

Study of Some Morphometric and Biological Parameters of Common Carp *Cyprinus carpio* in Sulaimaniya Reservoir

Nasreen Mohialddin AbdulRahman Zaid Khalaf Khidhir
Atoof AbdulRahem Aziz

University of Sulaimani, College of Agricultural Science, Department of Animal Production.

Sulaimaniya-Iraq

E-Mail: nasreenmar12@yahoo.com

Abstract

In the present study, twenty five common carp *Cyprinus carpio* of variable sizes ranging from 132- 1438.5 g in weight and 20.3- 42.3 cm in total length were sampled from Sulaimaniya reservoir. The length-weight relationships (LWR) and condition factors of common carp were studied. The straight line equation is $\text{Log (W)} = \text{Log (a)} + 3.455 * \text{Log (L)}$, so $b=3.455$ and $\text{Log (a)} = -2.453 \Rightarrow a = 10^{-2.453} = 0.0035$

For an efficient fisheries management of the stocks it was interest to know the important of biological parameters of the commercially exploited species. Therefore, the aim of this study was to obtain necessary growth- length relationships, condition factor and liver index of common carp in the study area.

Keywords: length-weight relationships , Condition factors , Common carp and Sulaimaniya

دراسة بعض الصفات المظهرية والحياتية لسمكة الكارب العادي *Cyprinus carpio* في خزان سد السليمانية

نسرین محی الدین عبدالرحمن زید خلف خضر عطوف عبدالرحیم عزیز

قسم الانتاج الحيواني ، كلية العلوم الزراعية ، جامعة السليمانية

السليمانية - العراق

الخلاصة

جمعت 25 سمكة من اسماك الكارب العادي *Cyprinus carpio* من الأسواق المحلية في مدينة السليمانية بأطوال واوزان مختلفة ، إذ تراوحت أوزانها بين 132 - 1438.5 غم وأطوالها بين 20.3-42.3 سم. وكانت

معادلة الخط المستقيم للعلاقة بين الوزن والطول كالآتي $\text{Log (W)} = \text{Log (a)} + 3.455 * \text{Log (L)}$, so $b=3.455$ and $\text{Log (a)} = -2.453 \Rightarrow a = 10^{-2.453} = 0.0035$

ولغرض ادارة الثروة السمكية بكفاءة ، فمن الضروري معرفة بعض القياسات الحياتية لكيفية استغلال الأنواع التجارية . تهدف الدراسة الحالية الى وصف علاقة النمو عن طريق العلاقة بين الطول والوزن ومعامل الحالة ودليل الكبد.

الكلمات المفتاحية: علاقة الطول بالوزن ، معامل الحالة ، الكارب العادي و السليمانية

Introduction

The length-weight relationship (Wt/Lt) has been widely used in fish biology with several purposes (Ahmad Dar *et al.*, 2012); conversion of the length equations in weight for equivalent of growth in weight (Bolger and Connolly, 1989); morphometrics interspecific and intrapopulational comparisons; and to assess the index of well-being of the fish populations (Olusegun, 2011). A sample range of variation in the allometric coefficient is expected for such a widely distributed populations, as results of different habitats along the Brazilian coast, with higher values expected for estuaries and rich semi-closed environments and lower values for coastal open areas and offshore zones (Vazzoler, 1991; Zakaria *et al.*, 2000). The condition factor (K) (Le Cren, 1951) is a quantitative parameter of the Well-being state of the fish and reflects recent feeding conditions. This factor varies according to influences of physiologic factors, fluctuating according to different stages of the development. Anderson and Neumann (1996) referred to length/weight data of population, as basic parameters for any monitoring study of fisheries, The condition factor is also a useful index for monitoring of feeding intensity, age, and growth rates in fish (Abowei, 2009). It is strongly influenced by both biotic and abiotic environmental conditions and can be used as an index to assess the status of the aquatic ecosystem in which fish live (Rajput, 2011). The paucity of this information propelled this study, which was aimed at bridging this gap and provide useful information for the management of Sulaimanieya reservoir fisheries (Ilhan *et al.*, 2010). Despite the usefulness of length-weight relationship and condition factor in fisheries science information about the length-weight relationships and condition factors of fish species in Sulaimanieya reservoir are non-existent.

