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STUDIES ON LWR AND CONDITION FACTOR OF TWO POPULATIONS OF *LABEO GONIUS* FOUND FROM RIVER INDUS; SINDH-PAKISTAN

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ABSTRACT

The current study reports the Length weight relationship (LWR) and condition factor of *Labeo gonius* from Matyari and Thatta, upstream and downstream respectively of River Indus; Sindh, Pakistan. In the current investigation 17 Morphometric and 6 meristic traits of *Labeo gonius*, 230 individuals of population A (upstream) and 195 individuals of population B (downstream) were analyzed. The expected LWR and condition factor was computed by LeCren (1951) formula and Fulton condition factor also was calculated for both populations. LWR for population A was found r^2=0.876 and r^2=0.846 was recorded for population B. Whereas, the physical association of population A was found to be as *b*=2.782 and *a*=0.038. While for the population B it was recorded as *b*=2.063 and *a*=0.045. Further, the LeCren condition factor was *Kn*=41.561 and *Kn*= 44.0234 for population A and B, respectively. In further, the Fultons condition factor *K*=12.486 was calculated for population A and *K*=13.832 was calculated for population B. The *b* value of *labeo gonius* showed less than standard value (*b*=3) in present research which indicates the fishes becomes lighter as it grows. Whereas smaller variation in findings might be because of food accessibility and state of development. The Condition factor follows, throughout its changes, report on the physiological status of the fish in relative to its benefit. The variation in the value of k and kn of the fish has been basically relegated to reliance on numerous components such as feeding, intensity, fish size and accessibility of fish. These dissimilar figures specify the quantity of nourishment resource accessibility and ecological circumstances. Over all, study suggests that there is poor nutritional supplements in the environment, even downstream is poor as comparative to the upstream. Further, investigations needed on the nutrient contents in both the environment for better fishery sources in future. The findings of this research might be helpful as supportable administration in addition to fishing supervisor.

1. INTRODUCTION

Fish is an extensive supply of nutrients and extremely valuable within the diet they contribute superior amount of protein and vitamins (Roopma Gandotra *et al.*, 2017). Fisheries are one in all the foremost essential sources of income to the financial system of a country and as a crucial food sector in human being nourishment (Dwivedi *et al.*, 2009). Comparatively 8,000 variety of natural water Pisces

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occupy reservoir, pond and waterway all over the globe (Nelson, 2006).

Concerning 193 inhabitant Pisces variety are reportable in natural water of Pakistan (Rafiq *et al.*, 2007). Pakistan is one in all the super diverseness of fishes and as well water resources, thus it's particularly significant to try and do such assessment (Das B. K *et al*., 2013). *Labeo gonius* (Hamilton-Buchanan) that is medium sized cyprinid that initiate as an essential food fish (Ricker W. E *et al*., 2013). *L. gonius* (Hamilton), domestically known as "Gonia" or 'Seriah". Begin in reservoir, ponds and waterway of Pakistan, India, Nepal, Burma and East Pakistan (Mirza, 1982). The Indus River is one of the major fishery sources of Pakistan, that has diverse variety of fish species. As the fish is cold blooded animal and quickly adopt the environmental changes. There is anthropological effect on the environment of Indus River water flow along with the global environmental change. Therefore, it is essential for the fishery production to know the health status of the fish in Indus River. *L. gonius* is one of the species that is not only popular because of its delicious taste but also popular because of its beautiful morphological features. Morphometric measurements, length-weight relationships could modify throughout the events of life cycle like structural changes, development and beginning of maturity. L-W relation provides awareness lying on the changes within the prosperity of the fishes that happens for the period of their life cycle (LeCren, E. D *et al*., 1951). The weight-length research has useful assessment in fish biology. Implication of the study in fishes is to evaluate the expansion of fish in diverse environments. Weight length relationship is employed on business scales in population assessments. Various authors delineated the significance of length weight relationship on a variety of fish species (Naeem. M *et al*., 1992).

