Analysis of Length-Weight Relationship and Condition Factor of *Tor Putitora* (Hamilton) and *Labeo Dero* (Hamilton) From Nangal Wetland, Punjab, India

Y. K. Rawal[1], Amandeep Kaur[2], Apneet Kaur[3]

[1]Assistant Professor, Panjab University, Fisheries Lab., Department of Zoology, Chandigarh – 160014, India
[2, 3]Research Scholars, Panjab University, Fisheries Lab, Department of Zoology, Chandigarh – 160014, India

Abstract: ***The Nangal dam has been constructed across the river Sutlej at Nangal (Punjab) that led to the development of a lake called as Nangal Lake, which has recently been declared as wetland of National importance. The present investigation has been designed to estimate length-weight relationship and condition factor for two fish species i.e. Tor putitora (Hamilton) and Labeo dero Hamilton collected from Nangal wetland. The correlation coefficient (r) was found to be 0.965 (p<0.01) for both the fish species indicating a direct linear relationship. In LWR ($W=aL^b$) values of exponent 'b' and condition factor was observed to be 2.7; 2.9 and 0.922; 1.183 for Tor putitora (Hamilton) and Labeo dero (Hamilton) respectively.***

Keywords: allometric growth, condition factor, Nangal dam.

1. Introduction

Freshwater habitats occupy nearly 1% of the earth's surface as compared to sea water; with lakes occupying merely less than 0.007% of the world's fresh water resources. Though area occupied by lakes are too less, yet they represent the hotspots of biodiversity that supports 10% of all the known species. 20% of the known biodiversity in India has been estimated to be supported by freshwater ecosystems (Deepa and Ramachandra, 1999).

Wetlands far from being the wastelands of past perception have a wide range of valuable functions which provide goods and services to humans (Hollis *et al.*, 1988). They are considered as 'Biological Supermarkets' and rightly called as 'kidneys of the landscape' (Mitsch and Gosselink 1986). Four of the major functions performed by wetlands are biodiversity support, water quality, flood abatement and water quality management (Greeson *et al*., 1979).

It is only in 1981 that India accepted the Ramsar Convention of classification of the wetlands, according to which, there are a total of 26 Ramsar sites in India till date, out of which 3 viz. Harike, Kanjli and Ropar wetlands are present in Punjab (February 2, 2007). Apart from the internationally important wetlands, two wetlands viz. Nangal wetland and Ranjit Sagar wetland have also been categorised as national wetlands on account of the rich biodiversity they support but so far no efforts are being made towards to assess their conservation status.The nationally important wetland i.e. Nangal wetland in Punjab has recently been declared as a wildlife sanctuary (July, 2010) too so fishing activities are restricted there. Nangal wetland was constructed by diverting water of Sutlej River. It is also important to mention here that Nangal wetland act as a balancing reservoir so as to smoothen out the diurnal variation in release of water from Bhakra dam during the production of electricity. This factor contributes to comparatively lesser productivity in terms of fish biodiversity in this wetland. Hence it has also been categorized as a "Buffer Lake". There is no previous documentation of aquatic biodiversity of this wetland. So the present investigation on Nangal wetland has been undertaken with the aim to analyze length-weight relationship and condition factor of *Tor putitora* (Hamilton) and *Labeo dero* (Hamilton) from Nangal wetland.

2. Study Area

Nangal is located at 31.37^0 N 76.38^0 E on the boundary of Himachal Pradesh and Punjab at an altitude of 326 meters at the base of the Shiwalik hills (Figs.1.). The Nangal wetland came into existence mainly due to the discharge of the Bhakra dam. The construction of the Nangal dam has led to the development of a lake called as Nangal Lake. The average depth of the lake is 24 meters with a maximum depth of 41 meters and spreads over an area of 400 ha.

