

## Detailed Analysis of *Cirrhinus Mrigala* Length-Weight Relationships and Condition Factors in Local Fish Markets of Quetta City

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### Abstract

Residents of Quetta frequently consume *C. mrigala*, since it is a member of the family of carps renowned for its delectable flavor. The current study's objective is to ascertain the growth, length, and weight relationships of *C. mrigala* in Quetta's local fish markets. From June to December 2022. They were between 60 and 1580g in weight and 15–47 cm in length (TL). Equations below demonstrate the link between length and weight:  $W = 0.00428 L^{3.2875}$ ,  $W = 0.0048 L^{3.251}$ , and  $W = 0.0082 L^{3.076}$  (for the combined population) (for female population). Relative condition factor (Kn) samples ranged from 0.77 to 1.56 in the total population (Mean 1.036 0.30); for men, they ranged from 0.70 to 1.70 (Mean 1.0332 0.276); and for females, they ranged from 0.69 to 1.70. (Mean 1.0334 0.283). In all categories, there was a positive allometric association between length and weight, with females having the strongest correlation. The condition factor demonstrates that *C. mrigala* growth in local fish markets of Quetta city is good.

**KEYWORDS:** *Cirrhinus Mrigala*, Cyprinidae Quetta, Condition Factor.

### INTRODUCTION

Quetta is the capital of Balochistan. (Bazai, Panezai, & sciences, 2020), which is the largest province of Pakistan in terms of area making 44% of the country's total land area. Quetta covers a total area of 2,653 km<sup>2</sup> (1,024 sq mi) bordered on all sides by four mountains known as Chiltan, Takato, Murdar and Zarghun. Quetta borders Mastung and Nushki districts to the south, Pishin district to the north, Ziarat and Harnai districts to the east. Afghanistan to the west (Sardar, Xu, Raziq, & Decisions, 2017). *C. mrigala* is the main fish consumed by the people of Quetta. The marine fishes are transported from coastal areas while the freshwater fishes are transferred to Quetta from the areas of Sindh. *C. mrigala* is consumed extensively by inhabitants of Quetta because it belongs to the group of carps that are known for their delicious flavor. So, the current study is intended to know the Growth, Length Weight Relationship of *C. mrigala* from local fish market of Quetta city.



***Cirrhinus mrigala***

*C. mrigala* belongs to the family *Cyprinidae* of class *Actinopterygii* which contains ray-finned fishes (Yang, Mayden, & Evolution, 2010). It is a member of the carp family. It inhabits the water bodies of different Asian countries like the subcontinent, Nepal, China Thailand and Myanmar (Hossain & Wahab, 2010). *C. mrigala* shows a very fast growth rate and locally it is known as *mrigal* or *Moraki* (Mayank, Rizvi, Dwivedi, & Studies, 2017). It is a huge fish with an oblong, fairly compressed body. Head width is equal to the length behind the eyes, which are in the front part of the head (Yadav, Bhatnagar, & Kaur, 2010). There is one pair of barbells, the body is protected by cycloid scales but the head is scale less (Majeed, Gul, MussaMandokhail, Masood, & Khan, 2015). The *mrigala* fish's body color is typically dark grey and silvery in color on the sides and ventral region, their fins are brownish in hue, while pelvic and caudal fins appear orange-tinged at the time of the breeding season (Chatta, Khan, Khan, Ayub, & Sciences, 2015). *C. mrigala* is the third most significant fish in the world. *C. mrigala* has a unique market status in Quetta due to its high consumer demand and delicacy. It is very nutritious concerning its chemical composition since it is a source of different vitamins like folic acid, Niacin and also different minerals like calcium and phosphorous. (Riaz, Asif, Ali, & Nutrition, 2009). The research on Growth of *C. mrigala* was conducted first time in Quetta it is supportive in discovering the following factors. The determination of the length-weight relationship is helpful in assessment of the growth rates of *C. mrigala* found in the local fish market of Quetta.

