Study on Length, Weight Relationship and Ponderal Index of Oreochromis Mossambicus Fish in Bhima River, Tal. Pandharpur, Dist Solapur (M.S).

A.N. Dede[1] A.L. Deshmukh[2]
[1,2]Department of Zoology
[1,2]Karmaveer Bhaurao Patil Mahavidyalaya, Pandharpur, Solapur (MS), India

Abstract— The present study was undertaken to unveil information on the length weight relationship and Ponderal index of freshwater fish *Oreochromis mossambicus* from Bhima river tal. Pandharpur, Dist. Solapur. Fishes were studied by examine 185 males and 177 females collected from July 2018 to Jan 2019. . The smallest and highest recorded range of TL varies from 10 to 25 cm. The weight of fish range are 23 to 286 gm. The Ponderal index value is greater than one in present study area. The length weight relationship and Ponderal index indicates that negative allometric growth and good condition of fish growth.

Key words: Bhima River, Ponderal Index, Length, Weight

I. INTRODUCTION

Fishes are finned, aquatic, cold blooded vertebrates and are said to be "gold" from water as they have a high economic value. Length weight relationship (LWR) of fishes are important in fisheries and fish biology because they allow the estimation of the average weight of the fish of a given length group by establishing a mathematical relation between them (Sarkar *et al.*, 2008; Mir *et al.*, 2012). The relationship between total length (L) and total weight (W) for nearly all species of fish is expressed by the equation: W = a L b. LWR explain mathematically the correlation between fish length and weight and are useful for converting length observations into weight estimate to provide some measure of biomass. In fish studies, the length of a fish is often more rapidly and easily measured than is its mass, therefore it is opportune to be able to determine mass where only the length is known. Like any other morphometric characters, the LWR can be used as a character for the differentiation of taxonomic units and the relationship changes with the various developmental events in life such as metamorphosis, growth and onset of maturity (Thomas *et al.*, 2003).

Fish can attain either isometric growth, negative allometric growth or positive allometric growth. Isometric growth is associated with no change of body shape as an organism grows. Negative allometric growth indicates the fish becomes more slender as it increase in weight while positive allometric growth indicates the fish becomes relatively stouter or deeper bodied as it increases in length (Riedel *et al.*, 2007). The exact relationship between length and weight differs among species of fish according to their inherited body shape, and within a species according to the condition (robustness) of individual fish. Condition sometimes reflects food availability and growth within the week period of sampling. The condition factor which show the degree of well-being of the fish in their habitat is expressed by 'coefficient of condition' also known as length – weight factor. It is therefore an index reflecting connections between biotic and abiotic factors such as degree of fitness, gonad development and the suitability of the environment with regard to the feeding condition (Mac Gregoer, 1959). The main focus of this present study is to assess the length-weight relationship and Ponderal index of *Oreochromis mossambicus* in Bhima river Pandharpur, Dist Solapur.

II. MATERIAL & METHODS

A. Study area:

The Bhima River originates from Bhimashankar hills near Karjat of western ghat in Maharashtra, India. The length of Bhima River is 289 km in Solapur district. The Bhima River flows nearby this village in Pandharpur, taluka water is used for irrigation and drinking purpose. The Bhima river lies in Latitude 17^0 43' 50.2'' North and Longitude 75^0 18' 36. Solapur has dry and hot climates, except in monsoon, with very low average rainfall 545mm and temperature ranging from 30^0 to 40 ^{0}C.

B. Sample collection:

Water samples were collected from monthly during July 2018 to Jan 2019. The fishes were monthly collected from sites by Gill nets, cast nets, trap nets, long line and hooks with the help of local fisherman.

C. Materials:

1) Fish
2) Ruler
3) Digital Balance

D. Length measurement:

Refers to the whole body length of a fish, there are three types of length measurements:

1) Standard length is the distance from the tip of mouth to beginning of tail fin.
2) Fork length is the distance from the tip of mouth to the tip of the median caudal fin rays.
3) Total length is the distance from the tip of mouth to the distal tip of the longest caudal fin ray.

