the interactions between biotic and abiotic factors of the fish which reflects overall growth and development of animals [52]. [1] reported that the condition factor also reflects the influence of seasonal variations and habitat changes on the species robustness. Aqua-culturists have documented the morphometric analysis and condition factor for prawns and fishes as crucial indicators of their growth, development and health [9]. Variability in these key parameters (morphometric analysis and condition factors) for prawns provides insights into the suitability of aquatic ecosystems for prawn strength, standing stock, and their production [54, 3].

Prawns and shrimps belonging to the genera *Macrobrachium* and *Panaeus* hold significant value worldwide, and are often used to enhance the flavour of food preparations due to their high protein content [18, 42, 28]. The freshwater prawn is a relatively small size compared to prawn species, readily available whole year in local habitats. It matures entirely in freshwater and holds promise for freshwater aquaculture [58, 59, 4, 57, 41]. Additionally, this prawn species serves as a bio-indicator for monitoring environmental pollution [55, 56, 40, 39, 38, 37, 58, 62, 4].

Therefore, the present investigation focused on both morphometric and condition factor analysis of *M. lamarrei* from the river Gomti, Lucknow (U.P.), India.

2. MATERIALS AND METHODS

Freshwater prawns, *Macrobrachium lamarrei* (Fig.2) were collected from different locations of the river Gomti, Lucknow (U.P.) (Fig.1), with the help of local fisherman and brought to the laboratory (N- 26º49' 54" E- 80º55'58") and maintained in glass aquaria [55].

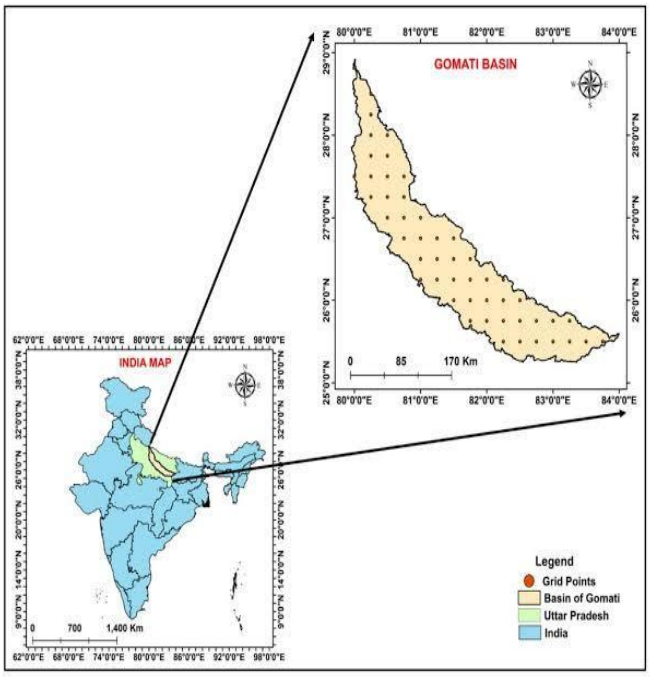

Fig.1 Collection Site the Gomti river Lucknow (U.P) India (N-26º52'27" E- 80º54'42")

Fig. 2: Freshwater prawn, *M. lamarrei*.

The total length of each individual was measured with the help of a divider, meter scale and vernier calliper, and the weight by digital weighing machine [36, 5, 27, 31, 26]. The male and female prawns were analysed separately by collecting them according to their gender, and by the month for body mass and length-weight relationship [12]. The length-weight relationship was calculated by linear regression [50] according to the following formula [35].

$W = aL^b$

Where:

W= Weight of Prawn(g)

L= Length of Prawn (cm)

a = Intercept; b= Regression coefficient

The parameters a and b were evaluated by linear regression [35, 50, 60, 30, 33]. This equation is sometimes also referred to as the length-weight key [14].

Condition Factor (CF)

It shows interaction between exogenous and endogenous factors which reflects the overall growth and development of small prawns. It was calculated using the following formula [20]:

$CF=100*W/L^3$

Where:

CF= Condition Factor

W is the weight (g) of the prawn and L is the Total length of the prawn (cm)

Sex ratio

By inspecting the presence or absence of appendix masculine in the second abdominal pleopod,

the sex of the specimens was ascertained. The ratio of male and female was based on the frequency of the prawns caught during the sampling period. The sex ratio of the male and female individuals was calculated [51].