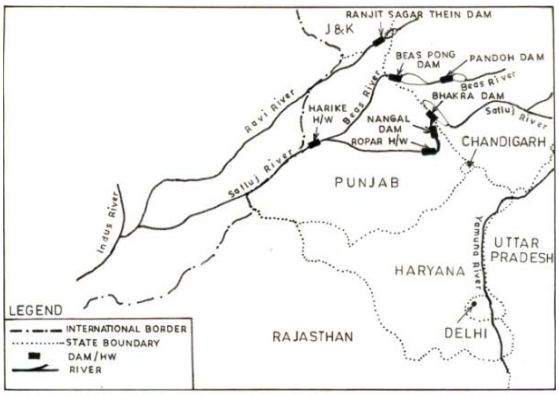

Figure 1: Location of Nangal Wetland, Punjab

3. Material and Methods

The data for length-weight analysis was collected during the months of May, 2011 and October, 2011 from Nangal wetland. A total of 35 samples were assessed out of which 23 specimens were *Tor putitora* (Hamilton) and 12 *Labeo dero* (Hamilton). Data for length-weight assessment was recorded in the field itself with the help of measuring board and weighing balance upto an accuracy of 0.1 cm and 0.1 gms by a single person so as to avoid handling errors of any kind (Jayaram, 2010).

The parameters of the length-weight relationships were calculated by using Le Cren (1951) equation. The length-weight pairs were plotted initially in order to identify and delete the possible outliers. Linear transformation was made by using the natural logarithm of the observed lengths and weights proposed by Zar (1984).

Condition factor

Condition factor (K) was determined using length-weight data following the equation given by Le Cren (1951).

4. Results

Sample size, minimum and maximum reported length (Froese and Pauly, 2010) for both the species is presented in Table1.

Exponent value 'b' for both *Tor putitora* (Hamilton) and 12 *Labeo dero* Hamilton was observed to be 2.7 and 2.9 respectively, although value of 'b' in case of latter is very nearer to 3 i.e. isometric growth but still represents negative allometric growth.

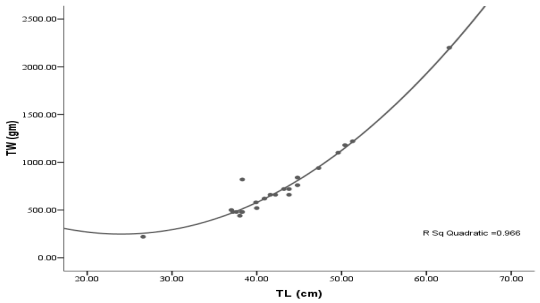

Figure 2: Relationship between actual Total Length (TL) (cms) and Total Weight (TW) (gms) of *Tor putitora* (Hamilton) from Nangal wetland

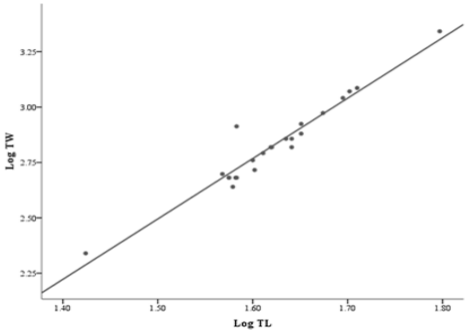

Figure 3: Relationship between Log Total Length (TL) (cms) and Log Total Weight (TW) (gms) and Log TL and Log TW of *Tor putitora* (Hamilton) from Nangal wetland

Curvilinear graphs have been obtained when plotted between actual length and weight but to simply data interpretation and to obtain a straight line graph, logarithmic values have been used (Figures 2-5). Regression equation was observed to be:

TW= -1.59 + 2.72 LogTL *Tor putitora* (Hamilton)
TW= -1.89 + 2.98 Log TL *Labeo dero* (Hamilton)

The value of condition factor 'K' was calculated to be 0.922 and 1.183 for *Tor putitora* (Hamilton) and 12 *Labeo dero* (Hamilton) respectively.

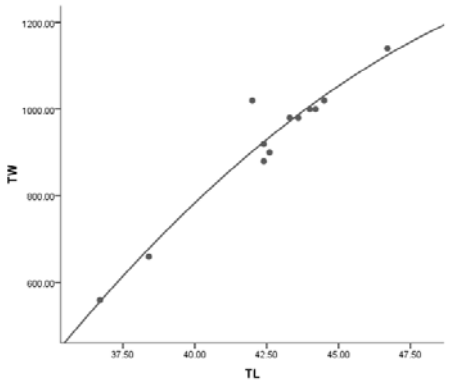

Figure 4: Relationship between actual Total Length (TL) (cms) and Total Weight (TW) (gms) of *Labeo dero* Hamilton collected from Nangal wetland.

