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Length-weight relationship and condition factor of Pacific whiteleg shrimp (*Litopenaeus vannamei*, Boone, 1931) cultured in polyethylene lined pond

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Abstract
Pacific whiteleg shrimp *Litopenaeus vannamei* (Boone, 1931) cultured worldwide with developments and revolutions in culture ponds like spread polyethylene liner over earthen ponds. The length-weight relationships in shrimp, *Litopenaeus vannamei* was evaluated cultured in polyethylene (PE) lined ponds from Bhimpore village of Surat district (Gujarat). For this purpose, 500 specimens from pond were collected during 2021 and their length and weight were recorded as per the standard methods. The length and weight were noted 11.488-15.581 (13.393±0.035) cm and 12.26-31.22 (19.613±0.162) gm during study. The noted length frequency distribution for length group A-23, for B-377 and for C-100. The recorded correlation coefficient (r^2) of the shrimp were 0.633 (A), 0.780 (B), 0.809 (C) and 0.906 (pooled) noted. The growth constant or regression coefficient (b) was observed 2.541, 2.812, 3.531 and 2.997 for length group A, B, C and pooled population. The growth constant depicted that growth of shrimp was isometric (b=3.0) and normal. A mean Fulton's condition factor value noted 0.808 (±0.002). These findings are clearly indicating that the growth of studied shrimp was normal and good in the polyethylene (PE) lined pond.

Keywords: Shrimp (*Litopenaeus vannamei*), length weight relationship, Fulton's condition factor (K), PE lined pond

Introduction
Shrimps consumption demanded around the world and to achieve the required production to attain the increasing demand of shrimp farming is goingon in many countries. Therefore, comparatively high export rated penaeid shrimp '*Litopenaeus vannamei*' cultured worldwide (Suriya *et al*., 2016; Khademzadeh and Haghi, 2017) [23, 7] with expected benefits of species like specific pathogen free (SPF), specific pathogen resistance (SPR), fast growth rate and easy to culture even with high dense stocking. In Gujarat, it was introduced during 2001-02 when farmers met enormous economic losses in tiger shrimp's (*Penaeus monodon*) culture owing to several infectious diseases. The developments and innovations in shrimp farming was implemented to enhance the shrimp production i.e. spread polyethylene liner over earthen pond to reduce seepage, maintain pH fluctuation in the water without directly contact with soil, and maintain sludge etc.

The effective production of shrimp is respite on physico-chemical and biological parameters but it could be monitored by length-weight relationship (LWR) and condition factor (K). The length-weight relationships is modestly substitute to evaluate body weight as of length measurements which is not as much of variable and further easily measured in the field (Gautam *et al*., 2014) [4] are enormously valuable tools for considerate the biological fluctuations in aquatic organisms (Shah *et al.*, 2013; Gautam *et al*., 2014; Prajapati and Ujjania, 2021) [20, 4, 18]. The length-weight relationship has important role in fisheries science to regulate conceivable variances between diverse stocks of the same species (King, 2007) [8], explain the comparative growth studies (Peixoto *et al*, 2004) [17].

The value of condition factor (K) is an index value which indicate the interaction among living and non-living factors in the biological condition of the aquatic organisms and calculated from the weight and length (Lizama *et al*., 2000; Solanki *et al*., 2020) [13, 22]. It can be used to estimate changes in nutritional condition (Lizama *et al*., 2000; Sutton *et al*., 2000; Lalrinsanga *et al*., 2012; Mohanty *et al*., 2015; Solanki *et al*., 2020; Prajapati and Ujjania, 2021) [13, 24, 11, 15,

[22, 18]. In cultured farms, it helps to assess health and habitat conditions such as food accessibility (Hanson and Bajjaliya, 2005; Khademzadeh and Haghi, 2017) [5, 7].
The study on length-weight relationship and condition factor (K) are important tool to understand the culture conditions, growth status and condition of shrimp consequently, present study was conducted.

Material and Methods

The morphometric variables including length and weight of randomly collected 500 specimens of shrimp were measured from catch of polyethylene lined pond at Bhimpore, Surat (Gujarat) during the crop cycle of 2021. The length of specimen was measured from the tip of rostrum to the end tip of uropod with the help of digital vernier calliper at the accuracy of ±0.02 mm and weight were taken by using an electronic balance to the nearest 0.01 gm (Lester, 1983) [12]. These length data of shrimp were divided in different length groups at the distances of 2.00 cm e.g. 10.001-12.000 cm, 12.001-14.000 cm and 14.001-16.000 cm which were designated as A, B and C respectively.
The length-weight relationship was calculated from nonlinear power function $Y= aX^{b}$ (Ricker, 1973) [19] and from transformed data using linear equation Log (W) = log (a) + b log (L) prescribed by Pauly (1983) [16]. The condition factor (K) was determined from the equation $K = (W/L^3) \times 100$ (Htun-Han, 1978) [6], where K is condition factor, W is weight (gm), L is total length (cm).