Sex Ratio= M/F, Where:

M = Number of male prawns

F = Number of female prawns

Statistical Analysis

The Chi square test was employed to assess the significant difference of sexes every month. All statistical analysis was done using Microsoft Excel 2019 and MINITAB Software.

3. RESULT AND DISCUSSION

The Prawn samples were collected in different months for the both sexes to explain the relationship between their morphometric data. A total of 100 prawns had been taken as a sample size. The females were found throughout the year, but the males were not found in the February and March stocks. The males were found in lower numbers compared to females.

A strong positive significant relationship was observed between length and weight of *Macrobrachium lamarrei* (R^2 = 0.881) in July, and insignificant relationship was observed in the month of October (R^2 = 0.356). In the males, the relationship was significant in October (R^2 = 0.808) and weak relationship was observed in the month of September (R^2 = 0.147). Table 1 showed morphometric analysis between body weight and body length of female freshwater prawn, *Macrobrachium lamarrei* in different months. While table 2 showed the morphometric relationship of the male prawns. The Sex ratio of the prawns showed significant difference in various months at (*P* = .05). Therefore, the result showed that the sexual frequency and sex ratio varied in different months. The highest sex ratio was observed in the month of September and the lowest one in February and March (Table 3).

The condition factor of the males showed the maximum value in September (CF = 1.52) and the minimum in January (CF= 1.06, Table 2) whereas, in the females, the condition factor was highest in the January (CF= 0.83) and lowest in the March (CF= 0.75) (Table 1). A positive allometric growth of *Macrobrachium lamarrei* from the Gomti river on the basis of growth coefficient (b value) by using t-test (P = .05) (Table 1 and 2). The values of growth coefficient were high in September, which indicates the suitability of the environment for food availability in the Gomti river [7]. Other species of Macrobrachium have also been reported to exhibit similar range of condition [8, 20].

The study of the length-weight relationship of *M. lamarrei* showed a highly significant correlation between total length and body weight. The present study showed, the regression coefficient (b) for females is moderately high as compared to the males. This suggests that the females gain more weight with increase in the length, indicating better well-being. [11], also reported the same observations in freshwater Prawn *Macrobrachium rosenbergii* in Earthen Pod at High Density (Ming Y et al., 2016). The regression coefficient values showed a positive allometric growth pattern, which corresponds to the outcomes of [48, 6] regarding the *M. macrobrachion*, and [34] reported in *P. notialis*. [45], suggests that prawns become relatively robust and stronger as they increase in length when showing positive allometric growth patterns. Strong regression coefficient between length and weight were observed, with coefficients for males (R^2 = 0.14-0.80) and for females (R^2 = 0.35-0.88), indicating that the model is suitable for the study [5].

Table 1: Regression analysis and condition factor of the Female freshwater prawn, *Macrobrachium lamarrei*

Month	Weight (g) ± SE	Length (mm) ± SE	R^2	b	CF Value
January	0.83 ± 0.09	45.7 ± 0.13	0.768	1.25	0.83
February	0.81 ± 0.05	46.9 ± 0.10	0.528	1.37	0.78
March	0.58 ± 0.03	42.5 ± 0.08	0.635	2.09	0.75
April	0.83 ± 0.08	46.2 ± 0.16	0.815	1.76	0.81
May	0.69 ± 0.06	44.7 ± 0.16	0.761	2.14	0.76
June	0.89 ± 0.07	47.7 ± 0.11	0.366	0.87	0.81
July	0.76 ± 0.05	45.2 ± 0.12	0.881	2.06	0.81
August	0.83 ± 0.08	46.7 ± 0.14	0.660	1.37	0.79
September	0.88 ± 0.07	46.9 ± 0.11	0.812	1.39	0.82
October	0.73 ± 0.05	45.8 ± 0.12	0.356	1.34	0.77
November	0.87 ± 0.06	47.1 ± 0.11	0.806	1.53	0.81
December	0.77 ± 0.06	45.5 ± 0.11	0.803	1.63	0.80

