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# WHITELEG SHRIMP (*Litopenaeus vannamei* Boon, 1931) IN A SELECTED SHRIMP FARM OF SOUTH GUJARAT (INDIA)

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## ABSTRACT

**Whiteleg shrimp (*Litopenaeus vannamei* Boone, 1931) being specific pathogen-free and specific pathogen-resistant fast growing less aggressive species is becoming the choice of farmers for culture. The length-weight relationship helps to explain the stocks; and comparative growth studies are recorded for culture management purposes. In present study, 1200 individuals of Pacific shrimp (*L. vannamei*) were investigated for length-weight relationship (LWR) and condition factor (K). The specimens were randomly collected during January to March 2020 from Dhanlaxmi Aqua Farm, Palsana, Valsad district, Gujarat (India). The length-frequency distribution showed that length group 12.00-14.00 cm was dominant with 447 specimens followed by 14.00-16.00 cm (445), 10.00-12.00 cm (183), 14.00-16.00 cm (101), 8.00-10.00 cm (21) and 18.00-20.00 cm (3). The correlation coefficient ($r^2$) 0.854, intercept (a) -1.994, regression coefficient (b) 2.897 and regression coefficient or growth constant (b) 2.897 (< 3.000) indicated negative allometric growth of white leg shrimp. The values of K obtained were ≤ 1.0 and suggested good and normal growth of shrimp indicating the better adoption of farm management practices during the culture period. These findings may be useful for shrimp farm managers to have better operational activities and assess the health and habitat conditions of rearing shrimps.**

**Keywords:** Condition factor, growth, length-weight relation, Pacific shrimp

## INTRODUCTION

Shrimps support commercially valuable fisheries and are considered economically valued seafood harvested from coastal waters throughout the world (Ajani *et al*., 2013). In recent years the shrimp aquaculture has expanded rapidly around the world because of its high demand (Pokrant, 2014; FAO, 2020). After worldwide spread of viral diseases, disaster and shrimp mortality, the Pacific whiteleg shrimp (*Litopenaeus vannamei*) became popular because of its less susceptibility to the diseases and ability to survive in any environmental conditions. *L. vannamei* is the most widely cultivable species all over the world (Boyd, 2002; Zhu *et al*., 2006; Bajaniya*et al*., 2019). Whiteleg shrimp has become major shrimp species for culture since 2009 and accounted for India's important seafood exports of ₹. 30,868 crores in 2017-18 (MPEDA, 2019). Length-weight relationship (LWR) is a useful biological tool for understanding the changes in aquatic environment (Shah *et al*., 2013) and in fisheries assessment (Khademzadeh and Haghi, 2017). Such studies are useful in biomass estimation (Morey *et al*., 2003) and in the assessment of variations in seasonal growth of aquatic

organism (Solanki *et al*., 2020). LWR is helpful in predicting the condition, reproductive history and life history (Nikolsky, 1963) and in morphological comparison of species and populations of aquatic species (King, 1996). The condition factor reflects the physical and biological circumstances that fluctuate due to interactions of feeding conditions, infections and physiological factors (LeCren, 1951). Moreover, it is related to fitness and condition of aquatic organism for the individual and fish populations in aquatic environment (Deekae and Abowei, 2010; Gautam *et al*., 2014). Suryanti *et al.* (2018) and Rabago-Quiroz *et al*. (2019) worked on length-weight relationships for three commercially important penaeid shrimps from the Gulf of California and North Sumatra, Indonesia, respectively. Gautam *et al*. (2014) studied the morphometric relationship of Pacific white shrimp (*L. vannamei*) through length-weight from East coast of India and positive allometric growth was reported. The present study elucidates the important information on length weight relationship, length-frequency distributions and condition factor of *L. vannamei* cultured in an earthen pond at Valsad district of Gujarat (India). The study may be helpful in managing the biomass of species and smoothly regulate the farm operations.

## MATERIALS AND METHODS

In present study the morphometric parameters like total length and weight of 1200 specimens of pacific shrimp were randomly measured during January to March 2020 from the final harvested crop reared for 120 days at Dhanlaxmi Aqua Farm, Palsana village, Valsad district of Gujarat state (India), situated at 20°29'55.3" N 72 ° 53'56.2" E geographic location.

