

(RESEARCH ARTICLE)



Length-weight relationship of *Cirrhinus Cirrhosus* inhabiting Indus River, Sindh-Pakistan

Kashaf Malik¹, Sumeera Malik¹, Dilawer Bhambhro², Maryam Sheikh², Shehla Malik¹, Ayaz Hussain Qadri¹, Muhammad Younis Laghari^{2,*}, Punhal Khan Lashari² and Ateeq-u-Rahman Khuharo³

¹ Department of Zoology, University of Sindh, Jamshoro, Pakistan.

² Department of Freshwater Biology and Fisheries, University of Sindh, Jamshoro, Pakistan.

³ Centre of Excellence in Marine Biology, University of Karachi, Sindh, Pakistan.

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Abstract

The present work reports the length–weight relationships (LWR) and condition factor and of *Cirrhinus cirrhosus* inhabiting in River Indus, Sindh-Pakistan. The Length-weight relationship is an important tool for fishery management. A total of 340 specimens (individual) of length–weight were measured. A maximum length of the groups was observed 20.7cm and minimum as 9.4cm. The maximum weight was recorded about 84gm and minimum as 6gm. The estimated values of length-weight relationship and condition factor were calculated by formula Le Cren (1951), as $Kn=0.547$, and Fulton as $K=0.724$. Length-weight was found with a strong correlation of $n=3.101$, $C=0.0176$ with $r^2=0.894$. The results of this work would be beneficial for sustainable management as well as fishery managers.

Keywords: *Cirrhinus Cirrhosus*; LWR; Condition Factor; Growth Pattern; Indus River.

1. Introduction

Fish can be a potential candidate for artificial culture in ponds, so it is important to study its length-weight relationship and condition factor. At present no published information is available on any biological aspect of this important food fish *Cirrhinus cirrhosus* from Pakistan “[1]”. Mrigal (*Cirrhinus cirrhosus*) is known as ‘Saryo’, one of the common members of major carps in Pakistan found in the rivers, canals and floodplains. The genus is represented by 2 species namely *Cirrhinus mrigala* and *Cirrhinus reba*, *Cirrhinus mrigala* (Hamilton) is currently a synonym of *Cirrhinus cirrhosus* (Bloch). Rohu and mrigal are important major carps in our aquaculture and also a vital source of the protein food supply for the people of Pakistan “[2]”. It is commonly found in clean waters of rivers, canals, streams and other flood plains of Pakistan India and Bangladesh “[3]”. Pakistan has about 193 “[4]” freshwater fish species and *Cirrhinus cirrhosus* is one of the popular and commercial species. This is mostly found in large water bodies and Rivers. Before a decade it was found in large number in the Indus River. Hence, it provided lively hood to local people because of highest production in the natural water. It is a bottom feeder and it feeds on vegetables and small animals “[5]”. It usually does not take worms, insects, mollusks and fishes “[6]”. *C. cirrhosus* is benthopelagic and potamodromous plankton feeder. The aim of the Present study was to determine LWRs for this *Cirrhinus cirrhosus* in two different ecosystems of Indus River Pakistan. Fish populations are highly dependent upon the aquatic habitat which supports all biological functions “[7]”. In fishery science, length weight relationships provide statistics in research and management “[8]”. Length-weight relationship (LWR) is of great importance in fishery assessments. Length and weight measurements can give information on the stock composition, life span, mortality, growth and production “[9]”. Length weight relationships are good indicators of fitness and fish condition “[10]”. Length-weights relationships (LWRs) are still scarce for most

* Corresponding author: M.Y. Laghari

Department of Freshwater Biology and Fisheries, University of Sindh, Jamshoro, Pakistan.

tropical and sub-tropical fish species “[11,12]”. The results obtained from this study will be useful to fisheries biologist. The species had no LWR available in fish base and therefore our results may contribute to this database. Relative weight as management goal is considered by fisheries management and used for Monitoring condition of fishes and for comparative growth studies. Relative weight is also a suitable index for comparing condition across populations and species “[13]”. Slowly the production of such species became declined due to the destruction of its habitat. Therefore, it is essential to save the natural population of this species and ensure the origin stock in future. The present study will contribute for higher production, culture and conservation of this valuable fish species of the Indus River. The Indian major carp species catla (*Gibelion catla*), mrigal (*Cirrhinus cirrhosus*), rohu (*Labeo rohita*) and sometimes kalibaus (*Labeo calbasu*) are major contributors and potential candidate species to the aquaculture and inland fisheries production of Pakistan and have a high demand in the domestic market.

