Length-weight Relationship and Condition Factor of Red Tilapia (Hybrid) Reared in Cemented Tanks of Sun-bright Red Tilapia and Ornamental Hatchery-Karachi, Sindh-Pakistan

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Abstract: Length-weight relationship (LWR) and condition factor (K) were estimated for the Red tilapia (hybrid) brooders collected from cemented tanks (11x7x4 feet of Sun-bright Red Tilapia and Ornamental Hatchery, Karachi-Pakistan. The female brooders (average length 16.2 ± 2.4 cm and weight 133.9 ± 15.6 g) and male brooders (average length 16.48 ± 1.9 cm and weight 143.42 ± 11.4 g) were randomly sampled from brood-stock maturation tank. Log transformed regression was used to test the growth of the specimens (n=177). It was observed that value of the regression co-efficient 'b' was found to be 1.20 for female and 1.36 for male showing an isometric growth among the brooders. There was no significant (P<0.05) difference in K of both sexes. On the basis of length-weight and condition factor data, it is concluded that Red tilapia brood-stock were in good condition for mass seed production purposes.

Keywords: Red tilapia, Cemented tank, Condition factor, length-weight relationship

1. INTRODUCTION

Oreochromis species are the most popular candidate for aquaculture after carps (Malik *et al.,* 2014, Daudpota *et al.,* 2016, Kembenya *et al.,* 2014). Aquaculture production of tilapia has continuously increased in current years in the most tropical, subtropical and temperate areas of the world (FAO, 2012, Daudpota *et al.,* 2016). Global consumption rate of tilapia species is increasing day by day (Ogello *et al.,* 2014). Due to insufficient supply of quality feed (floating) and quality seed of tilapia is a big problem to get maximum production, particularly in under-developing countries (Ogello *et al.,* 2014). Fish farmers are facing problems into tilapia culture due to stocking their ponds with poor quality seed which is produced from roughly conditioned brooders in several hatcheries (Munguti *et al.,* 2014).

Information regarding quantitative characteristics such as length and weight relationship, ponderal index, growth increment and mortality of fishes are principal tools for understanding fish biology (Lizama *et al.,* 2002). In fish species condition factor (K) reflects, through its differences, information on the physical state of fish in relation to its welfare (Ighwela *et al.,* 2011). From a nutritive point of view, there is the growth of fat and gonadal development (Le Cren, 1951) hence from a reproductive point of view; the maximum condition factor (K) values reached in few species (Ighwela *et al.,* 2011). The values of "K" also give data for comparing two inhabitants existing in certain nourishing, density, environment, and other conditions; when describing the time for maturation of gonads; and when locating the degree of food intake movement of a species to confirm whether it is making best use of its nourishing source (Anyanwu *et al.,* 2007). In addition, information about condition factor is more important to understand life cycle of a fish and contributes to satisfactory management of these fish in an ecosystem (Laghari *et al.,* 2011). Condition factor of fishes can be affected from a several factors like pressure, sex, season, Presence of food, water temperature, pH and dissolved oxygen etc. (Kembenya *et al.,* 2014,). In fish hatcheries, mostly managers particularly in under developed countries they do not relate the importance of brooders condition factor for quality seed production. Due to lack of this information several hatcheries and fish farms dealing with tilapia species in Pakistan facing difficulties. Thus, the present study was conducted to provide information about the length-weight relationship and condition factor (K) for Red tilapia brooders (hybrid*),* to determine, whether the brooders are in ideal condition for mass seed production in Karachi-Sindh climate.

2. MATERIALS AND METHODS

Study area

This study was conducted in cemented tanks (11x7x4 feet) at Sun-bright Red Tilapia and Ornamental Hatchery, Karachi-Sindh, Pakistan.

Sample size and data collection

Red tilapia (hybrid) brooders (n=177) were collected from the brood-stock ponds of hatchery, then transported to the laboratory for length and weight measurement. These fish were washed and blot-dried to

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remove extra water from their whole body before measurement. Female specimen was 16.202 ± 2.4 cm in average length and male specimen was 133.95 ± 15.6 g in average weight. Digital weight balance (1-5000 g) was used to get weight and length was measured by using scale (1-30 cm) as described by Legler (1970).