**Length weight relationship**

It is critical to assess the growth features of fish based on their weight and length in biometric research (Jisr, Younes, Sukhn, & El-Dakdouki, 2018). LWRs are represented as a formula that can be used to determine the weight (W) of a fish based on its length (L). Fish have one of three development patterns: isometric, positive, or negative allometric. Isometric growth is linked to a constant development of the body's morphology. Negative allometric growth describes the fish being thinner as it puts on weight, and positive allometric growth describes the fish getting stouter as it grows longer. For the management of fisheries, relationships between fish length and weight are essential.

**MATERIALS AND METHODS****Fish collection**

Between June and December 2022, 280 *C. mrigala* fish samples were procured from Quetta's local fish market. They varied in size from 21.1-43.2 cm (combined). Out of 280 fishes 134 were male ranging from 21.2-43.2cm and 146 were female ranging from 21-

43.3cm. Fish were preserved by putting the fish samples in formalin and the gut were also injected with formalin for the prevention of activities of enzymes.

### Length-weight relationship and condition factor:

The formula  $W=a L^b$ , where  $W$  is total weight in grammes,  $L$  is total length in centimeters,  $a$  is a body-formation coefficient, and " $b$ " is an exponent that, when equal to 3.0, denotes isometric growth, was used to calculate the length-weight relationship. The updated equation's parameters  $a$  and  $b$  were calculated using linear regression as follows:  $\log(a + b)$   $\log W$ . ( $L$ ). This log approach was used to get the smooth mean weight ( $W$ ) for each length group, and the relative condition factor ( $K_n = W/a L^b$ ) was determined using a modified version of Le Cren's (1951) formula.  $W$  is the observed weight and  $W$  is the predicted weight, respectively.  $K_n = W/$ . For each 2 cm length interval, the relative condition factor ( $K_n$ ) values for the male, female, and mixed populations were calculated separately.

### Ethical Approval

The Departmental Animal Care Committee at the University of Balochistan approved the study's conduct. The "Prevention Cruelty to Animals Act of 1980 of Pakistan" was adhered to in this study. Thus, no animals were injured in the course of this research. No wild fish have been killed nor harmed in this study.

### Result

**Table1:** This presentation describes length-weight relationships for females, males, combined sexes, and  $n$  (sample size) and estimates their parameters.

Sex	N	Length range (cm)	Weight range (g)		A	95% CL		b	95% CL		$r^2$
M	148	15.5-47.0	65.0-1575.0		0.005	2.98151	1.6392	3.252	2.79803	3.7057	0.96
F	174	15.0-47.0	60.0-1580.0		0.004	3.03886	1.6964	3.288	2.83385	3.7413	0.96
C	322	15.0-47.0	60.0-1580.0		0.008	2.77471	1.395	3.076	2.60965	3.5424	0.96

