

# Length-Weight Relationship in Terms of Seasonal Variation of Carps from Kori Lake, Thatta Pakistan

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**Abstract:** The Experimental fish samples were collected monthly during winter and summer from various fishermen of the Kori lake Thatta Sindh. A total number of 900 fishes (*Labeo rohita*, *Cirrhinus mrigala*, *Cyprinus carpio*, *Catla catla* and *Labeo calbasu*). These fishes ranged from 20.1-25 cm, 25.1-30cm, 30.1-35 cm, 35.1-40, 40.1-45 cm and 45.1-50 cm in TL respectively. The regression coefficient of length- weight relationship and condition factor of *Labeo rohita*, *Cirrhinus mrigala*, *Cyprinus carpio*, *Catla catla* and *Labeo calbasu* were  $\text{Log } W = -0.84 + 2.31 \text{ Log } L$  and  $\text{Log } W = -0.28 + 2.01 \text{ Log } L$  (*Labeo rohita*)  $\text{Log } W = -1.02 + 2.39 \text{ Log } L$  and  $\text{Log } W = -0.76 + 1.73 \text{ Log } L$  (*Cirrhinus mrigala*)  $\text{Log } W = -0.97 + 2.37 \text{ Log } L$  and  $\text{Log } W = -0.14 + 1.89 \text{ Log } L$  (*Cyprinus carpio*)  $\text{Log } W = -0.92 + 2.33 \text{ Log } L$  and  $\text{Log } W = -0.17 + 1.93 \text{ Log } L$  (*Catla catla*)  $\text{Log } W = -0.14 + 2.32 \text{ Log } L$  and  $\text{Log } W = -0.68 + 2.21 \text{ Log } L$  (*Labeo calbasu*)

The length weight relationship values indicated that growth of *Labeo rohita*, *Cirrhinus mrigala*, *Cyprinus carpio*, *Catla catla* and *Labeo calbasu* from Kori lake Thatta Sindh was found to be positive allometry and regression coefficient ( $b=2.31, 2.39, 2.37, 2.31$  and  $2.32$  respectively) indicated as satisfactory growth of major carp *Labeo rohita*, *Cirrhinus mrigala*, *Cyprinus carpio*, *Catla catla* and *Labeo calbasu* from Kori lake Thatta Sindh. The values of relative condition factor (Kn) was calculated for combined sexes for all the fish species found to be mean Kn = 1.06, 1.10, 1.05, 1.03, 1.04 in winter, 1.04, 1.03, 1.03, 1.04, and 1.05 during summer respectively.

**Keywords:** Kori lake, Length- weight relationship, Condition factor and Thatta

## Introduction

Pakistan is bestowed with the land of geological and topographic diversity. The ecological variation is uniformly reflected in all water lands of the country. Pakistan has significantly huge natural inland water resources in the form of ocean, rivers, networks of canals and lakes (Mirza and Rafique, 1994). The country is blessed with one of the largest freshwater resources in the world correspondingly large number of freshwater living vertebrates is available from which fishes are quite significant considering the ecological balance and its consumption as food. It is one of the food sources which solely provide all the essential nutrients, minerals and high quality protein which is not common from other food items (Rafique, 2007). Demand of fish is increasing day by day not only being the naturally available source of food rather the health benefits associated with its consumption. This necessitates to develop a more efficient and sustainable system to increase their growth. Fisheries are one of the most important sources of revenue and socio-economic industry of our country and serves as an important food sector in human nutrition (Dwivedi, *et al.*, 2009). The fish fauna of Pakistan is characterized by at least 193 freshwater fish species belonging to 13 orders, 30 families and 86 genera (Rafique, 2007). Among them, 86 species (8 exotic and 78 indigenous) have been documented as “species of special importance”, in which a minimum of 31 species are important economically (Rafique and Khan, 2012). These fishes are economically important species, which are among the Indian major carps and inhabits river, natural lakes and man- made pond, and distributed in Pakistan, India, Bangladesh, Burma and Nepal.