Material and Methods

Data on total length (TL) in (cm) and total weight (TW) in (g) were recorded for each fish. The constant a and b parameters of the LWR were estimated using the logarithmic transformation of the below equation, a was the regression constant and b was the regression coefficient:

$W = aL^b$ (Ricker, 1973). Condition factor and length-weight relationship were assessed from measurement of total weight (Wt) and total length (Lt), and the curves parameters a and b were determined by log 10 transformation of raw data, Growth curves obtained from straight line for regression between total weight and total length was: $\log Wt = \log a + b * \log Lt$, where Wt was the total weight (g) (dependent variable), Lt was the total length (cm) (independent variable), The theoretical equation of the length-weight relationship was as follows:

$Wt = a * Lt^b$ (Schneider *et al.*, 2000). Condition factor and length-weight relationship were assessed from measurement of total weight (Wt) and total length (Lt), and the curves parameters a and b were determined by log 10 transformation of raw data. Growth curves obtained from straight line for regression between total weight and total length was: The theoretical equation of the length-weight relationship followed the equation

$Wt = a * Lt^b$. $\log Wt = \log a + b * \log Lt$, Where Wt. was the total weight (g), Lt was the total length (cm), a and b were constant. the values of the compiled growth exponent were used for the calculation of condition factor, K.

$$K = 100 W / L^b$$

Where K= condition factor, W= total body weight (g), L= total length (cm), b= growth exponent.

Condition factor – K was assessed for comparisons among months, sites and sizes, was determined by the following expression: $k = Wt / Lt^b$, Where k corresponds to the condition factor and

b was the allometry coefficient related with the form of the individuals growth, calculated from the length-weight relationship.

Results and Discussion

The slopes (*b*) of the fish L-W regression lines from fishes was 3.455 this within the value recorded by (Pauly, 1993) that ranged from 2.5 to 4.0 for many fish species. When $b = 3$, the fish grew isometrically resulting in ideal shape of fish. When the value of *b* was less than 3.0, the fish illustrated a negative allometric growth (Sandon, 1950). As the values of *b* increased, the size of the fish also increased because the fish usually grew proportionately in all directions. However, the changes in fish weight in general were actually greater than the changes in its length. However, the body shape of fish tends to change as the length increased (Mbaru *et al.*, 2011). The value of *b* then became greater than 3 as the fish became fatter, or when the *b* value was lower than 3, the parameters may vary significantly under the influence of the following factors: (i) differences in the number of specimens examined; (ii) area season effect; (iii) habitat; (iv) degree of stomach fullness; (v) gonad maturity; (vi) sex; (vii) health and general fish condition; (viii) preservation techniques; and (ix) differences in the observed length ranges of the specimens caught. (Maci *et al.*, 2009).

The length-weight relationship was determined as below, the blue line was the curve between Log (L)-Log (W), and the straight line was called Trend line to fit the original data. The straight line equation was: $\text{Log (W)} = \text{Log (a)} + 3.455 * \text{Log(L)}$, So $b=3.455$ and $\text{Log (a)} = -2.453 \Rightarrow a = 10^{-2.453} = 0.0035$

Chu *et al.*, (2012) analyzed the length-weight relationship for *Coryphaenoides rupestris* for different fishing in the Atlantic and found different values for the regression coefficients and constant of regression. This relationship can be

explained by differences in environments and ontogeny of fish (Cherif *et al.*, 2008). Young's of the year tends to allocate a large amount of energy in growth, while adults put a considerable part of their energy in reproduction process or increasing weight (Anbalagan *et al.*, 2009). Isaac-Nahum and Vazzoler (1983) studied the condition factor as indicator of the period of spawning in the north coast of São Paulo State, an adjacent area to Sepetiba Bay, found changing values over all year, presenting three peaks (May, August-October and December). The lowest values occurred in June, November and February, coinciding with higher frequency of emptied ovaries.