**Table 2:** Length Weight Relationship of *C. mrigala* from local fish markets of Quetta city

Length groups	Males	Females	Combined
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(cm)	N	Mean Length $\pm$ SD	Mean weight (g)	n	Mean Length $\pm$ SD	Mean weight (g)	n	Mean Length $\pm$ SD	Mean weight (g)
15-17	5	16.2 $\pm$ 0.51	65.2	9	15.9 $\pm$ 0.81	66.3	14	16.0 $\pm$ 0.70	65.9
17-19	5	17.6 $\pm$ 0.40	79.5	12	18.3 $\pm$ 0.50	78.7	17	18.1 $\pm$ 0.58	78.9
19-21	17	20.2 $\pm$ 0.57	84.1	22	20.3 $\pm$ 0.45	81.4	39	20.3 $\pm$ 0.50	82.6
21-23	15	21.6 $\pm$ 0.74	86.6	17	21.8 $\pm$ 0.81	90.1	32	21.7 $\pm$ 0.77	88.5
23-25	16	24.0 $\pm$ 0.60	120.3	18	23.8 $\pm$ 0.47	116.8	34	23.9 $\pm$ 0.54	123.3
25-27	5	26.3 $\pm$ 0.48	143.4	5	25.7 $\pm$ 0.59	136.8	10	26.0 $\pm$ 0.60	149.3
27-29	10	28.3 $\pm$ 0.75	220.5	13	28.3 $\pm$ 0.78	210.8	23	28.3 $\pm$ 0.75	215
29-31	14	30.2 $\pm$ 0.59	265.2	19	30.2 $\pm$ 0.57	261.2	33	30.2 $\pm$ 0.57	262.9
31-33	6	32.2 $\pm$ 0.78	321.7	11	32.3 $\pm$ 0.63	311.3	17	32.3 $\pm$ 0.66	312.1
33-35	10	34.2 $\pm$ 0.57	336.2	10	34.3 $\pm$ 0.59	334.8	20	34.3 $\pm$ 0.56	335.5
35-37	10	36.2 $\pm$ 0.68	547.1	8	36.3 $\pm$ 0.55	559.6	18	36.3 $\pm$ 0.61	405.1
37-39	5	38.0 $\pm$ 0.89	728.2	4	38.5 $\pm$ 0.85	736.2	9	38.2 $\pm$ 0.86	501.8
39-41	11	39.8 $\pm$ 0.78	982.1	8	39.7 $\pm$ 0.57	982.3	19	39.7 $\pm$ 0.68	573.4
41-43	11	42.0 $\pm$ 0.59	1275.7	9	41.7 $\pm$ 0.43	1242.5	20	41.9 $\pm$ 0.53	1260.8
43-45	3	44.9 $\pm$ 0.05	1418.3	5	44.5 $\pm$ 0.66	1422.8	8	44.6 $\pm$ 0.55	1421.1
45-47	5	46.0 $\pm$ 0.88	1529	4	46.6 $\pm$ 0.62	1556.5	9	46.2 $\pm$ 0.80	1541.2
<b>Total</b>	<b>148</b>			<b>174</b>			<b>322</b>		

**Table 3.** *C. mrigala* male, female, and combined relative condition factor (K) values at different size groups

Length groups (cm)	Male			Female			Combined sexes		
	Weight discovered (g)	Figured Weight (g)	Kn	Weight discovered (g)	Figured Weight (g)	Kn	Weight discovered (g)	Figured Weight (g)	Kn
15-17	65.2	41.96	1.55	66.33	38.81	1.7	65.92	42.06	1.56
17-19	79.54	54.94	1.44	78.75	61.46	1.28	78.98	61.27	1.28
19-21	84.12	87.06	0.96	81.45	85.97	0.94	82.62	86.74	0.95
21-23	86.67	108.01	0.8	90.15	109.24	0.82	88.52	107.48	0.82
23-25	120.39	151.91	0.79	116.89	144.74	0.8	123.36	143.8	0.85
25-27	143.48	203.34	0.7	136.84	185.65	0.73	149.32	185.64	0.8
27-29	220.5	258.02	0.85	201.85	254.21	0.82	215.04	240.6	0.89
29-31	265.25	320.95	0.82	261.26	315.11	0.82	262.95	294.82	0.89
31-33	313.72	395.04	0.79	311.34	393.69	0.79	312.18	361.39	0.86
33-35	336.2	479.71	0.7	334.8	481.54	0.69	335.5	435.04	0.77
35-37	547.1	577.91	0.94	559.6	580.87	0.96	405.17	518.43	0.78
37-39	728.2	674.71	1.7	736.25	703.77	1.04	501.89	609.14	0.82
39-41	982.18	783.18	1.25	982.38	775.13	1.26	573.42	685.89	0.83
41-43	1275.73	936.03	1.36	1242.56	915.56	1.35	1260.8	807	1.56
43-45	1418.33	1160.44	1.22	1422.8	1127.4	1.26	1421.13	979.85	1.45
45-47	1529	1251.19	1.22	1556.5	1312.31	1.18	1541.22	1091.93	1.41
<b>Mean Kn</b>			<b>1.0332</b>			<b>1.0334</b>			<b>1.036</b>

**Table 4.** Mean Length and Weight of *C. mrigala*

Length groups Cm	Mean Length			Mean Weight		
	Mixed	Male	Female	Mixed	Male	Female