E. Statistical Analysis:

$W = a L^b$ ---- (1) Where, W is the weight of the fish, L its length and a and b are constants. Equation (1) could be expressed in the linear form by using logarithms, as given below: ln W = ln a + b ln L the constants a and b.

The Fulton"s Condition Factor / Ponderal index (K) was computed by using the formula, as given below:

$$\boldsymbol{Condition\ Factor\ (K) = Weight\ /\ (Length)^3 \times 100}$$

III. RESULTS

A. Fish taxonomy:

Oreochromis mossambicus (Peters, 1852)
English Name: Common tilapia. Local Name: Chilapia

1) Morphology:

- Body is elongated, short and compressed structure.
- The abdomen is rounded shape.
- The upper side of the body is concave structure.
- Mouth is terminal and very wide position.
- The snout is rounded in shape. Females in this system produce an average of 380 eggs each spawning.
- Females lay their eggs into the males' nest before picking them up in their mouth.
- The male then immediately releases milt (sperm) over the nest, which the female gulps at to fertilized her eggs.
- The female then abandons the male to set up her own territory where she broods the embryos in her mouth for a period of 20–22 days.
- Fry are free swimming, they will leave the female for brief periods but return to her mouth if threatened.
- Females aggressively defend eggs and fry from predators during this time.
- The jaws are equal in size.

Distribution: Pakistan, Bangladesh, South Africa, India.

Fin formula: D.15; P. 14; A.10, V. 15, C.17

Fig. 1: Length of fish (Orecochromis mossambicus)

Fig. 2: Weight of fish

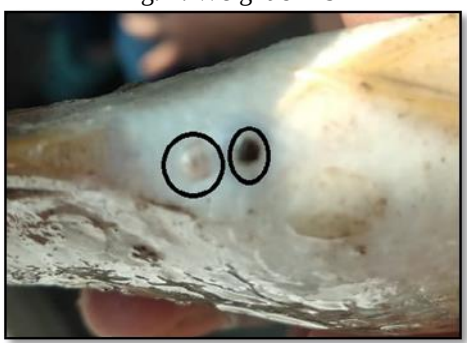

Fig. 3: Male genital pore

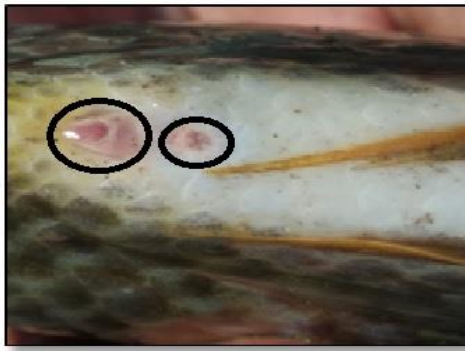

Fig. 4: Female genital pore

B. Length weight relationship:

In the present study total 185 male and 177females were collected. The minimum and maximum recorded range of TL varies from 10 to 25 cm. The weight of fish range are 23 to 286 gm. The length weight relationship, the data for males and females analysed separately and following regression equation were obtained (Table no. 1 and 2).

$$\ln W = \ln a + b \ln L$$

$$\ln W = 0.21 + 1.62 \ln L \text{ for male and female.}$$

The value of b indicates that the values obtained for males and females was less than 3 which indicates that fish become lighter (negative allometric) for a particular length.

No. of Males	Length (cm)	Mean	Weight (gm) Mean	Ln L (x)	$(\text{Ln L})^2$ $(X)^2$	Ln W (Y)	$(\text{LnW})^2$ $(Y)^2$	(lnL) (ln W) (X) (Y)
16	10-12	10.9	23.6	2.38	5.66	3.16	9.98	5.61
40	12-14	13.3	44.2	2.58	5.67	3.78	14.2	9.75
47	14-16	15.2	67.4	2.72	7.3	4.21	17.7	11.45
41	16-18	17.1	80.5	2.83	8.00	4.38	19.18	12.39
13	18-20	19.2	145.6	2.95	8.70	4.9	24.01	14.4
14	20-22	21.4	195	3.06	9.36	5.25	27.56	16.06
6	22-24	23.5	256	3.1	9.61	5.57	31.02	17.2
8	24-26	25.5	286	3.23	10.43	5.65	31.92	17.5
185		146.1	922.8	22.85	64.73	36.9	175.57	104.36