Table 2: Regression analysis and condition factor of the Male freshwater prawn, *Macrobrachium lamarrei*

Month	Weight (g) ± SE	Length (mm) ± SE	R^2	b	CF Value
January	0.25 ± 0.01	28.7 ± 0.07	0.730	4.49	1.06
February	-	-	-	-	-
March	-	-	-	-	-
April	0.27 ± 0.02	27.8 ± 0.06	0.500	1.93	1.27
May	0.31 ± 0.02	28.4 ± 0.06	0.549	2.11	1.37
June	0.27 ± 0.07	27.9 ± 0.04	0.765	5.10	1.25
July	0.27 ± 0.07	27.8 ± 0.05	0.695	5.61	1.29
August	0.23 ± 0.01	26.7 ± 0.08	0.709	4.55	1.23
September					

	0.30 ± 0.01	27.5 ± 0.07	0.147	1.41	1.52
October	0.25 ± 0.00	25.9 ± 0.05	0.808	6.52	1.45
November	0.29 ± 0.02	28.2 ± 0.06	0.578	1.82	1.27
December	0.24 ± 0.01	25.9 ± 0.08	0.819	5.88	1.40

Table 3: Sex ratio of Male and Female freshwater prawn, *Macrobrachium lamarrei*

Month	M/F Ratio
January	0.28
February	0
March	0
April	0.36
May	0.25
June	0.31
July	0.28
August	0.42
September	0.47
October	0.38
November	0.28
December	0.31

According to many factors such as food availability, feeding rate and reproductive activity the length-weight relationship may temporarily vary, however, the parameter 'b' is usually insignificant throughout the year [13]. In *M. dux* and *M. macrbrachoin* the regression coefficient showed gender diversity for male and female prawns as reported by [27].

[29] reported length- weight relationship of *Macrobrachium vollenhoveni* with regression coefficient value ranged from 2.58 to 3.11 from Badagry creek. The analysis of length-weight relationship was given by [35] in *Perca fluviatilis*. [25, 43], inspected the value of 'b' varying from 2.5 to 4.0. The evaluated parameter 'b' revealed negative allometric growth and was supported by high correlation values, suggesting elevated predictability between carapace length and weight of the studied shrimps [16, 21].

In the present study, *Macrobrachium lamarrei* reflected the highest condition factor for the males (1.53 in September) and the females (0.83 in January). There were notable differences between male and female in different months (April, June, July, September) of the year. Similar results were observed by [5] in *M. nipponense* in the Siah Darvishan River, [19] in *Metapenaeus monoceros*, Bhidiya and [6], in *M. macrobrachion* from the Kwa-river.

[31] reported Fulton's condition factor for *Labeo rohita* ranged from 0.77506- 2.45703. The key factors which affect the K value consists of size, season, sex and development of gonads in fish [24]. The well-being of the fish is also influenced by food supply, ecological factors etc. [35]. [61, 23, 22] reported that the K value tends to decline with age. In Southern coasts of the Caspian Sea, Iran, condition factors of *M. nipponense* were found 0.89-1.90 [47].

The gender distribution in the present studies varies significantly from month to month. February and March showed a notable gender imbalance with 0 males and 100 females each. This suggests that these months might represent a specific stage in the prawn's life cycle or behavior, such as reproduction or molting when males are less active or not present.

4. CONCLUSION

Macrobrachium lamarrei shows a positive allometric growth in the Gomti river. The elevated value of regression coefficient "R" showed a strong relationship between total length and body weight. The high value of the coefficient of determination R^2 suggested that the model used for the analysis fits the data, hence confirming the fitness of the model. Knowledge of morphometric analysis and the condition factor of introduced or invaded species are essential to assess an appropriate management of alien and native species in an aquatic ecosystem. More advanced studies are required to determine where there is a correlation between each morphotype's physiological, behavioural and functional characteristics. An understandable explanation of the morphotype of this species is very important for understanding growth processes and adaptive value in the population to improve culture management.

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