15-17 cm	16.06	16.20	15.98	65.93	65.20	66.33
17-19 cm	18.15	17.60	18.38	78.98	79.54	78.75
19-21 cm	20.32	20.28	20.35	82.62	84.12	81.45
21-23 cm	21.78	21.67	21.89	88.52	86.67	90.15
23-25 cm	23.95	24.06	23.84	123.36	120.39	116.89
25-27 cm	26.02	26.32	25.72	149.32	143.48	136.84
27-29 cm	28.31	28.32	28.30	215.04	220.50	210.85
29-31 cm	30.24	30.29	30.21	262.95	265.25	261.26
31-33 cm	32.31	32.28	32.33	312.18	313.72	311.34
33-35 cm	34.32	34.27	34.37	335.50	336.20	334.80
35-37 cm	36.33	36.29	36.39	405.17	547.10	559.60
37-39 cm	38.29	38.06	38.58	501.89	728.20	736.25
39-41 cm	39.79	39.85	39.73	573.42	982.18	982.38
41-43 cm	41.96	42.09	41.79	1260.80	1275.73	1242.56
43-45 cm	44.69	44.97	44.52	1421.13	1418.33	1422.80
45-47 cm	46.29	46.02	46.63	1541.22	1529.00	1556.50

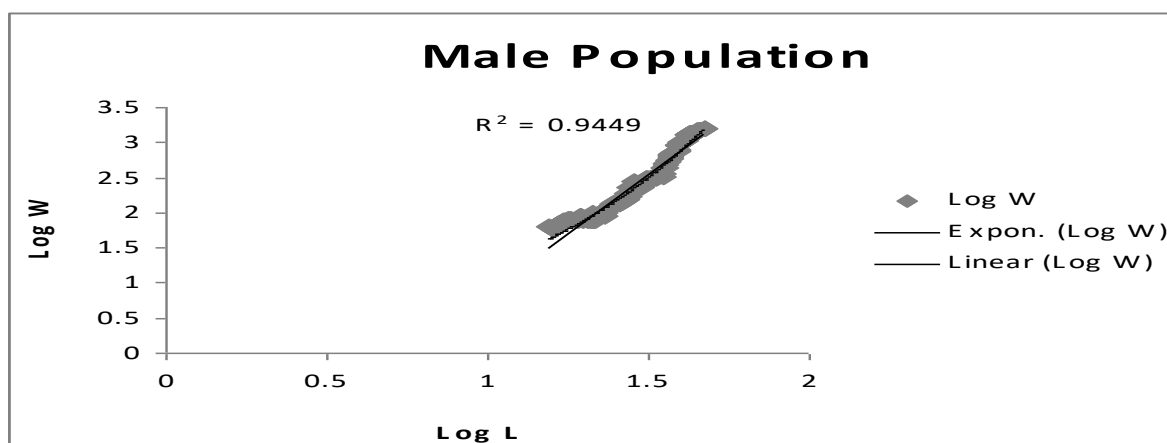


Figure 1: LWR when plotted in log values of Male *C. mrigala*

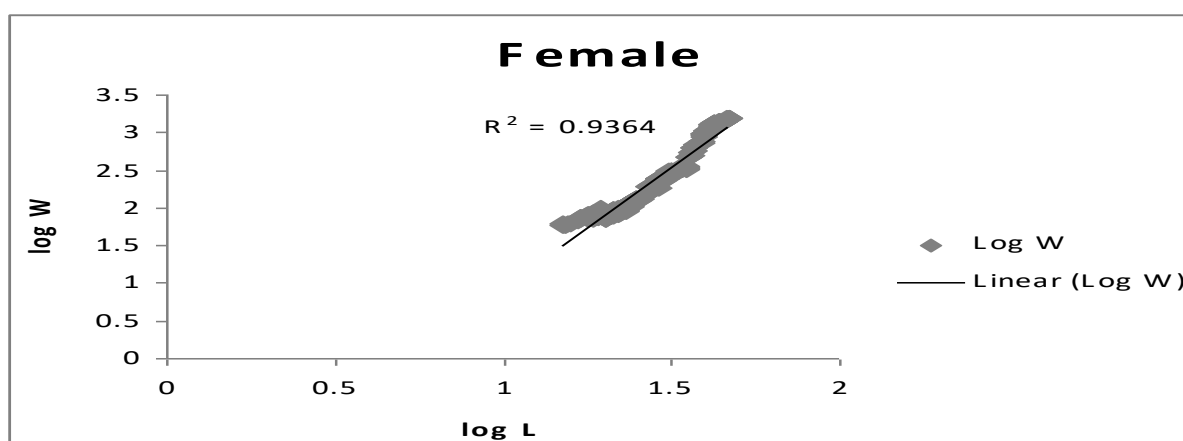


Figure 2: LWR values plotted logarithmically for females

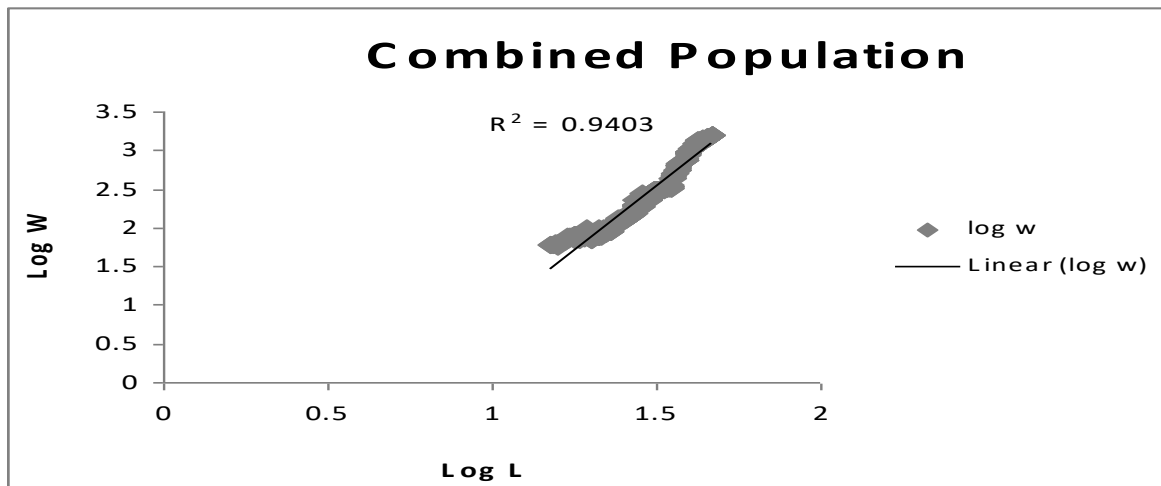


Figure 3: Plot of values of logarithmic LWR of combined Population

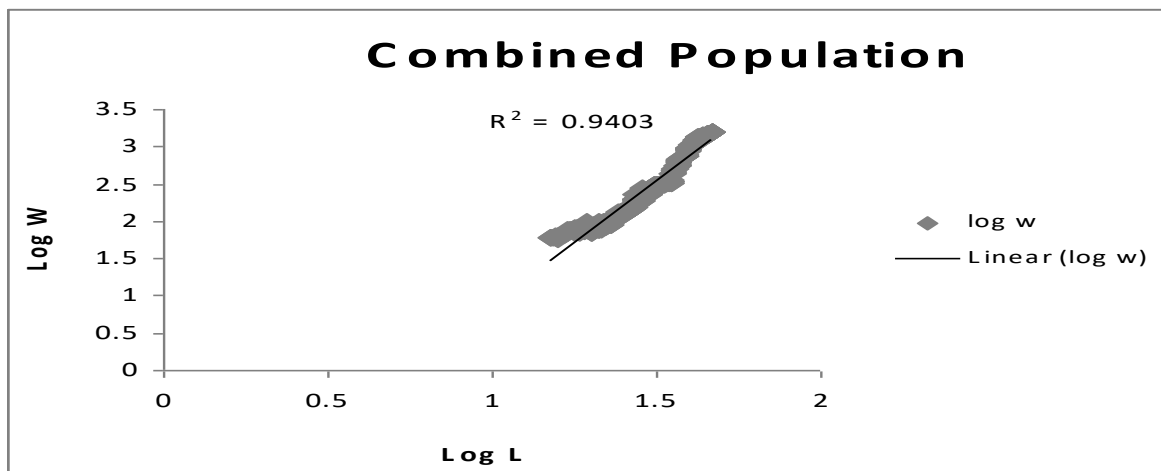


Figure 3: Plot of values of logarithmic LWR of combined Population