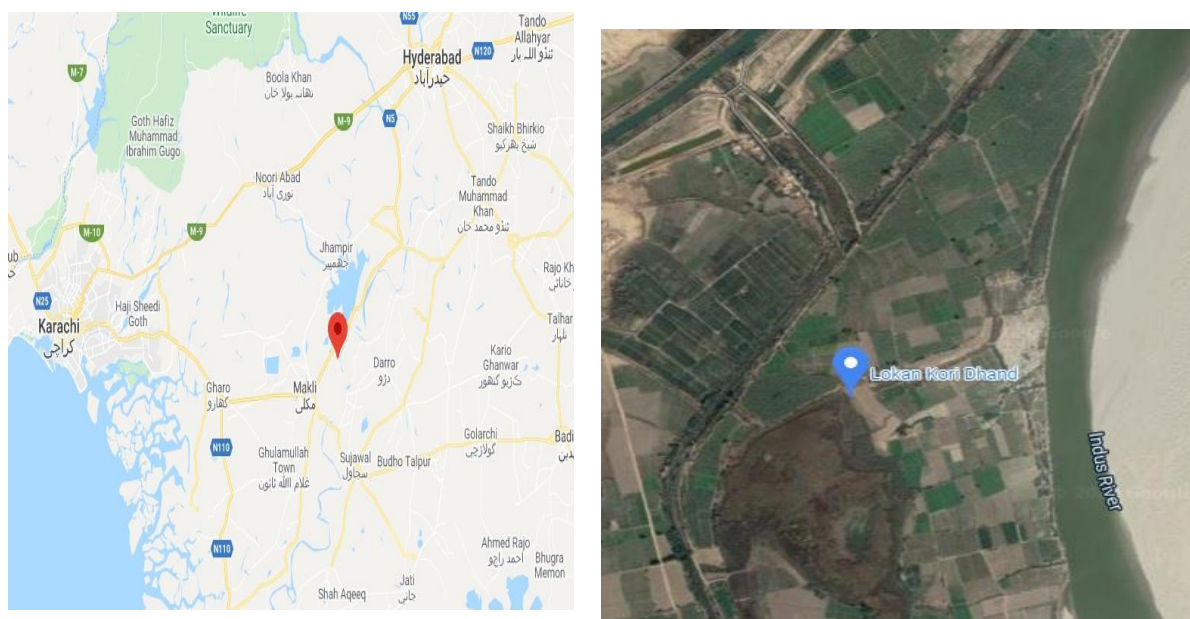
Length weight relationships (LWR) give basic knowledge on fish biology and thus is helpful to approximate the weight from length of individual fish (Forese, 1998; Koutrakis and Tsikliras, 2003) [9, 14]. This also helps to estimate fish crop biomass (Martin-Smith, 1996; Petrakis and Stergiou, 1995) [17, 22] and to convert growth -in- length equations to growth-in weight for prediction of weight-at-age (Pauly, 1993) [21]. Similarly, it is also useful to calculate condition indices (Safran, 1992; Petrakis and Stergiou, 1995) [27, 22] and to compare the morphology of populations from different regions (Petrakis and Stergiou, 1995) [22]. This relationship can also be used to obtain information on the somatic growth condition of fish to find out whether it was isometric or allometric (LeCren, 1951; Ricker, 1975) [15, 25].

Number of fishery scientists around the world was inspired from the importance of length weight relationship and condition factor of fishes and this relationship was applied in marine and freshwater fishes. Such kind of study of Indian major carps in relation to growth parameters was earlier studied by (Patel *et al.*, 2014; Behera *et al.*, 2015; Gokhale *et al.*, 2015; Barrich and Kaur, 2015 and Verma, 2015) [20, 3, 10, 2, 32].