Result and Discussion

The data of morphometric variables were compiled and findings were depicted that length and weight of studied shrimp were noted 11.488-15.581 (13.393±0.035) cm and 12.26 to 31.22 (19.613±0.162) gm respectively (Table 1). The length frequency distribution data shows that length group B was dominated 377 (75%) among the studied shrimp population followed by length group C 100 (20%) and A containing 23 and 5% (Table 1). The assumptions of Fatima, (2000) [2] for penaeid shrimps (Tandel, 2020) [25] for whiteleg shrimp is substantiate the present results, while dominancy of large sized shrimp was reported by Fatima (2001) [3]; Solanki *et al*. (2020) [22] and Prajapati and Ujjania (2021) [18].
The length-weight relationship consents for the modification of growth-in-length to growth-in-weight in ordinary valuation representations (Silva *et al.*, 2015) [21]. The variables (length and weight) are positive linearly related and correlation coefficient (r^2) was noted 0.633, 0.780, 0.809 and 0.906 for length group A, B, C and pooled population (Table 2, Fig. 1). The growth constant or regression coefficient (b) was found 2.541, 2.812, 3.531 and 2.997 for length group A, B, C and pooled population (Table 2). These findings elucidated that growth of studied shrimp was isometric (b=3.0) and indicate that the growth of shrimp was normal consequently length and weight were follow the cube law of the growth. The similar findings were reported by Konan *et al*. (2014) [9], Udoinyang *et al*. (2016) [26] and Khademzadeh and Hanghi (2017) [7] while Mane *et al*. (2019) [14] and Prajapati and Ujjania (2021) [18] reported positive allometric growth in the shrimp.
The condition factor imitates, through the situation variations, information on the physiological condition of fish in relation to the well-being (Prajapati and Ujjania, 2021) [18]. In existing study, it was observed for length group A 0.763-0.850 (0.814±0.005), for length group B 0.720-0.974 (0.806±0.002) and for length group C 0.729-0.910 (0.815±0.004) whereas it was 0.720-0.974 (0.808±0.002) for pooled population (Table 2). The resulted value of K was 1.0-0.5 which specified that the condition of studied shrimp inhabitant was variably good and aquatic environment of PEL pond conducive. Comparable findings for K value were reported by Kunda *et al*. (2008) [10] in *P. penicillatus*, Tandel (2020) [25] in *L. vannamei* and Solanki *et al*. (2020) [22] in *P. monodon*. In contradiction of existing findings more than 1.0 K value in *L. vannamei* was reported by Prajapati and Ujjania (2021) [18] from Gujarat and in *P. monodon* from Odisha and Maharashtra by Mohanty *et al.* (2015) [15] and Mane *et al.* (2019) [14] respectively.

Table 1: Length and weight observation in studied ponds.

Length group	n	Total Length (cm) Min-Max (Mean±SE)	Weight (gm) Min-Max (Mean±SE)	Condition factor (K)
A	23	11.488-11.993 11.815±0.039	12.26-14.66 13.437±0.141	0.763-0850 0.814±0.005
B	377	12.003-13.998 13.206±0.026	14.06-25.62 18.626±0.115	0.720-0.974 0.806±0.002
C	100	14.003-15.581 14.462±0.042	20.35-31.22 24.753±0.285	0.729-0.910 0.815±0.004
Pooled	500	11.488-15.581 13.393±0.035	12.26-31.22 19.613±0.162	0.720-0.974 0.808±0.002

Note: Length group A is 10.001-12.000 cm, B is 12.001-14.000 cm and C is 14.001-16.000 cm

Table 2: Statistical values of the variables in studied ponds.

Length group	n	a	B	r^2
A	23	-1.598	2.541	0.633
B	377	-1.884	2.812	0.780
C	100	-2.705	3.531	0.809
Pooled	500	-2.090	2.997	0.906

Note: Length group A is 10.001-12.000 cm, B is 12.001-14.000 cm and C is 14.001-16.000 cm