The length weight relationship (LWR) is a crucial implement in fish biology, physiology and environmental science and fisheries evaluation (LeCren, 2001 and Choudhury S. *et al*., 2012). In Pisces, characteristically the development design pursues the cubical shape law (Bolger T. and Connoly P. L., 2009; Froese R. and Pauly D., 2008; Kar D., 2007). Such correlations for the fishes are going to be applicable once the fish grows isometrically. In such belongings the exponential rate should be accurately (Das B. K., 2013 and Kar D., 2013). The definite correlation among length and mass could abandon as of the perfect rate because of ecological circumstances or state of fishery (LeCren, 2001).This association is articulated through the equation $W = aL^b$. This equation was use by numerous workers for various species from dissimilar habitats. Additionally, condition factor (K) is calculated from the link among the Pisces mass and its length, through the purpose of describing the "condition" of that individual fish (Froese, 2006).

2. MATERIALS AND METHODS

Data collection:

In the current study 230 samples of *Labeo gonius* were together from upstream (Population A) and 195 specimen from downstream (Population B) River Indus, Sindh- Pakistan, by a variety of kind of the nets. Digital photographs of all the samples were taken within the field in addition the specimen were bring toward the research lab of Zoology Department, University of Sindh, Jamshoro Pakistan for fishery recognition, description and measurement of length and mass. Recognition of preferred fish was through by the assistance of connected articles, findings, research papers, details and keys particular through Talwar and Jhingran (1991).

Morphometric and Meristic traits:

A total of 17 Morphometric traits were measured on the fish measurement board. The fish mass was measured by the balance machine. A total length (TL) of every fishery was noted toward the nearby 0.01 cm and body weight (BW) was record nearest to 0.01 gm. The subsequent parameters Total weight (TW),Total Length (TL), Eye diameter (ED), Standard Length (SL), Head length (HL), Fork length (FL), Girth (Gr), Dorsal Fin base Length (DFL), Pectoral Fin Length (PFL), Ventral Fin Length (VFL), Anal Fin Length (AFL), Caudal Fin Length (CFL), Snout Length (SnL), Height of Caudal Peduncle (CPH), Lateral Line Scale Length (LLSL), Pectoral Ventral Distance (PVD) and Ventral Anal Distance (VAD) . The eye diameter was calculated by the assistance of Vernier caliper. All the recorded data was statistically analysed. Further, 6 meristic traits together with Dorsal Fins Rays (DFR), Pectoral Fins Rays (PFR), Ventral Rays (VFR), Anal Fins Rays (AFR), Caudal Fins Rays (CFR) and Lateral

Line Scales (LLS) were count through assistance of magnify reflector and node.

STATISTICAL DATA ANALYSIS:

The information was analyzed by revenue of SPSS (11.5) software package LWR relation was computed as recommended through LeCren (1951).

Length-weight relationship:

All LWR were calculate with the least square fitted methodology toward Log transformed facts by means of the gathering as recommended by the LeCren, (1951) equation $W= aL^b$ in excel computer program. While total weight of Pisces in gm, length of fishery in cm, the constant c.f was *a* and *b* was an exponent representing isometric/allometric development. Parameters *a* and *b* were calculable with linear regression on transformed equation. The equation 1 may showed in the linear form by use of logarithms, as given below:

Log W = Log a + b Log L

The estimation of the constant c and n were accessed empirically through with the formula, as follows:

$$Log\ = \frac{\Sigma LogW \times (\Sigma logL2) - \Sigma LogL \times \Sigma(LogL \times LogW)}{N(\Sigma LogL2) - (\Sigma(LogL)2)}$$

$$n = \frac{\Sigma LogW - NLogC}{\Sigma LogL}$$

Length Frequency:

Computer software package FiSAT II (FAO-ICLARM) reserve assessment apparatus, (Gayanilo *et al*., 2003) was useful for the investigation of length-frequency information of *Labeo gonius* to estimation the centered parameters of g parameters of development

Condition factor 'k'