The objective of this study was to determine the length-weight relationships, condition factors and growth performance of major carps as these information will be helpful to management, conservation, culture and population comparison of the species under study.

## Material and method

**Study area** Kori lake locally known as Lokan Kori Dhand is located at Thatta Sajawal road district Thatta Sindh Pakistan. Distance from Hyderabad is 92 km. (Figure 1)



**Figure: 1 showing the map of Kori lake, district Thatta, Sindh Pakistan**

The experimental fish was collected during (November 2017 to January 2018 for winter and from May to July summer season) the fish species were caught by the help of local fisher men from 9am to 5pm in each month randomly from Kori lake Thatta Sindh.

Sampled fish were examined in terms of size and weight, after that the sampled fish were preserved in formalin solution with an individual sample and analyzed at size groups 5.0 cm each ranged from 20.1 - 50.0 cm. The regression coefficient  $n$  (slope of regression line of weight to length) was calculated using (Le Cren, 1951) equation,  $W = a L^n$ .

## Result

The data on experimental fish samples procured from Kori lake Thatta under different seasons are shown in **Table 1-4**. The regression coefficient of length- weight relationship and condition factor of *Labeo rohita*, *Cirrhinus mrigala*, *Cyprinus carpio*, *Catla catla* and *Labeo calbasu* respectively, when calculated gave following equations for winter and summer season respectively.

$\text{Log } W = -0.84 + 2.31 \text{ Log } L$  and  $\text{Log } W = -0.28 + 2.01 \text{ Log } L$  (*Labeo rohita*)

$\text{Log } W = -1.02 + 2.39 \text{ Log } L$  and  $\text{Log } W = -0.76 + 1.73 \text{ Log } L$  (*Cirrhinus mrigala*)

$\text{Log } W = -0.97 + 2.37 \text{ Log } L$  and  $\text{Log } W = -0.14 + 1.89 \text{ Log } L$  (*Cyprinus carpio*)

$\text{Log } W = -0.92 + 2.33 \text{ Log } L$  and  $\text{Log } W = -0.17 + 1.93 \text{ Log } L$  (*Catla catla*)

$\text{Log } W = -0.14 + 2.32 \text{ Log } L$  and  $\text{Log } W = -0.68 + 2.21 \text{ Log } L$  (*Labeo calbasu*)

Above mentioned values are shown in **(Figs. 1 and 2)**

Table 01: showed length weight relationship of different fish species during the winter season from Kori lake Thatta Sindh Pakistan (L.G=Length group, G1=20.1-25.0cm, G2=25.1-30.0cm, G3=30.1-35.0cm, G4=35.1-40cm, G5=40.1-45.0cm, G6=45.1-50.0cm).

| L.G | <i>Labeo rohita</i> |                | <i>Cirrhinus mrigala</i> |             | <i>Cyprinus carpio</i> |             | <i>Catla catla</i> |             | <i>Labeo calbasu</i> |             |
|-----|---------------------|----------------|--------------------------|-------------|------------------------|-------------|--------------------|-------------|----------------------|-------------|
|     | Mean length (cm)    | Mean weight(g) | Mean length              | Mean weight | Mean length            | Mean weight | Mean length        | Mean weight | Mean length          | Mean weight |
| G1  | 22.6±1.45           | 179.4±35.31    | 22.5±1.37                | 166.33±33.4 | 22.52±1.4              | 170.61±31.4 | 22.61±1.4          | 156.22±29.7 | 22.49±1.3            | 163±32.3    |
| G2  | 27.5±1.49           | 308.2±40.85    | 27.4±1.42                | 292.41±32.8 | 27.51±1.5              | 297.27±41.9 | 27.47±1.5          | 290.24±46.9 | 27.51±1.5            | 287.3±39.8  |
| G3  | 32.6± 1.5           | 441.9±39.19    | 32.6±1.46                | 418.41±32.5 | 32.56±1.2              | 435.31±40.6 | 32.55±1.3          | 435.51±29.4 | 32.53±1.2            | 419.02±38.2 |
| G4  | 37.5±1.40           | 593.9±44.34    | 37.5±1.39                | 542.39±33.7 | 37.51±1.5              | 573.35±48.2 | 37.50±1.5          | 580.09±46.2 | 37.42±1.4            | 558.56±47.1 |
| G5  | 42.6±1.39           | 765.9±51.65    | 42.6±1.40                | 711.05±55.7 | 42.49±1.4              | 748.69±48.8 | 42.59±1.5          | 740.77±53.1 | 42.48±1.3            | 732.73±52.3 |
| G6  | 47.5±1.38           | 963.7±52.55    | 47.5±1.31                | 948.32±56.8 | 47.43±1.4              | 916.06±56.7 | 47.58±1.4          | 934.53±65.1 | 47.43±1.4            | 914.20±51.6 |