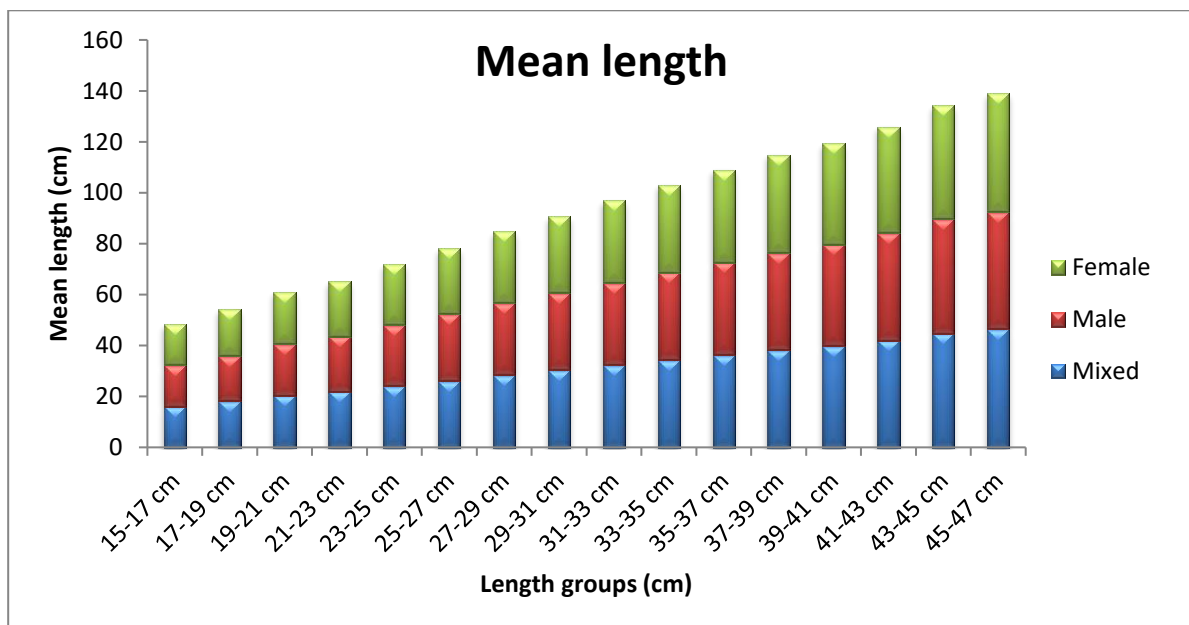


Figure 4. Mean length of Male, Female and Mixed Population

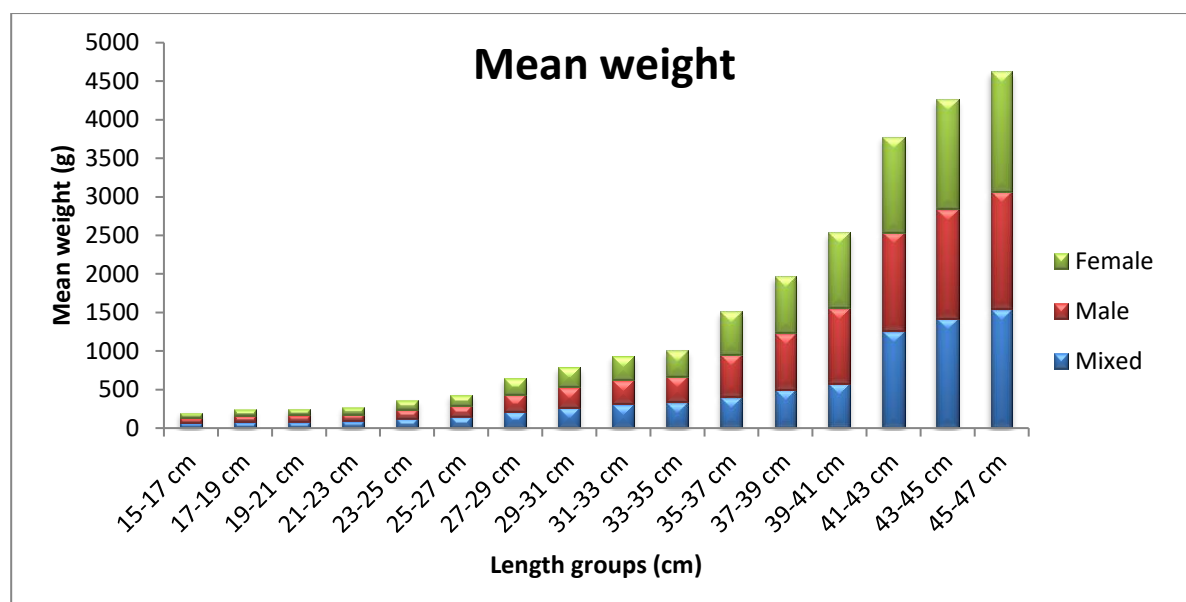


Figure 5. Mean Weight of Male, Female and Mixed Population.

## DISCUSSION

To determine the length-weight relationship of 15–47 cm *C. mrigala*, 280 fish were collected. The results were computed individually for combined, male, and female populations. The sample was sorted into groups of 2 cm length (Table 1) and characterized using the following formula:

$$W = a L^b$$

Weight is in W, a and b are constants, while L stands for length. Figures 1, 2, 3, 4, and 5 show the outcomes of graphing empirical length values against their associated weights on an arithmetic scale. When the regression coefficients for male and female *C. mrigala* in the size ranges of 15.5–47 cm (for males) and 15–47 cm (for females) were calculated using the least square techniques, the following equations were generated:

$$W = 0.0082 L^{3.076} \text{ (for combined population)} \quad W = 0.0048 L^{3.251} \text{ (for male population)} \quad W = 0.0042 L^{3.287} \text{ (for female population)}$$

## Relative condition factor

Le Cren's (1951) approach was used to determine the relative condition factor (Kn).