The fishery condition factor (f.c) the Fulton's Condition Factor (*K*) was calculated through with the formulae, as follows:

$$\text{Fulton c.f. } (K) = \frac{Weight\ (g)}{(\ length)3\ (cm)} \times 100$$

(*K* is the c.f. while W is the weight of the fish in g and L, the length in cm). Condition factor (*Kn*) was determined for diverse length groups using length and weight information following the equation given by LeCren (1951):

$$\text{The LeCren Condition Factor } Kn = \frac{(w \times 100)}{L3}$$

3. RESULTS

The LWR of the two populations, Matyari upstream (A) and Thatta downstream (B) populations was analyzed for *Labeo gonius* found from Indus River Sindh-Pakistan. The evaluated *b* values in current investigation for *Labeo gonius* was a= 0.038, b= 2.782 and correlation r^2= 0.876 for population A (Figure 1 and Table.1). Further the correlation for population B was resulted r^2= 0.846, a= 0.045 and b= 2.063 (Figure 2 and Table.1). The LeCren condition factor was found *Kn*=41.561 and *Kn*= 44.0234 for population A and B, respectively. While, the Fultons condition factor for the population A was recorded *K*=12.486 and for population B was *K*=13.832.

Out of 17 morphometric traits, 15 traits (except length and weight) were analyzed for their correlation with the length in each population. The correlation of TL with fifteen characters (BW, ED, SL, HL, FL, Gr, DFL, PFL, VFL, AFL, CFL, SnL, CPH, LLSL, PVD and VAD) at that point we determined that eight traits SL, FL, DFL, PFL, CFL, CPH, PVD, L.LSL found strong correlation 0.991 (cm), 0.814 (cm), 0.844 (cm), 0.857 (cm), 0.853 (cm), 0.806 (cm), 0.878 (cm), 0.820 (cm) while five traits ED= 0.645 (mm), HL 0.789 (cm), Gr= 0.704 (cm), VFL= 0.625 (cm), VAD= 0.758 (cm) reflects moderate correlation whereas two characters AFL= 0.386 (cm) and SnL= 0.211(cm) have poor relationship separately in population A (Table.2). While in population B only one trait, the eye diameter (ED= 0.226) shows the weak correlation and all other traits have strong correlation with the length (Table.3). Overall only ED is one of the trait in both of the population that shows weak correlation (Table.4).

4. DISCUSSTION

In current research LWR and condition factor of two populations of *Labeo gonius* from Indus River were studied. LWR relation gives the knowledge regarding the occasional modifying and information of specific region of fishery species. It additionally characterizes the fishery development like isometric or allometric, this knowledge concerning the development design of fishery is well thought-out to be an imperative characteristic to recognize the fishery populace direction. The statistical relationship connecting LWR is greatly significant means used for the assessment masses of the fishery of well-known lengths (pauly and Gayanilo, 1996). The approximated LWR specifications in current research were correlated to LWR specifications of the further researcher's effort. The approximated findings of (a)

0.038 in my investigation for *Labeo gonius* were usually less significant than earlier approximated findings and the approximated findings except *L. rohita* (b) 2.782 in this investigation for *Labeo gonius* were usually smaller than the earlier approximated findings except *L. rohita* for diverse region of the world. However, the current evaluated values of *labeo gonius in* (upstream population) *a, b* and r^2 as 0.038, 2.782 and 0.876 while LWR parameters for *labeo gonius* (downstream population) were as *a*= 0.045, *b*=2.063 and r^2=0.846. In the present study (upstream and downstream population) the approximated *b* value of *labeo gonius* showed less than standard value (*b*=3) in present research which indicates the fishes becomes lighter as it grows. Whereas smaller variation in findings might be because of food accessibility and state of development (Frost, 1945; Le Cren, 1951; Naeem *et al*., 1992; Salam*et al*., 1994;Ali *et al*., 2000).

The Condition factor (K) follows, throughout its changes, report on the physiological status of the fish in relative to its benefit. The variation in the value of *K* and *Kn* of the fish has been basically relegated to reliance on numerous components such as feeding, intensity, fish size and accessibility of fish (LeCren, E. D., and J. Anim. Ecol., 1951). In upstream populace correlation coefficient was 0.878 and it was very noteworthy ($p<0.001$). This showed a close up connection among length and mass. Whereas the correlation coefficient of downstream population was 0.846 and it was significant ($p<0.001$). The determined b value (upstream and downstream population) in this work b=2.782 and b=2.063 of *Labeo gonius* the estimated results of *Labeo gonius* upstream population less than 3 that indicates negative allometric growth, whereas the evaluated results of downstream population less than 3 that also shows negative allometric growth, out of these both populations the growth condition of the downstream population is more concern.