Table 02: Showing relative condition factor (Kn) values of different fish during the winter season from Kori lake Thatta Sindh Pakistan (L.G=Length group, G1=20.1-25.0cm, G2=25.1-30.0cm, G3=30.1-35.0cm, G4=35.1-40cm, G5=40.1-45.0cm, G6=45.1-50.0cm)

| L.G | <i>Labeo rohita</i> |            |      | <i>Cirrhinus mrigala</i> |              |      | <i>Cyprinus carpio</i> |              |      | <i>Catla catla</i> |             |      | <i>Labeo calbasu</i> |              |      |
|-----|---------------------|------------|------|--------------------------|--------------|------|------------------------|--------------|------|--------------------|-------------|------|----------------------|--------------|------|
|     | Obs. Wt.(g)         | Cal. Wt(g) | Kn   | Obs. Wt. (g)             | Cal. Wt. (g) | Kn   | Obs. Wt. (g)           | Cal. Wt. (g) | Kn   | Obs. Wt. (g)       | Cal Wt. (g) | Kn   | Obs. Wt. (g)         | Cal. Wt. (g) | Kn   |
| G1  | 179.37              | 187.12     | 0.96 | 165.11                   | 176.57       | 0.93 | 170.62                 | 162.97       | 1.05 | 156.22             | 161.39      | 0.96 | 152.82               | 158.32       | 0.97 |
| G2  | 308.21              | 275.67     | 1.11 | 288.93                   | 265.83       | 1.09 | 297.27                 | 255.51       | 1.16 | 290.24             | 255.83      | 1.11 | 281.51               | 251.36       | 1.12 |
| G3  | 435.99              | 406.82     | 1.07 | 417.05                   | 383.9        | 1.09 | 435.31                 | 380.65       | 1.14 | 438.91             | 392.3       | 1.11 | 411.72               | 381.1        | 1.08 |
| G4  | 600.89              | 548.18     | 1.09 | 538.17                   | 514.27       | 1.05 | 573.32                 | 517.92       | 1.11 | 583.43             | 554.13      | 1.05 | 551.78               | 526.25       | 1.05 |
| G5  | 752.76              | 698.71     | 1.07 | 708.78                   | 669.5        | 1.06 | 748.69                 | 672.58       | 1.11 | 746.84             | 742.2       | 1.01 | 722.95               | 692.54       | 1.05 |
| G6  | 950.65              | 891.45     | 1.07 | 940.05                   | 843.047      | 1.12 | 916.06                 | 867.61       | 1.05 | 939.89             | 970.13      | 0.96 | 911.01               | 910.95       | 1.01 |