$$W/aL^b = K_n$$





This is expressed as  $Kn = W/$ .

W stands for the observed weight.

= weight determined based on length-weight connections

For different length groups, Kn values for men, females, and the entire population were estimated. Table 3 displays Kn values for different population sizes, with values for males ranging from 0.70-1.70 (Mean 1.0332 0.276) to females from 0.69-1.70 (Mean 1.0334 0.283) to females overall from 0.77-1.56 (Mean 1.036 0.31). The length-weight correlations of the *C. mrigala* species are shown in Tables 1, 2, 3, and 4 by sex. A fish is said to be developing isometrically if its specific gravity stays constant and it maintains its form throughout its lifespan, in which case the length exponent b is exactly 3.0. (Wooton,1990). The values of a and b in our study were computed as follows: 0.0048, 3.2518 for men; 0.0042, 3.287 for women; and 0.0082, 3.0760 for mixed populations. The findings show that the allometric growth of *C. mrigala* is positive.

These results unambiguously demonstrate that for *C. mrigala*, the correlation coefficient for LWR was strong, showing that length increases as weight rises. Previous studies on fish from diverse bodies of water in various places provide support for these conclusions. (Fegade 1983; Merella *et al.* 1997; Laleye 2006 & Naeem *et al.* 2010).

The values of constant "a" and exponent "b" were obtained using the linear regression using log transformed data to verify the "cube rule" for the species under examination. Using combined data, the values of exponent "b" were computed and determined to be more than 3.0. These percentages were 3.0760 (mixed), 3.2518 (males), and 3.2875 (females) in *C. mrigala* (females). The values of "K" and "Kn" appear to remain constant when "b" is equal to 3.0, but they alter when body weight grows in relation to length. Murty (1980) and Jayasankar have both found evidence of this connection between size and maturity (1990). According to reports, a useful indicator of the length at which sexual maturity begins is the diminishing trends of the "K" value with length increase (Harts



1946). The variation in the values of "K" and "Kn" in fish has mostly been attributed to dependence on a variety of parameters, including the amount of feeding, the size of the fish, and the availability of fish (Le Cren, 1951).

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