Table 1: Number of specimens, range of Total Length and Total Weight of *Tor putitora* (Ham.) and *Labeo dero* (Ham.) collected from Nangal Wetland, Punjab

Fish Species	*N*	*TL (cm)*	*TW (gms)*
Tor putitora (Ham.)	23	26.60-62.70	220-2200
Labeo dero (Ham.)	12	36.70-46.70	560-1140

N: Number of specimens; TL: Total Length; TW: Total Weight

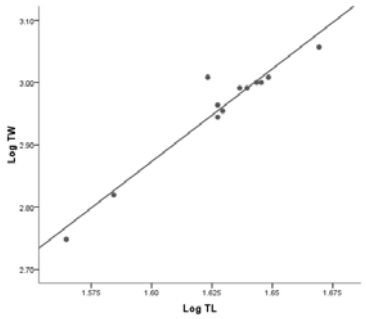

Figure 5: Relationship between Log Total Length (TL) (cms) and Log Total Weight (TW) (gms) of *Labeo dero* Hamilton collected from Nangal wetland.

5. Discussion

The growth pattern of the fish is measured by the value of exponent 'b' in Le Cren length-weight equation and is a measure of robustness of the fish. Various authors described different range of value of exponent 'b'. According to Hile (1936) whereas according to Tesch, (1971) it may range between 2.0-4.0. The slopes (*b*) of the L-W regression lines for *Tor putitora* and *Labeo dero* from Nangal wetland was observed to fall within the range prescribed by above authors. However, as per Wootton (1990) the value for 'b' remains constant at 3 for the ideal fish, lesser or greater value indicate allometric growth either positive (b>3) or negative allometric growth (b<3) (Tesch, 1971, Chaudhuri, 1973 and Ricker, 1975), thus suggestive of negative allometric growth for both the fish species.

Furthermore, negative allometric growth has been observed in Bhimtal Lake (2.538), India by Rajput (2011), contrastingly positive allometric growth for *Tor* species was observed at Pong Reservoir, India (3.150), Nursery Kotly Araian, Pakistan (b= 3.143) and Bari Talab, India (b= 3.113) by Johal *et al*. (2005), Chatta and Ayub (2011) and Ujjania *et al*. (2012) respectively.

Present observations has been found to be in strong correlation to studies of Laskar *et al*. (2009) and Rajput (2011) who worked on *Neolissocheilua hexagonolepis* and *Tor tor*.

Various earlier workers investigated water bodies for LW analysis on different species of *Labeo*. Pioneer work dated back to 1992 by Torres who investigated Lake Kariba, Zambia for LW analysis of four species of *Labeo* and observed exponent value 'b' to be ranged between 2.976-3.325 for *L. altivelis* and *L. cylindricus* respectively, thus indicating negative and positive allometric growth.

Value of 'b' has been found to vary between a minimum of 2.320 to a maximum of 3.460 at Malilangwe Reservoir, Zimbabwe and Keenjhar Lake, Pakistan worked out by Dalu *et al*. (2013) and Dars *et al*. (2010) respectively. The results of present investigation has been found to be in strong corroboration to the studies of Bhat (2011), Karna and Panda (2012), Naeem *et al*. (2012) and Prasad *et al*. (2012) as value of 'b' was observed to be 2.98 which is very nearer to 'b' for *Labeo* worked out by these workers.

6. Conclusion

From the present investigations, it can be concluded that both fish species exhibited highly significant positive correlation between total length and total weight. Furthermore, negative allometric growth has been observed although growth in case of *Labeo dero* is quite nearer to isometric as indicated by 'b' value. The major contribution of this study is the provision of base line data on the length-weight relationship of fish species found in Nangal wetland as there is no previous documentation.

7. Acknowledgement

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