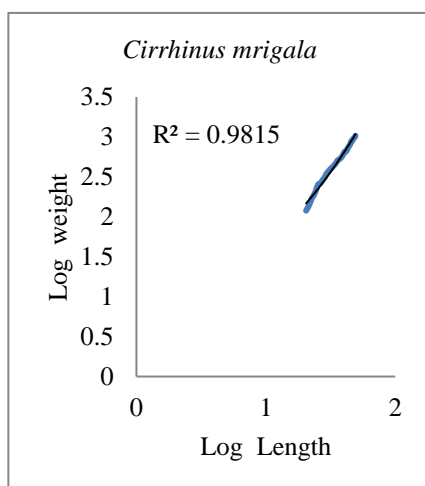
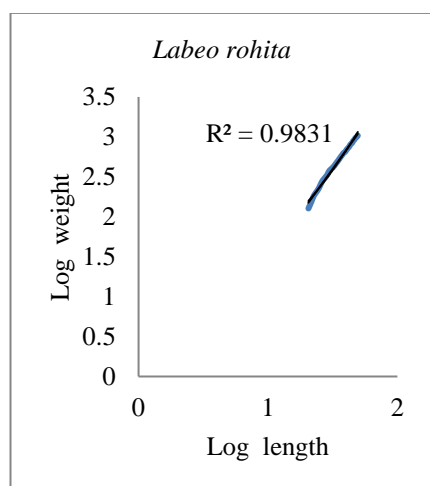
Table 03: showed length weight relationship of different fish species during the summer season from Kori lake Thatta Sindh Pakistan (L.G=Length group, G1=20.1-25.0cm, G2=25.1-30.0cm, G3=30.1-35.0cm, G4=35.1-40cm, G5=40.1-45.0cm, G6=45.1-50.0cm).

| L. G | <i>Labeo rohita</i> |                | <i>Cirrhinus mrigala</i> |             | <i>Cyprinus carpio</i> |             | <i>Catla catla</i> |             | <i>Labeo calbasu</i> |             |
|------|---------------------|----------------|--------------------------|-------------|------------------------|-------------|--------------------|-------------|----------------------|-------------|
|      | Mean length (cm)    | Mean weight(g) | Mean length              | Mean weight | Mean length            | Mean weight | Mean length        | Mean weight | Mean length          | Mean weight |

|    |            |               |           |              |           |              |            |                |             |               |
|----|------------|---------------|-----------|--------------|-----------|--------------|------------|----------------|-------------|---------------|
| G1 | 22.58±1.4  | 284.07± 43.9  | 22.55±1.5 | 245.0±47.5   | 22.5± 1.4 | 236.95± 34.1 | 22.61±1.4  | 262.47± 53.92  | 22.5± 1.52  | 189.07± 38.42 |
| G2 | 27.52± 1.4 | 431.89± 44.3  | 27.5± 1.5 | 410.8± 48.1  | 27.5± 1.5 | 372.73± 46.9 | 27.5± 1.5  | 408.19± 42.75  | 27.5± 1.42  | 330.62± 39.99 |
| G3 | 32.56±1.4  | 592.47± 49.6  | 32.6± 1.4 | 561.3± 40.1  | 32.6± 1.2 | 546.19± 56.8 | 32.5± 1.3  | 573.17± 55.61  | 32.49± 1.34 | 461.3± 45.72  |
| G4 | 37.55± 1.4 | 773.11± 52.9  | 37.4± 1.4 | 731.67± 58.6 | 37.4± 1.5 | 710.3± 43.7  | 37.5± 1.5  | 770.65± 64.31  | 37.52± 1.39 | 628.27± 53.13 |
| G5 | 42.6± 1.5  | 972.81± 53.2  | 42.5± 1.3 | 907.85± 53.2 | 42.5± 1.4 | 864.6± 48.07 | 42.6± 1.5  | 966.10± 50.04  | 42.44± 1.43 | 818.13± 59.18 |
| G6 | 47.49± 1.4 | 1159.67± 52.5 | 47.5± 1.4 | 1097.6± 55.7 | 47.4± 1.4 | 1107.1± 87.3 | 547.6± 1.4 | 1164.46± 66.98 | 47.47± 1.37 | 1018.85± 43.3 |