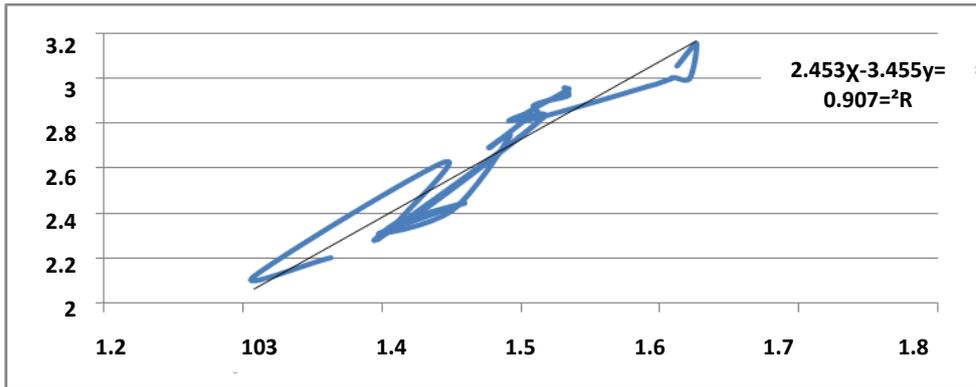


Fig (1) The weight- length relationship.

Reports on the length-weight relationship of either cyprinid fishes showed that many of them strictly follow cue law while there were many in which the weights of fishes tend to increase or decrease in proportion to

the cube of length. Isometric growth pattern has been reported in *Catla catla*(Karthan and Rao, 1990) and *Schizopygep lagisotomus*(Bhagat and Sunder, 1983).

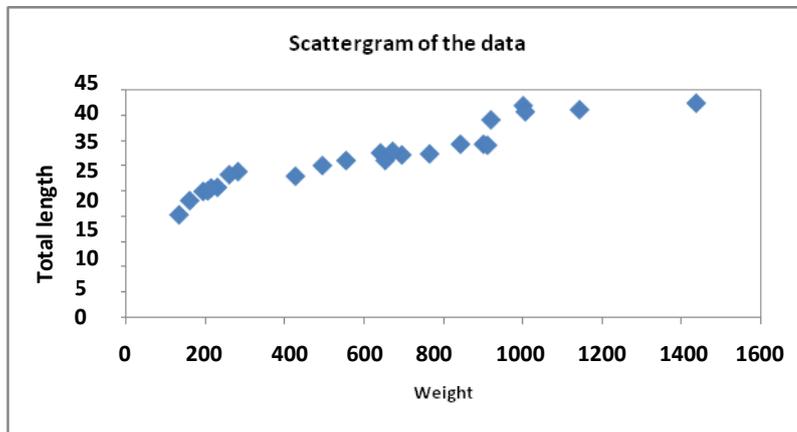


Fig (2) The relation between weight and total length, Significance level: 0.01 Pearson's correlation coefficient test (parametric test):

Observed value	0.952
Two-tailed p-value	< 0.0001
Alpha	0.01

At the level of significance Alpha=0.010 the decision was to reject the null hypothesis of absence of correlation. In other words, the correlation is significant.

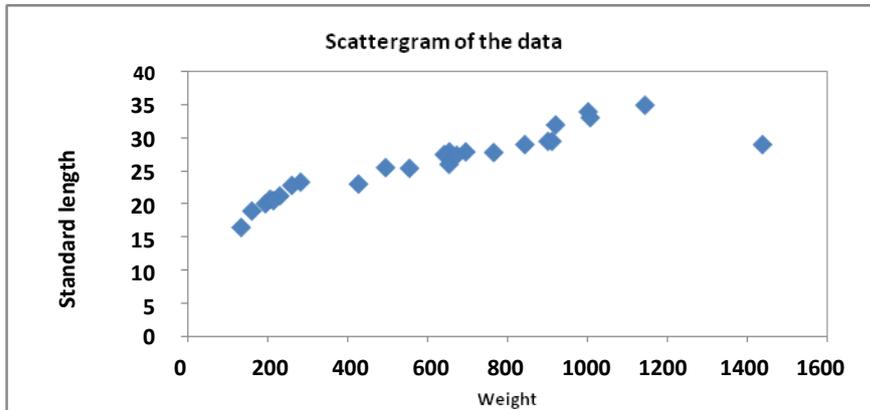


Fig (3) The relation between weight and standard length, Significance level: 0.01
Pearson's correlation coefficient test (parametric test):

Observed value	0.905
Two-tailed p-value	< 0.0001
Alpha	0.01

At the level of significance $\text{Alpha}=0.010$ the decision is to reject the null hypothesis of absence of correlation. The correlation is significant