5. CONCLUSION

The result of LWR and condition factor in both of the populations (upstream and downstream) is of great concern. The growth condition of the both the population is not normal according to the present findings. That is great threat to the species. These findings suggest that there are not enough food available. As we know the food production or productivity of water is depend upon the quality of water in any water body. Therefore, this is the indicator that water quality of Indus River is not suitable for primary productivity. Therefore, further more investigation is needed on the water quality of Indus River. Further, the current research has a great concern over the growth of *L.gonius*. Hence it has to consideration for preservation biologist, fruitful improvement, production and supervision of fishes and ultimate preservation of the foremost preferred food fishes of the states.

6. ACKNOWLEDMENT

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7. CONFLICT OF INTEREST

All authors have declared that there is no conflict of interest regarding publication of this article.

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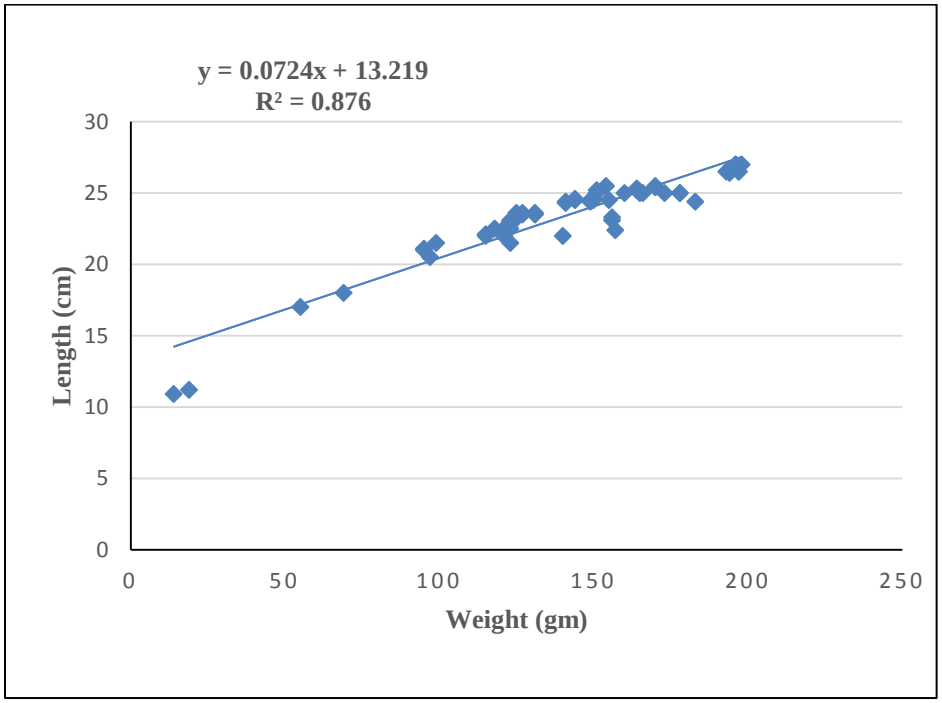

Fig.1. LWR of *Labeo gonius* population A (upstream population), Indus River, Sindh Pakistan