The total length (TL) of each specimen was measured from the tip of the rostrum to the end of telson to the nearest 1 mm by measuring board whereas weight (W) was measured after wiping the shrimp to the nearest 1.0 g with the help of an electronic single pan balance. For length-frequency distribution analysis, the collected morphometric data was categorized into different length groups with class interval of 2 cm i.e. 8-10, 10-12, 12-14, 14-16, 16-18 and 18-20 cm which named as A, B, C, D, E and F, respectively. The equations of LeCren (1951) and Ramasesaiah and Murty (1997) were used to calculate the length-weight relationship.

$$Y = a+b\,X$$

$$W = aL^{b}$$

$$\text{Log } W = \text{Log } a + b\text{Log } L$$

The condition factor (K) is considered as the percentage of body weight with cube of the total length and it was calculated following formula given by Hile (1936).

$$K=W/L^{3}\times 100$$

Where 'W' is the weight (g) of shrimp, 'L' is the total length (cm) of shrimp, 'a' is the intercept of variables and 'b' is the slope of variables. The statistical analysis of data and graphical presentation were completed by MS Excel 2010.

## RESULTS AND DISCUSSION

The average length of Pacific whiteleg shrimp was 13.74 ± 0.05 cm with minimum and maximum length of 8.70 and 18.30 cm, respectively (Table 1). Similarly, the weight ranged from 6.00-48.00 g with an average value of 21.19 ± 0.24 g. The length-frequency distribution was evaluated to find out the population structure of shrimp and it was observed that in present study length group 12.00-14.00 cm contributed 447 shrimp specimen, followed by 14.00-16.00 cm (445 specimen), 10.00-

**Table 1: Length weight parameters of whiteleg shrimp (*L. vannamei*)**

| Length groups | | Number (n) | Total length (cm) | Weight (g) |
|---|---|---|---|---|
| (A) | 8.00-10.00 | 21 | 8.70-10.00 (9.64 ± 0.08) | 6.00-12.00 (8.00 ± 0.35) |
| (B) | 10.00-12.00 | 183 | 10.10-12.00 (11.30 ± 0.04) | 6.00-17.00 (11.78 ± 0.17) |
| (C) | 12.00-14.00 | 447 | 12.10-14.00 (13.06 ± 0.03) | 9.00-28.00 (17.13 ± 0.16) |
| (D) | 14.00-16.00 | 445 | 14.10-16.00 (14.96 ± 0.03) | 14.00-37.00 (26.18 ± 0.21) |
| (E) | 16.00-18.00 | 101 | 16.10-17.80 (16.62 ± 0.04) | 26.00-47.00 (36.39 ± 0.46) |
| (F) | 18.00-20.00 | 3 | 18.10-18.30 (18.17 ± 0.07) | 46.00-48.00 (47.00 ± 0.58) |
| Pooled mean | | 1200 | 8.70-18.30 (13.74 ± 0.05) | 6.00-48.00 (21.19 ± 0.24) |