Table 04: Showing relative condition factor (Kn) values of different fish during the summer season from Kori lake Thatta Sindh Pakistan (L.G=Length group, G1=20.1-25.0cm,G2=25.1-30.0cm,G3=30.1-35.0cm,G4=35.1-40cm,G5=40.1-45.0cm, G6=45.1-50.0cm)

| L.G | <i>Labeo rohita</i> |           |      | <i>Cirrhinus mrigala</i> |             |      | <i>Cyprinus carpio</i> |             |      | <i>Catla catla</i> |             |      | <i>Labeo calbasu</i> |             |      |
|-----|---------------------|-----------|------|--------------------------|-------------|------|------------------------|-------------|------|--------------------|-------------|------|----------------------|-------------|------|
|     | Obs. Wt.(g)         | Ca. Wt(g) | Kn   | Obs. Wt. (g)             | Ca. Wt. (g) | Kn   | Obs. Wt. (g)           | Ca. Wt. (g) | Kn   | Obs. Wt. (g)       | Ca. Wt. (g) | Kn   | Obs. Wt. (g)         | Ca. Wt. (g) | Kn   |
| G1  | 284.07              | 278.05    | 1.02 | 245.01                   | 261.49      | 0.93 | 236.95                 | 217.61      | 1.11 | 262.47             | 263.02      | 1    | 189.07               | 205.94      | 0.91 |
| G2  | 431.89              | 405.14    | 1.06 | 410.77                   | 383.84      | 1.07 | 372.733                | 340.74      | 1.09 | 408.19             | 389.32      | 1.05 | 330.62               | 309.4       | 1.06 |
| G3  | 592.47              | 552.63    | 1.07 | 561.31                   | 522.1       | 1.07 | 546.19                 | 496.23      | 1.09 | 573.17             | 547.36      | 1.05 | 461.3                | 447.22      | 1.03 |
| G4  | 773.11              | 731.06    | 1.05 | 731.67                   | 683.04      | 1.07 | 710.34                 | 697.43      | 1.02 | 770.65             | 719.15      | 1.07 | 628.27               | 580.52      | 1.08 |
| G5  | 972.81              | 934.37    | 1.04 | 911.97                   | 889.37      | 1.02 | 864.78                 | 945.65      | 0.92 | 966.1              | 926.34      | 1.04 | 818.133              | 736.86      | 1.11 |
| G6  | 1159.57             | 1174.42   | 0.99 | 1098.22                  | 1105.88     | 0.99 | 1107.07                | 1224        | 0.92 | 1165.46            | 1157.01     | 1.01 | 1018.85              | 927.5       | 1.1  |