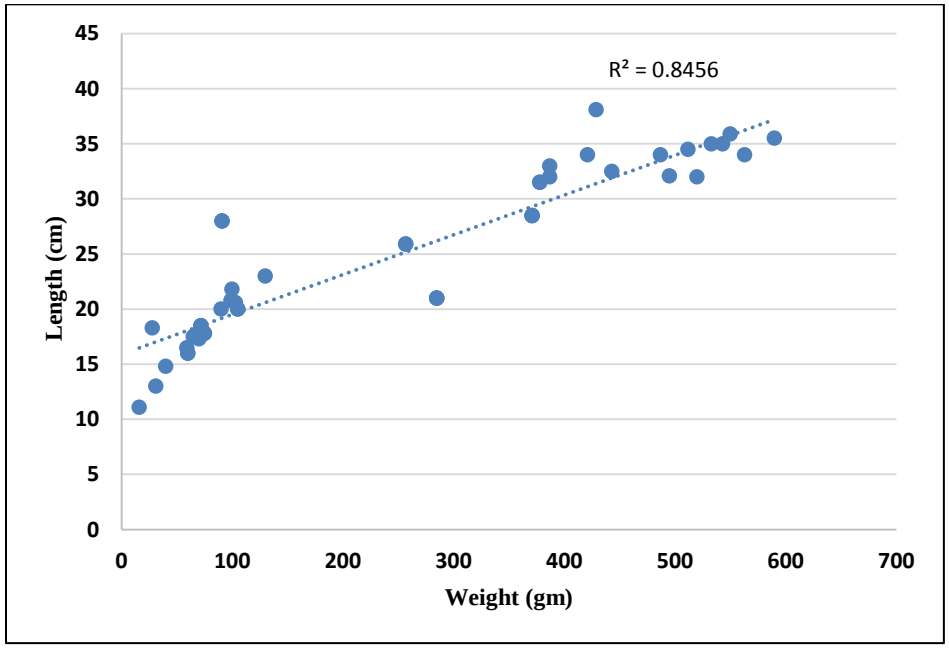

Fig.2. LWR of *Labeo gonius* population B (downstream population), Indus River, Sindh Pakistan

Table 1. Length-Weight relationship of Labeo gonius (Upstream and Downstream population)

Groups	**Average Length (cm)**	**Average Weight (gm)**	***a***	***B***	**Fulton's Condition factor (*k*)**	**Le Cren Condition factor (*kn*)**
Population A	23.457	141.443	0.038	2.782	12.486	41.561
Population B	24.6	240.92	0.045	2.063	13.832	44.024

Table 2. Correlation of various morphological traits of Upstream Population *L. gonius* from Indus River, Sindh-Pakistan

	w (gm)	*TL (cm)*	*ED (cm)*	*SL*	*HL*	*FL*	*Girth*	*DFL*	*PFL*	*VFL*	*AFL*	*CFL*	*SnL*	*CPH*	*PVD*	*VAD*	*L.LS.L*
w (gm)	1																
TL (cm)	0.937	1															
ED (cm)	0.564	0.645	1														
SL	0.945	0.991	0.672	1													
HL	0.771	0.789	0.511	0.790	1												
FL	0.755	0.814	0.440	0.813	0.672	1											
Girth	0.689	0.704	0.334	0.698	0.596	0.821	1										
DFL	0.781	0.844	0.652	0.854	0.773	0.681	0.582	1									
PFL	0.812	0.857	0.615	0.851	0.805	0.733	0.665	0.764	1								
VFL	0.656	0.625	0.373	0.620	0.677	0.528	0.460	0.606	0.689	1							
AFL	0.356	0.386	0.332	0.402	-0.026	0.337	0.262	0.168	0.294	-0.143	1						
CFL	0.840	0.853	0.532	0.853	0.648	0.733	0.648	0.631	0.781	0.487	0.465	1					
SnL	0.246	0.211	0.164	0.239	-0.248	0.151	0.134	-0.011	0.096	-0.157	0.840	0.368	1				
CPH	0.813	0.806	0.457	0.801	0.761	0.584	0.435	0.777	0.710	0.600	0.145	0.642	-0.055	1			
PVD	0.868	0.878	0.534	0.873	0.718	0.708	0.645	0.809	0.736	0.592	0.239	0.718	0.096	0.771	1		
VAD	0.785	0.758	0.427	0.755	0.716	0.605	0.600	0.664	0.649	0.628	0.051	0.635	-0.038	0.711	0.832	1	
L.LS.L	0.779	0.820	0.441	0.807	0.770	0.701	0.665	0.707	0.754	0.625	0.158	0.674	-0.047	0.740	0.757	0.752	1