Sex determination

Male or female gender was distinguished manually on the basis of external sexual characters. Male have two openings which are present just before the anal fin. Other is the opening of the urethra, at the end of the genital papilla (an oval-shaped lobe just rearward of the anus), from which milt and urine are released second is anus. Female have three body openings, one is the anus, second is urethra and third is opening of the oviduct (a crescent-shaped slit), from which eggs are discharged.

Water quality parameters

Water quality parameters were monitored during the maturation period (March to June 2015) such as temperature, pH, dissolved oxygen (D.O), hardness and ammonia. Water temperature was monitored daily with mercury thermometer. Dissolve oxygen (DO) was observed at the same time with a portable test kit (Merck KGaA, 64271, Germany). The pH was determined by using pH meter (EzDO 6011, Taiwan) and ammonia was determined by portable test kits (Merck KGaA, 64271, Germany) on weekly basis.

Data analysis Length-weight relationship

Linear transformation of length and weight of fish was completed using natural logarithm at the observed lengths and weights. The length-weight relationship (LWR) was calculated following Pillay (1983). The LWR was used to calculate the regression coefficient (slope 'b' of regression line of weight and length). The parameter "b" of the length-weight relationship was estimated using the formula $W = aL^b$.

Where: W = the weight of the fish in grams,
L = the total length of the fish in centimeters
a = exponent describing the rate of change of weight with length
b = weight at unit length
The expression of the relationship was represented by the following formula:
Log W = b log L + log a

Condition factor

The value of **b** from the weight-length relation (Lizama *et al.,* 1999) was used to calculate the condition factor. Individual values of the condition factor were obtained through the formula $K = 100W/L^b$ (Gomiero and Braga, 2005). The mean condition factor was obtained separately for both males and females.

Where: K=condition factor, W=the weight of the fish in gram (g), L=the total length of the fish in centimeters (cm), b=the value obtained from the length-weight equation.

3. **RESULTS**

Water quality
There were no significant differences (P>0.05) between water quality parameters within and among the brooder maturation production ponds at the station **(Table-1)**.

Length-weight relationship

On completion of maturation period, length-weight data were taken and presented in **(Table-2)**. The mean length and weight of brooders was, female 16.202 ± 2.4 cm and 133.95 ± 15.66 g respectively. The mean length and weight for the male fish were 16.48±1.97 cm and 143.42±11.4 g, respectively. The length-weight relationship between both sexes of plotted data, values of determination coefficients and corresponding equation are given in **(Fig 2 and 3)** for males and females respectively. Values of regression coefficient obtained from the length-weight relationship for male, female brooders and condition factor are shown in **(Table-2)**. There was significant correlation between length and weight for both male and female brood fish (P<0.05). There was no significant difference in condition factor between both genders of Red tilapia (hybrid) p<0.05.

Table 1: Water quality parameters recorded during the period of study including ± Standard Error (SE)

Parameter	Mean (± SE)
D.O (mg/L)	7.21 ± 0.28
pH	6.84 ± 0.11
Temperature (°C)	28.95 ± 0.22
Ammonia (mg/L)	0.52 ± 0.01

Table-2. length weight relationship, regression coefficient and condition factor parameters of Red tilapia (hybrid) in cemented ponds of Sun bright Red Tilapia and Ornamental Hatchery, Karachi-Pakistan.