Table 1: Length weight relationship in Female of *Oreochromis mossambicus*

No. of Females	Length (cm) Mean	Weight (gm) Mean	Ln L	$(\text{Ln L})^2$	Ln W	$(\text{LnW})^2$	(lnL) (ln W)
20	11	23.8	2.39	5.7	3.1	9	7.40
33	13.3	43.8	2.56	6.55	3.7	9	9.47

41	15.2	67.5	2.70	7.29	4.20	16	11.34
47	17	80.5	2.89	8.35	4.3	16	12.42
11	18.9	132.1	2.89	8.35	4.8	16	12.42
12	21.4	189.6	3.0	6	5.24	25	15.72
5	23.5	264.3	3.13	9.78	5.57	25	17.4
8	25.3	283.6	3.21	9.80	5.64	25	18.1
177	145.6	1085.2	22.77	61.82	36.55	141	104.27

Table 2: Length weight relationship in Males of *Oreochromis mossambicus*

To estimate the slope (b) by means of the relationship

$$b = \frac{\sum xy - \frac{[(\sum x)(\sum y)]}{n}}{\sum x^2 - \frac{(\sum x)^2}{n}}$$

Sr. No.	Male length (cm)	Male Weight (gm)	Ponderal index	Female length (cm)	Female Weight (gm.)	Ponderal index
1	10.9	23.6	1.82	11	23.8	1.78
2	13.3	44.2	1.87	13.3	43.8	1.86
3	15.2	67.4	1.91	15.2	67.5	1.92
4	17.1	80.5	1.60	17	80.5	1.63
5	19.2	145.6	2.0	18.9	132.1	1.95
6	21.4	195	1.9	21.4	189.6	1.93
7	23.5	256	1.9	23.5	264.3	2.0
8	25.5	286	1.72	25.3	283.6	1.74

Table No. 3. Ponderal index of *Oreochromis mossambicus* Male and Female

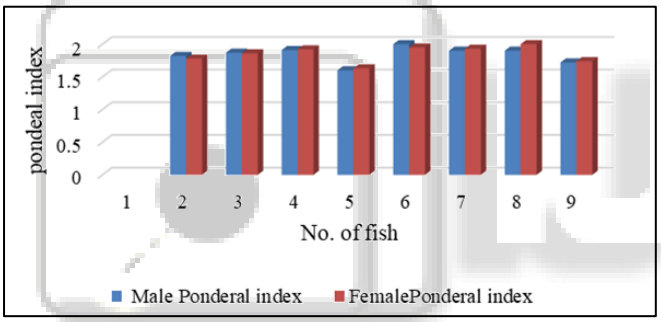

Fig. 5: Ponderal index of male and female *Oreochromis mossambicus* fish

IV. Discussion

A. Length- Weight Relationship:

The length weight relationship is the most important aspect in biological studies of fishes. Exponent of the arithmetic form and the slope of the regression line in the logarithmic form 'b' are the most important parameters in a LWR. The 'b' value less than 3 shows that fish become lighter (negative allometric) for a particular length. The value of the regression co-efficient usually lies between 2.5 and 3.0 only and ideal fish maintains the shape i.e. b = 3.

In present study value of b is 1.62 therefore If 'b = 3', then small specimens in the samples under consideration have the same form and condition as large specimens, then the growth in fish is isometric. If 'b > 3', then large specimens have increased in height or width more than in length, either as the result of a notable ontogenetic change in body shape with size, which is rare, or because most large specimens in the sample were thicker than small specimens, which is common. Conversely, if 'b < 3', then large specimens have changed their body shape to become more elongated or small specimens were in better nutritional condition at the time of sampling (Froese, 2006).

According to Le Cren (1951) fishes may not retain the same shape or body outline throughout their lifespan and the specific gravity of the tissue also do not remain constant. The value of b gives information on the kind of growth of fish.