Note: BW=Bodyl weight, TL =Total Length, ED=Eye diameter, SL=Standard Length, HL=Head length, FL=Fork length),Gr= Girth, DFL=Dorsal Fin base, PFL=Pectoral Fin Length, VFL=Ventral Fin Length, AFL=Anal Fin Length, CFL=Caudal Fin Length, SnL=Snout Length, CPH= Caudal peduncle height, PVD=Pectoral Ventral Distance, VAD=Ventral Anal Distance and L.L.S.L=Lateral Line Scale Length (1= strong correlation, 0.5= moderate correlation and 0.5<, weak correlation

Table 3. Correlation of various morphological traits of Downstream Population *L. gonius* from Indus River, Sindh-Pakistan

	w (gm)	*TL (cm)*	*ED (mm)*	*SL*	*HL*	*FL*	*Girth*	*DFL*	*PFL*	*VFL*	*AFL*	*CFL*	*SnL*	*CPH*	*L.L.SL*	*PVD*	*VAD*
w (gm)	1																
TL (cm)	0.920	1															
ED (mm)	0.133	0.226	1														
SL	0.935	0.990	0.181	1													
HL	0.820	0.915	0.167	0.919	1												
FL	0.903	0.964	0.181	0.966	0.884	1											
Girth	0.871	0.945	0.181	0.939	0.903	0.935	1										
DFL	0.926	0.982	0.161	0.988	0.900	0.959	0.942	1									
PFL	0.886	0.926	0.057	0.939	0.863	0.914	0.929	0.949	1								
VFL	0.914	0.955	0.121	0.963	0.898	0.927	0.954	0.965	0.949	1							
AFL	0.789	0.834	0.100	0.849	0.753	0.823	0.746	0.817	0.770	0.780	1						
CFL	0.846	0.934	0.150	0.940	0.884	0.919	0.958	0.938	0.916	0.948	0.725	1					
SnL	0.865	0.887	0.059	0.895	0.844	0.887	0.848	0.902	0.846	0.903	0.789	0.833	1				
CPH	0.844	0.920	0.157	0.921	0.871	0.904	0.907	0.919	0.879	0.895	0.818	0.891	0.852	1			
L.L.SL	0.897	0.966	0.174	0.965	0.904	0.958	0.935	0.956	0.911	0.951	0.823	0.925	0.888	0.910	1		
PVD	0.828	0.895	0.198	0.891	0.842	0.900	0.867	0.883	0.836	0.884	0.704	0.886	0.811	0.818	0.932	1	
VAD	0.894	0.916	0.125	0.917	0.865	0.919	0.909	0.922	0.873	0.915	0.751	0.876	0.890	0.870	0.949	0.897	1

Note: BW=Bodyl weight, TL =Total Length, ED=Eye diameter, SL=Standard Length, HL=Head length, FL=Fork length),Gr= Girth, DFL=Dorsal Fin base, PFL=Pectoral Fin Length, VFL=Ventral Fin Length, AFL=Anal Fin Length, CFL=Caudal Fin Length, SnL=Snout Length, CPH= Caudal peduncle height, PVD=Pectoral Ventral Distance, VAD=Ventral Anal Distance and L.L.S.L=Lateral Line Scale Length (1= strong correlation, 0.5= moderate correlation and 0.5<, weak correlation)

Table 4. Correlation of morphometric traits with total length (TL) for Upstream and Downstream Population L. gonius from Indus River, Sindh-Pakistan

S:No	Morphological trait	Population A	Population B
1	ED (mm)/TL	0.645	0.226
2	SL (cm)/TL	0.991	0.990
3	HL (cm)/TL	0.789	0.915
4	FL (cm)/TL	0.814	0.964
5	Girth (cm)/TL	0.704	0.945
6	DFL (cm)/TL	0.844	0.982
7	PFL (cm)/TL	0.857	0.926
8	VFL (cm)/TL	0.625	0.955
9	AFL (cm)/TL	0.386	0.834
10	CFL (cm)/TL	0.853	0.934
11	SnL (cm)/TL	0.211	0.887
12	PVD (cm)/TL	0.878	0.895
13	VAD (cm)/TL	0.758	0.916
14	L.L.S.L (cm)/TL	0.820	0.966
15	CPH (cm)/TL	0.806	0.920