Sex	Female	Male
Number	118	59
Mean Length (se)	16.202±2.4	16.48±1.97
Mean Weight (SE)	133.95±15.66	143.42±11.4
Exponential (a)	0.76	0.65
Slop (b)	1.20	1.36
Condition Factor (SE)	3.4±1.2	3.3±0.9
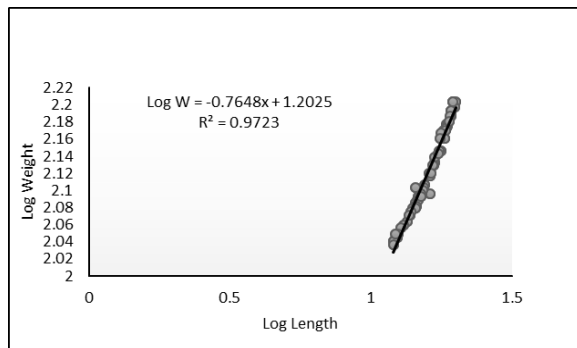
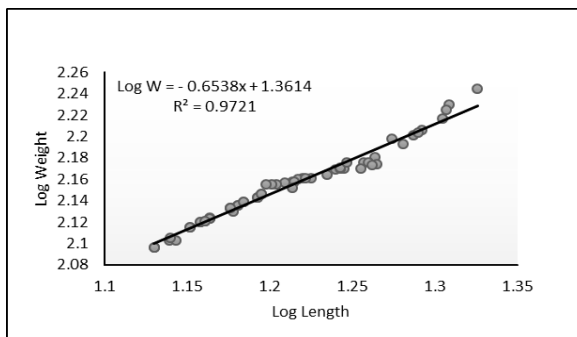**Fig-1. Length-Weight relationship of Red tilapia (Hybrid) Females**

Log W = -0.7648x + 1.2025
R² = 0.9723

Fig-2. Length-Weight relationship of Red tilapia (Hybrid) Males

Log W = - 0.6538x + 1.3614
R² = 0.9721

4.   DISCUSSION

It is well known fact that the knowledge of the length-weight and of condition factor relationship in studying the biology and growth is useful (Ighwela *et al.,* 2011). In this study length weight relationship showed that the regression coefficients are indicative of isometric growth in males and female brooders of Red tilapia. These results were in contrast with (Moradinasab *et al.,* 2012) who reported that the increase in weight is significant with per unit increase in length for isometric growth. In the present study, values of 'b' were 1.20 for females and 1.36 for males. These values were lesser than (Bagenal and Tesch, 1978). According to them, an ideal slope 2-4 for fish.

Slope 'b' in length- weight relationships describe growth form of the fishes. When values of b are equal to 3 or near to 3, this growth is known as isometric i.e. fish becomes healthier with increasing length (Bagenal and Tesch, 1978). On the same way, when b values are far away or greater than 3, this indicate that all parts of fish grow differently i.e. the fish becomes thinner with increase in length (King, 1996). Red tilapia (hybrid), in the present study, showed b values (1.2-1.3) in both sexes. These findings are in contrast with previous studies of (Dan-kishiya, 2013). He recorded b values 1.4-2.3 from Cichlids (*Tilapia zilli, Tilapia mariae, and Oreochromis niloticus*). Present study also in contrast with the findings of (Imam *et al.,* 2010) who

documented the range of b as 1.4 and 2.5. Ibrahim *et al* (2012) reported b values 1.9-2.3 in *Barbus occidentalis* and *Barilius loati* fish belonging *Cyprinidae* family from which are greater than the present findings. Though, the values of b recorded in the current research are lower than the documented values of 2.5 to 3.5 for tropical fish species (Pauly and Gayannilo, 1997).

Length-weight relationship can help in the estimation of condition factor (K) of fishes. In fisheries and aquatic science, condition factor plays key role for the estimation of condition, fatness or comfort of fish (Ahmed *et al.,* 2011). K is also a useful directory for monitoring of feeding intensity, age and growth increment in fishes (Ndimele *et al.,* 2010). In the present study, K values of fish are similar with the findings of (Kumolu-Johnson and Ndimele, 2011). They estimated 0.91 to 8.46 K values. But, Ibrahim *et al.* (2012) reported K-value 1.98 ± 0.35. While Ahmed *et al.* (2011) reported 0.506 and 3.415 of K-value from Sudan. K-values of fish species, greater than 1 is indication of the best growth. Even less than the 2.9 to 4.8 recorded by (Bagenal and Tesch, 1978) for mature fresh water fish fresh body weight which was attributed to difference in weight of individual fish species. There may be some differences in the condition factor due to sex, environmental conditions (Olurin and Aderibigbe, 2006). Keeping in view the above findings, it is concluded that the brooders of Red tilapia (hybrid) inspected were in normal and healthy conditions, and can be used for mass seed production.

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