B. Condition Factor/ Ponderal index:

The condition factor, K, was used to assess the degree of well-being of *Oreochromis mossambicus* in the study area which provides information on the environmental quality and suitability polluted or non-polluted of the ecosystem, physical and biological circumstances and fluctuations by interaction among feeding conditions, parasitic infections and physiological factors (Le Cren, 1951). In the present study Ponderal index value is greater than one (Table no. 3).

Wootton (1996) described that fish with higher K values (> 1) are in a better condition than fish with lower K values (< 1). Therefore, information on condition factor can be vital to culture system management because they provide the producer with information of the specific condition under which organisms are developing (Araneda *et al.*, 2008). This expresses the degree of wellbeing, sturdiness, fatness in numerical terms. Further it is suggested that condition factor is strongly influenced by both biotic and abiotic environmental conditions and can therefore be used as an index to assess the status of the aquatic ecosystem in which fish live (Anene, 2005).

V. Conclusion:

The results of the present study indicate that length-weight relationship and Ponderal index of *Oreochromis mossambicus* in Bhima river follow a negative allometric like growth pattern with 'b<3' based on cubic law. Similarly, the

condition factor value indicates fishes in river showed good condition with values above 1.

The results of the present investigation on length-weight relationships and Ponderal index of *Oreochromis mossambicus* in Bhima river habitat are conducible for the optimum growth of the fish. The present study thus provides baseline information on the growth status of *Oreochromis mossambicus* that will be useful for researchers in future study.

REFERENCES

[1] Anene, A. (2005): Condition factor of four Cichlid species of a man-made lake in Omo state, Southern Nigeria, Tur. J. Fish. Aqua. Sci. 5: 43-47.
[2] Anni Jain, Christina A, P and Jeyaseeli A (2016): Length – weight relationship and condition factors of freshwater fish Tilapia mosambicus, J. Bio.Innov 5(5) pp 758-763.
[3] Araneda, M., Perez, E.P., Gasca, L.E. (2008): White shrimp Penaeus vannamei culture in freshwater at three densities: condition state based on length and weight, Aquacult. 283: 13–18.
[4] Das K.B, Choudhauri D, Das S.S and Nanda S (2017): Length- weight relationship, relative condition factor and Ponderal index of Blotched roaker, Nibea maculate of Gopalpur cost Odisha. Int. J.of Fisheries and aquatic studies 59 2): 566-570.
[5] Froese, R. (2006): Cube law, condition factor and weight-length relationships: history, meta-analysis and recommendations, J. Appli. Ichthyol. 22:241–253.
[6] Le-Cren, E.D. (1951): The length-weight relationship and season cycle in gonad weight and condition in Perch (Perca fluviatilis), J. Ani. Ecol. 20:179–219.
[7] Mac Gregoer, J. S. (1959): Relation between fish condition and population size in the sardine (Sardinops cacrulea). U.S. Fishery Wild Service, Fish Bulletin, 60:215-230.
[8] Mir, J.I., Sarkar, U.K., Dwivedi, A.K., Gusain, O.P., Pal, A., Jena, J.K. (2012): Pattern of intrabasin variation in condition factor, relative condition factor and form factor of an Indian Major Carp, Labeo rohita (Hamilton-Buchanan, 1822) in the Ganges Basin, India. Europ. J. Biol.Sci. 4:126-135.
[9] Peters, (1852.): Monatsb. Akad. Wiss. Berlin 1852 681. Errore ortografico, nomenclatura
[10] Riedel, R., Caskey, L.M., Hurlbert, S.H. (2007): Length-weight relations and growth rates of dominant fishes of the Salton Sea: implications for predation by fish-eating birds, Lake and Reservoir Management. 23:528-535.
[11] Shafi and Yousuf (2012): Length – weight relationship and condition factor in Puntius conchonius from Dal lake Kashmir, International J. Of scientific and research Publication 2(3); PP. 2250- 3154.
[12] Thomas, J.S., Venus and Kurup B.M (2003): Length – weight relationship of some deep sea fish inhabiting continental slope beyond 250 m depth along west cost of India naga world fish center Quart 26, 17-21.
[13] Wey L.F, Hecht. T (1998): The biology of Tilapia rendalli and orechromis mossambicus in subtropical lake in Mozambique. South African J. of zoology. 33(3): 178-188.