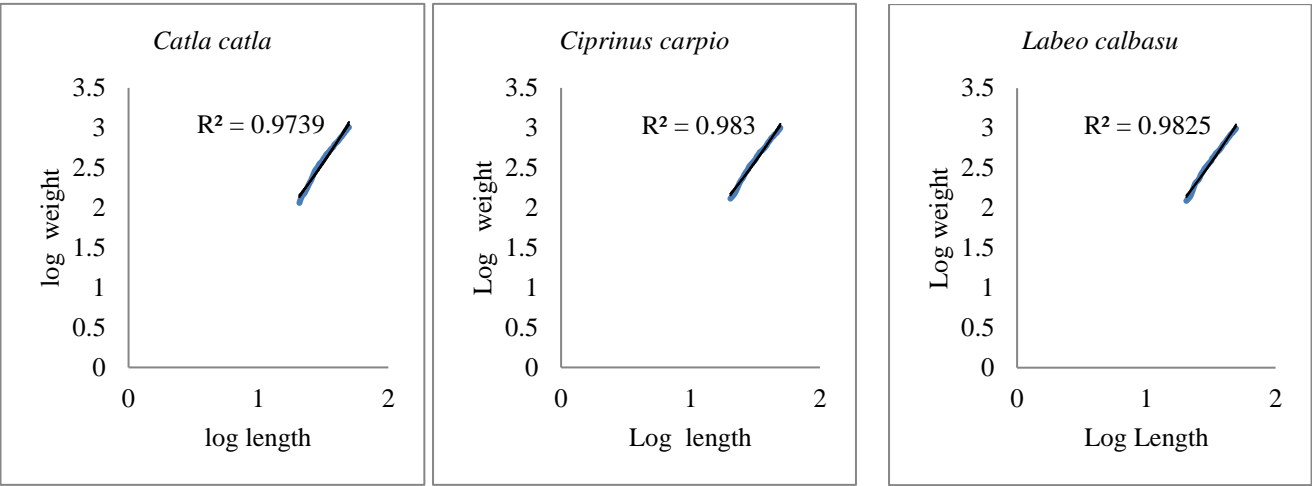


Figure: 1. showing log values relationship between total length versus total weight of different fish species during winter season.