Values in parenthesis are mean and standard error of the variables

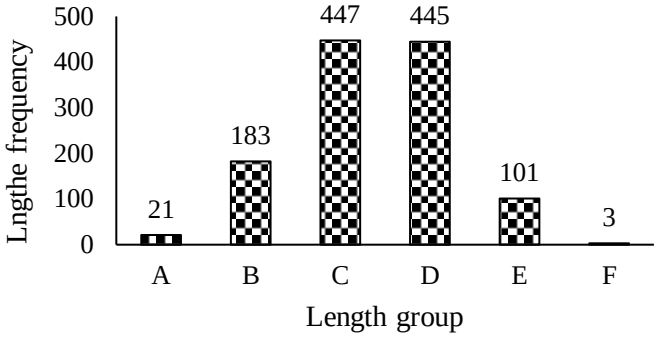


**Fig. 1: Length frequency distribution of white leg shrimp (*L. vannamei*)**

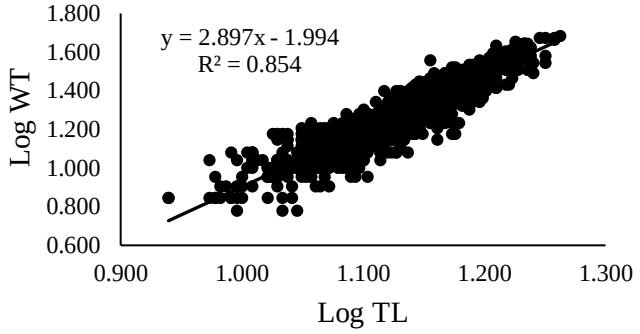


**Fig. 2: Length-weight relationship of the pooled population white leg shrimp**

12.00 cm (183 specimen), 16.00-18.00 cm (101 specimen), 8.00-10.00 cm (21 specimen), whereas only 3 specimens was contributed by length group 18.00-20.00 cm (Fig. 1). In length-frequency distributions the dominance of large sized shrimp was the indication of satisfactory growth of shrimp in the studied earthen ponds. Ayub and Ahmed (1992) and Fatima (2000) carried out the similar research work and their findings support the current study.

The length weight variables of whiteleg shrimp showed a straight-line distribution indicating a linear relationship (Fig. 2). These variables exhibited the correlation coefficient ($r^2$) 0.854, intercept (a) -1.994 and regression coefficient (b) 2.897 for whiteleg shrimp population in the studied area (Fig. 2). The regression coefficient value or growth constant (b) was observed to be <3, which indicated that the growth of whiteleg shrimp in the studied area was negative allometric. Sarada (2010) observed a significant relationship between males and females in *Penaeus semisulcatus* with the slope values of 3.01 in males and 2.98 in females. Gopalakrishna *et al.* (2013) in a similar study reported negative allometric growth for male (2.4) and females (2.6) between wild and cultured shrimps. Mohanty *et al*. (2015) also reported negative allometric growth (2.340 to 2.573) in *Penaeus monodon* from Odisha, India. Although, Udoinyang *et al.* (2016) reported isometric growth and Mane *et al*. (2019) reported positive allometric growths in *Macrobrachium rosenbergii* and negative allometric growths in *Penaeus monodon* and *Penaeus atlantica*.

The condition factor (K) of aquatic organism is an indicator of the changes in food reserves. It provides information about the specific growing conditions and thus plays an important role in culture system management. For different length groups of whiteleg shrimp (A-F), the K value was 0.897 ± 0.041 for A, 0.819 ± 0.011 for B, 0.764 ± 0.005 for C, 0.780 ± 0.005 for D, 0.793 ± 0.009 for E and 0.784 ± 0.005 for F, whereas it was 0.783 ± 0.003 for mean population (Fig. 3). The obtained K value indicated uniform condition of shrimp population during the study period. It showed that

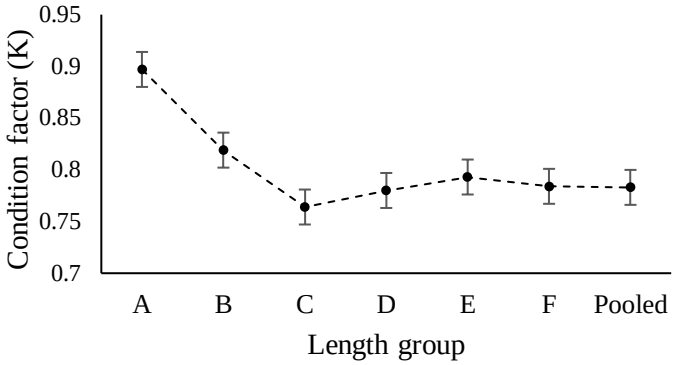


**Fig. 3: Condition factor of length groups and pooled population of whiteleg shrimp**

whiteleg shrimp was in good condition and no length group-based condition differences were noticed in the studied species. Similar values of *K* were reported by Ming *et al*. (2016) in *Macrobrachium rosenbergii*. Khademzadeh and Haghi (2017) reported a K value of 0.56 for whiteleg shrimp in culture systems of Choebdeh, West-South of Iran. Mane *et al*. (2019) reported similar range of condition factor (0.92-1.09) in *Penaeus monodon* from Maharashtra India.

**Conclusion:** The results of present study demonstrated that length-weight relationship exhibited a linear regression and significant correlation. Growth constant values (b) in current study was below f the isometric value (b = 3) which revealed that growth of studied species is negative allometric. The finding of LWR and the condition index (K) of commercially important Pacific whiteleg shrimp in south Gujarat may be helpful to evaluate the spawning season, growth status and condition with respect to farm management.

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