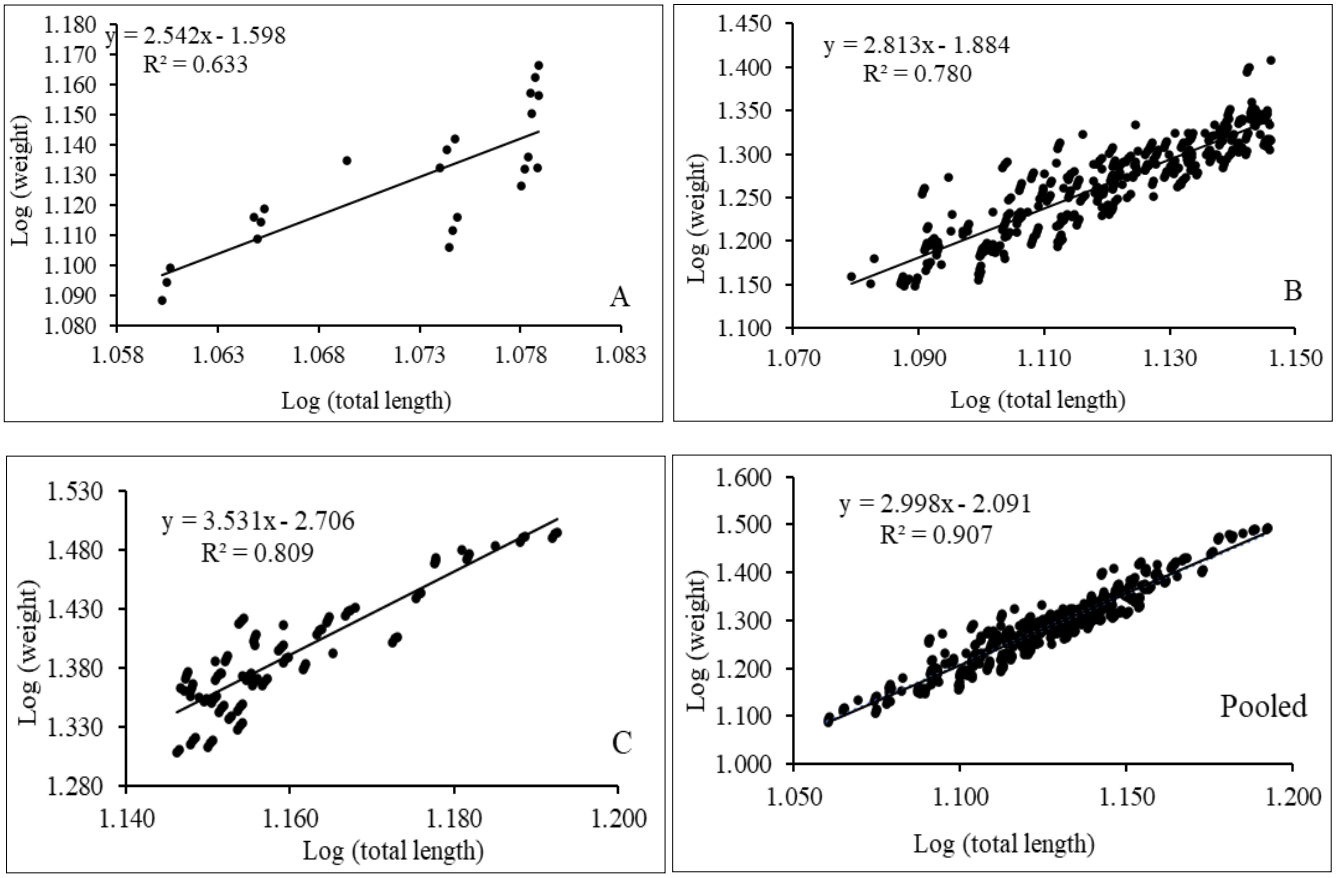

Fig 1: Length - weight relationship of different length groups (A, B & C) and pooled population of *L. Vannamei* cultured in polyethylene line pond.

Conclusion

On the basis of these findings it can conclude that the growth of shrimp was isometric and normal. Compatibly, the value of condition factor was noted between < 1.0 and >0.5 which specify that condition of the shrimp was fair good. Although cultured ponds environment was conductive for the shrimp but for optimal and commercial growth performances should be essential to alter the farm operations.