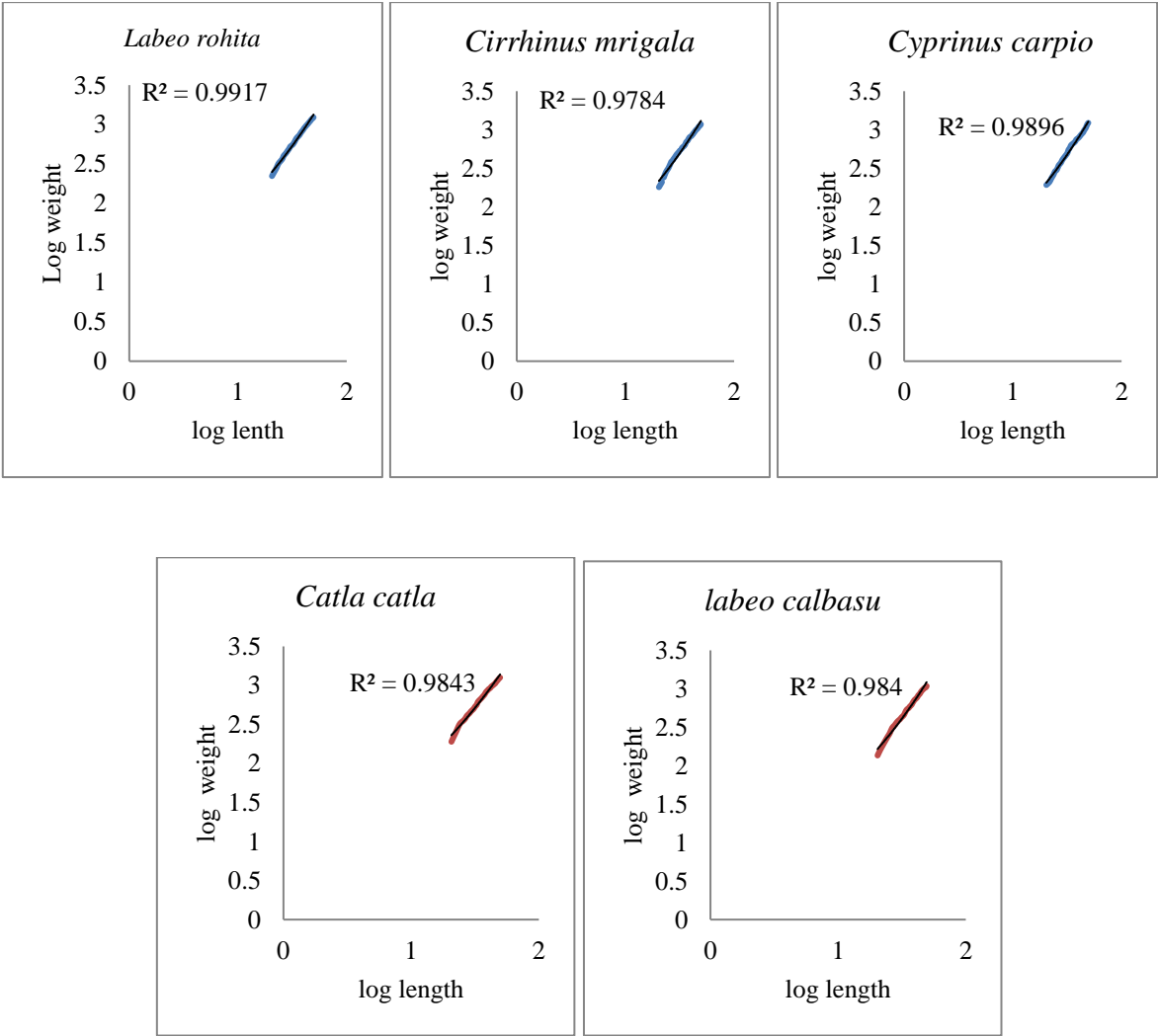


Figure: 2. showing log values relationship between total length versus total weight of different fish species during winter season.

## Discussion

During the present investigations the  $b$  (regression coefficient) varied from 1.73 to 2.39, highest was observed in *Cirrhinus mrigala* ( $b= 2.39$ ) during winter while lowest ( $b=1.73$ ) was recorded in *Cirrhinus mrigala*. Similar observation was noticed by Jamali *et al.* (2018) and Hamid *et al.*, (2015). Lot of researchers have estimated correlation in various fish and found less than ideal 3 like Narejo and Jafri (2000) in *Gudusia chapra*. Narejo *et al.*, (2001) in *Pisodonophis boro*, Gaygusuz *et al.*, (2013) and Ayyildiz, *et al* (2014) in *C. erhani*. The results of the mention workers accord with the current observation. Khan, *et al* (1991) stated that the exponent values can be contrary with the environment. While Salam and Mahmood (1993) commented that the exponent values greater than 3.0 indicate that the fish becomes heavier for its length as it increases in size. Moreover, (Narejo *et al* 2006, Narejo *et al.* 2002) suggested that the value of the exponent ( $b$ ) is 3 when fish grows isometric ally and values different than 3 indicated allometric type of growth. (Joadder 2009) observed that the values of exponent lie between 2 to 4 any deviation resulted as poor environmental condition species and sex variation. Values of condition analysis of the five fish during the course of investigations were calculated, values for *Labeo rohita* ( $Kn=1.06, 1.04$ ), *Cirrhinus rigala* ( $Kn=1.10, 1.03$ ), *Cyprinus carpio* ( $Kn=1.05, 1.03$ ), *Catla catla* ( $Kn= 1.03, 1.03$ ) and for *Labeo calbasu* ( $Kn=1.04, 1.05$ ) in winter and summer respectively. The highest values of  $Kn$  were noticed from *Cirrhinus mrigala* ( $Kn=1.1$ ) followed by *Labeo rohita* ( $Kn=1.06$ ) and lowest was recorded from *Catla catla* ( $Kn=1.03$ ). (Jamali *et al.* 2018), (Ahmed, and Aziz 2011 and Ibrahim *et al.*, (2012) calculated the coefficient values less than 1 in different fish species. Condition values obtained during the course of present investigations found to be higher that resulted that the experimental fish is in good condition in the Kori lake Thatta Sindh which is in accordance with (Narejo *et al* 2006 and Jamali *et al.*, 2018).

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Proximate composition of *Typha latifolia* showed that the range of total protein content in leaves observed between 1.65 - 2.99%, in stem the range was 0.99 - 1.92% and in rhizoids was 0.91 - 1.83%, the range of total carbohydrate content in leaves was found between 2.81 - 12.21%, in stem 2.67 - 9.23% and in rhizoids 2.16 - 10.21% and the range of total lipid concentration in leaves was recorded 0.24 - 1.02%, in stem 0.15 - 1.0% and in rhizoids was 0.21 - 1.31%.