2. Material and methods

2.1. Data collection

In the present study *Cirrhinus Cirrhosus* was collected from two sites, downstream (Thatta) and upstream (Mattiari), by various types of the nets. Digital photographs of all the samples were taken in the field as well as the specimen were brought to the laboratory Department of Zoology, University of Sindh, Jamshoro Pakistan. About 19 morphometric and 6 meristic traits were calculated. Morphometric was measured on the fish measuring board while meristic traits were calculated with the help of magnifying lens. The eye diameter was measured by the help Vernier caliper. The weight of fish was taken by the digital balance machine. The meristic traits were calculated with the help of magnifying lens. The data was analyzed by using SPSS (11.5) software package length weight relationship was calculated as suggested by Le Cren “[10]”.

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A total length (TL) of each fish was measured to the nearest 0.01 cm. Individual body weight (BW) was recorded to the nearest 0.01 gm. The following parameters were measured for data analysis to calculate the effect at different environments (Upstream and downstream) of Indus River.

2.2. Statistical Analysis of Data

2.2.1. Length-weight relationship and Condition factor

length weight relationships were calculated using the least square fitted method to Log transformed data using the function as suggested by the Le Cren “[10]” equation $W = aL^b$ in excel computer program. Whereas: W is the total weight of fish in g, L was the length of fish in cm, a was constant condition factor and b was an exponent indicating isometric/allometric growth.

The parameters a and b were estimated by linear regression on transformed equation. The equation 1 could be expressed in the linear form by using logarithms, as given below:

$$\text{Log } W = \text{Log } a + b \text{ Log } L$$

The estimates of the constants c and n were obtained empirically by using the formulae, as given below:

$$\text{Log } a = \frac{\sum \text{Log } W \times (\sum \text{Log } L^2) - \sum \text{Log } L \times \sum (\text{Log } L \times \text{Log } W)}{N(\sum \text{Log } L^2) - (\sum (\text{Log } L))^2}$$

$$n = \frac{\sum \text{Log } W - N \text{Log } C}{\sum \text{Log } L}$$

2.2.2. Length Frequency

Computer software package FiSAT II, stock assessment tool “[14]” was applied for the analysis of length-frequency data of to estimate the focused parameters of g parameters of growth.

2.2.3. Condition factor 'k'

The condition factor of the adult fish was determined the Fulton's Condition Factor (K) was computed by using the formulae, as given below:

$$\text{Condition Factor } (k) = \frac{\text{Weight (g)}}{(\text{length})^3 (\text{cm})} \times 100$$

(where K is the condition factor, W is the weight of the fish in g and L, the length in mm). Condition factor (K) was determined for different length groups using length and weight data following the equation given by Le Cren "[10]":

The Le Cren Condition Factor

$$Kn = \frac{(w \times 100)}{L^3}$$

3. Results

3.1. Length Frequency Distribution

The minimum length was observed 9.4cm and the maximum length was recorded 20.7cm with an average length of 20.5cm (Figure 1). While minimum weight was measured 6g and maximum weight was measured 84g with an average weight of 70.6 g.

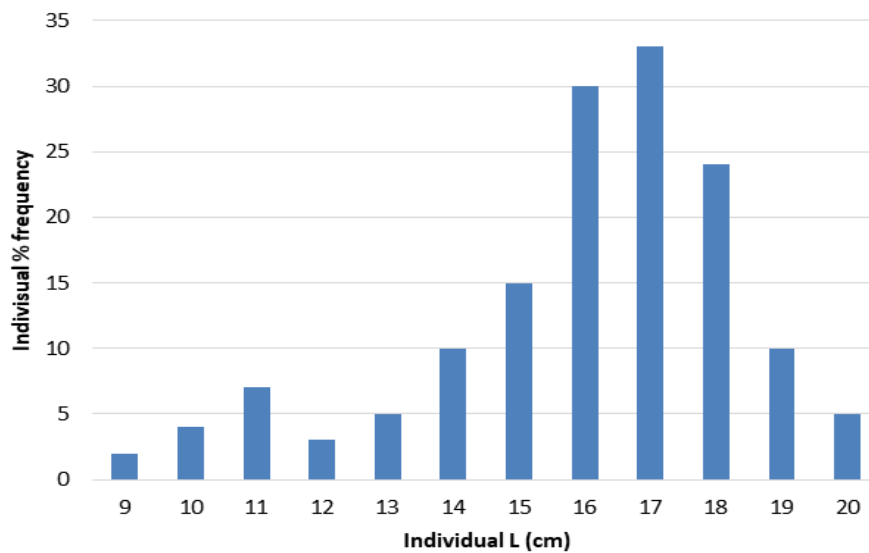


Figure 1 Graph shows the Length frequency of *Cirrhinus Cirrhosus* from Indus River, Sindh Pakistan

3.2. Length — weight relationship

The Length weight relationship of fish species provides knowledge about physical wellbeing of the fish. Gayanelo and pauly, "[8]" has defined the standard value of wellbeing of a fish, i.e. if the b value is 3, so it may shows that the fish growth is isometric, if the b values are <3, it means that the growth of fish is negative allometric, and if the b values are >3, that means the growth of fish is positive allometric. The estimated b values in present study for *Cirrhinus cirrhosus* from indus River (Matyri and Thatta) Sindh Pakistan was a=0.0176, b=3.101 and correlation $r^2=0.894$ (Figure 2).