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References

1. Boone L. Anomuran, macruran crustacea from Panama Canal Zone. Bulletin of the American Museum of Natural History. 1931;63(2):137-189.
2. Fatima M. Length-weight relationship of some penaeid shrimps from Karachi. Pak. J Zool. 2000;32:185-186.
3. Fatima M. Study on length-frequency and length-weight relationship of *Penaeus japonicus* and *Parapenaeopsis sculptilus*. J Biol. Science. 2001;1(3):171-172.
4. Gautam K, Nazar AR, Anand GE, Mahendran S, Mahedvan G. Study of length and weight relationship of *Litopenaeus vannamei* (Boone, 1931) from east coast of India. Int. J. Sci. Invent. Today. 2014;3(4):365-376.
5. Hanson CH, Bajjaliya F. Analysis of the condition of rainbow trout collected from the Kings-river downstream of Pine Flat Dam, 1983-2005. Hanson Environmental, Walnut Creek, CA, 2005, 12.
6. Htun-Han M. The reproductive biology of the dab *Limanda limanda* (L.) in the North Sea: gonosomatic index, hepatosomatic index and condition factor. J Fish Biol, 1978;13(3):369-378.
7. Khademzadeh O, Mahsa H. Length-weight relationship and condition factor of white leg shrimp *Litopenaeus vannamei* (Boone, 1931) in culture system of Choebdeh, West-South of Iran. Int. J Fish. Aqua. Std. 2017;5(1):298-301.
8. King M. Fisheries biology, assessment and management. 2nd edn. Blackwell Scientific Publications. Oxford, 2007, 1-138.
9. Konan KM, Ouattara A, Da Costa KS, Ade´po-Goure`ne AB, Goure`ne G. Allometric growth and condition factor of West Africa shrimp, *Macrobrachium vollenhovenii* (Herklots, 1857), in the river of Co´ted`ivoire. Marine and freshwater Res. 2014;65:849-856.
10. Kunda M, Dewan S, Uddin MJ, Karim M, Kabir S and Uddin MS. Length-weight relationship, condition factor and relative condition factor of *Macrobrachium rosenbergii* In Rice Fields. Asian Fish. Sci. 2008;21:451-456.
11. Lalrinsanga PL, Pillai BR, Patra G, Mohant S, Naik NK, Sahu S. Length-weight relationship and condition factor of giant freshwater prawn *Macrobrachium rosenbergii* (Deman, 1879) based on developmental stages, culture stages and sex. Turkish J Fish. Aqua. Sci. 2012;12:917-924.
12. Lester LJ. Developing a selective breeding program for penaeid shrimp mariculture. Aquaculture. 1983;33:41-50.
13. Lizama M, DeLos AP, Ambrósio AM. Condition factor

in nine species of fish of the characidae family in the upper Paraná river floodplain, Brazil, Braz. J Biol. 2000;62(1):113-124.
14. Mane S, Sundaram S, Hule A, Sawant M, Deshmukh VD. Length-weight relationship of commercially important Penaeid prawns of Maharashtra, India. Int. Res. J Sci. Engg. 2019;7(1):35-40.
15. Mohanty SK, Mohanty SS, Dash BP, Pramanik DS. Length-weight relationship and condition factor of *Penaeus monodon* Fabricius, 1798 in northern Odisha, India. Int. J Sci. Res. 2015;4(4):1300-1304.
16. Pauly D. Length-converted catch curves: a powerful tool for fisheries research in the tropics. Part 1-Fishbyte, 1983, 9-13
17. Peixoto S, Soares R, Wasielesky W, Cavalli RO, Jensen L. Morphometric relationship of weight and length of cultured *Farfantepenaeus paulensis* during nursery, grow out and brood stock production phases. Aquacult. 2004;241:291-299.
18. Prajapati SD, Ujjania NC. Study on length weight relationship and condition factor of whiteleg shrimp *Litopenaeus vannamei* (Boone, 1931) cultured in earthen pond, Khambhat (Gujarat). Int. J Fauna Biol. Std. 2021;8(1):67-70
19. Ricker WE. Linear regression in fisheries research. J. Fish. Res. Board Canada. 1973;30:409-434.
20. Shah TH, Hassan BUIM, Asimi OA, Khan I. Length weight relationship and ponderal index of rainbow trout (*Oncorhynchus mykiss* W., 1792) from Dachigam stream in Kashmir. African J Agricult. Res. 2013; 8:1277-1279.
21. Silva TSC, Santos LD, Silva LCR, Michelato M, Furuya VRB, Furuya WM. Length-weight relationship and prediction equations of body composition for growing-finishing cage-farmed nile tilapia. Rivista Brasileira de Zootecnia. 2015;44:133-137.
22. Solanki HG, Ujjania NC, Gopal C, Pillai SM. Length-weight relationship, condition factor and length-frequency analysis of tiger shrimp (*Penaeus monodon* Fabricius, 1798). Int. J Fauna Biol. Std. 2020;7(4):191-195.
23. Suriya M, Shanmugasundaram S, Mayavu P. Stocking density, survival rate and growth performance of *Litopenaeus vannamei* (Boone, 1931) in different cultured shrimp farms. Int. J Cur. Res. Biol. Med. 2016;1(5):26-32.
24. Sutton SG, Bult TP and Haedrich RL. Relationships among fat weight, body weight, water weight, and condition factors in wild Atlantic salmon. American Fish. Soc. 2000;129:527-538.
25. Tandel YU. Growth of shrimp *Litopeaneus vannamei* (Boon, 1931) in earthen ponds at Palsana, Valsad (Gujarat). Dissertation, Dept. of Aquatic Biol. VNSGU, Surat, 2020.
26. Udoinyang EP, Amali O, Iheukwumere CC, Ukpatu JE. Length-weight relationship and condition factor of seven shrimp species in the artisanal shrimp fishery of Iko river estuary, Southeastern Nigeria. Int. J Fish. Aqua. Stud. 2016;4(2):109-114.