Length- weight Relationship

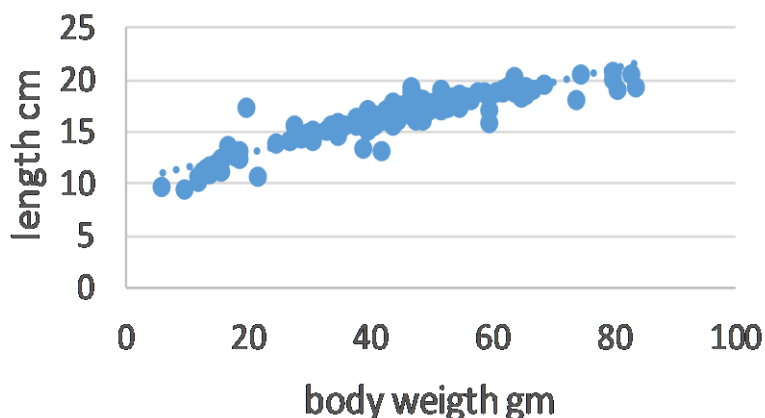


Figure 2 Graph shows the Length — weight relationship of *Cirrhinus Cirrhosus* from Indus River, Sindh Pakistan

4. Discusstion

4.1. Length-weight relationship

The obtained parameters of Length-weight relationship provide the information about the seasonal changes in their environment and about physical well-being of the fish. It is also defining the isometric or allometric growth of the fish, this information about the growth pattern of the fish is considered to be an important feature to know the fish population dynamics. The statistical correlation between the length and weight is highly important tool for the estimation of the weights of the fish of identified lengths “[8]”. The estimated Length weight parameters in present study were compared to Length weight parameters of the other scientist’s work (Table 1). The estimated results of (a) 0.0176 in our study for *Cirrhinus Cirrhosus* were generally smaller than previous estimated results and the estimated results (b) 3.101 in our study for *Cirrhinus Cirrhosus* were generally larger than the previously estimated results from various parts of the world. However, the estimated results of (b) value 0.0176 in our study for *Cirrhinus Cirrhosus* were less than 3, which indicates negative allometric rate of the fish less than 3.00 shows that fish becomes lighter as it grows. While small differences in results may be due to availability of food, condition of maturity and spawning, sex differences “[10,15,16,17]”.

Table 1 comparison of estimated results of length weight relationship of *Cirrhinus cirrhosus* in present study with species from other parts of the world.

Location	Species	<i>a</i>	<i>B</i>	R ²	Source
Taunsa Barrage, River Indus, Pakistan	<i>Cirrhinus Cirrhosus</i>	0.7287	3.29	0.974	Naeem M. <i>et al.</i> , (2017)
India	<i>Cirrhinus Cirrhosus</i>	1.2343	0.4297		Das B. K <i>et al.</i> , (2013)
Mahi Bajaj Sagar, India	<i>L. rohita</i>	-2.409	3.316	0.976	N.C. Ujjania <i>et al.</i> , (2012)
Pakistan	<i>Cirrhinus Cirrhosus</i>	0.00384	2.782	0.8785	Present study

4.2. Condition factor

The Condition factor (k) reflects, through its variations, information on the physiological state of the fish in relation to its welfare. The Fultons condition factor k value is 0.724 and the Le Cren condition factor (kn) value of *Cirrhinus Cirrhosus* is 0.547. The fluctuation in the value of k if fish has been mainly assigned to dependency on many factors such as feeding, intensity, fish size and availability of fish.

5. Conclusion

The results indicate that *Cirrhinus cirrhosus* showed an almost negative allometric pattern of growth in the present habitat and the condition factor values showed that it is in not good condition or health less than 3.00 shows that fish becomes lighter as it grows. Which may be is useful to the study of fishery biology, conservation biologist, successful development, production and management of fishes and ultimate conservation of the most preferred food fishes of the states.

Compliance with ethical standards

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Disclosure of conflict of interest

There is no conflict of interest. The manuscript was finally approved by all authors for publication.

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