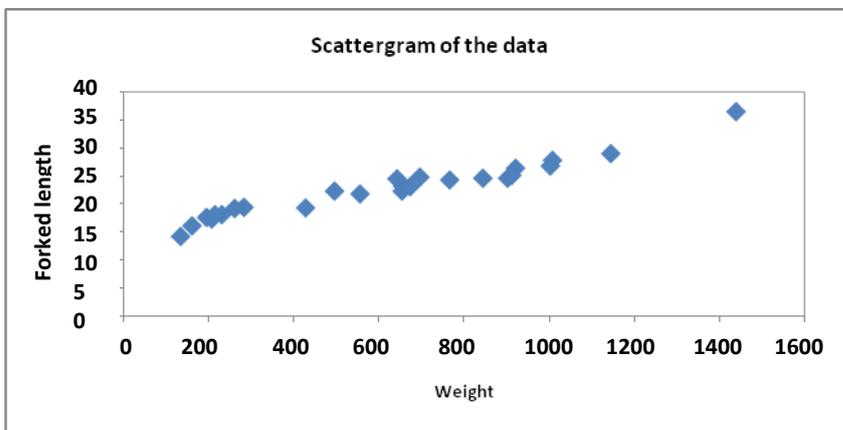


Fig (4) The relation between weight and forked length, Significance level: 0.01
Pearson's correlation coefficient test (parametric test):

Observed value	0.971
Two-tailed p-value	< 0.0001
Alpha	0.01

At the level of significance $\text{Alpha}=0.010$ the decision was to reject the null hypothesis of absence of correlation. The correlation was significant.

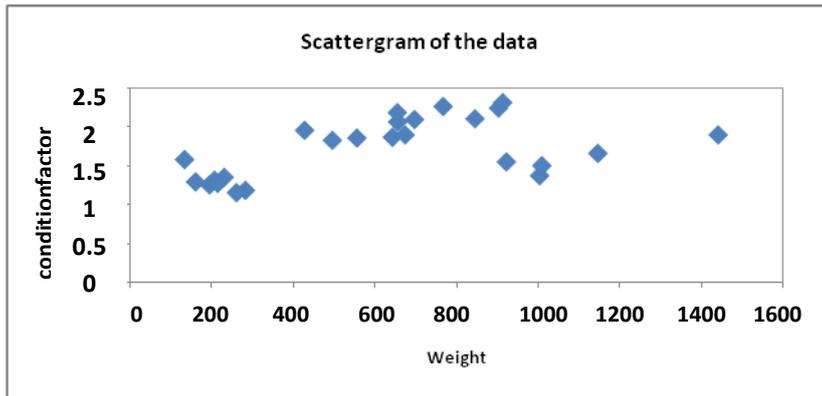


Fig (5) The correlation between weight and condition factor at 0.01 significance. Pearson's correlation coefficient test (parametric test):

Observed value	0.520
Two-tailed p-value	0.008
Alpha	0.05

The correlation is significant between weight and condition factor.

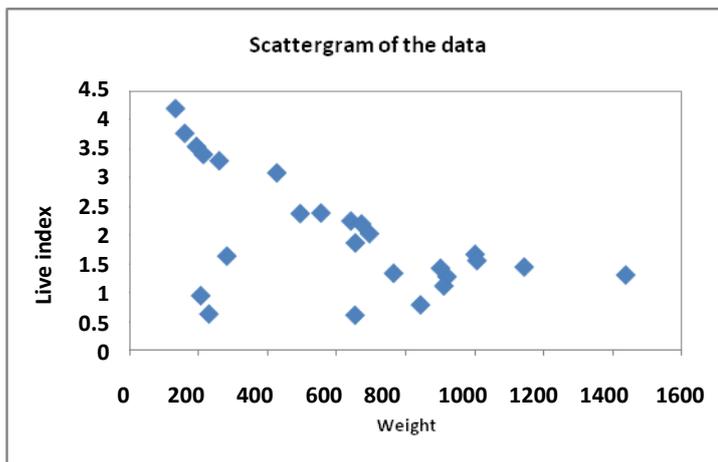


Fig (6) The correlation between weight and liver index at 0.01 significance. Pearson's correlation coefficient test (parametric test):

Observed value	-0.570
Two-tailed p-value	0.003
Alpha	0.01

The correlation was significant between fish weights and liver index.

Reports on the length-weight relationship of cyprinid fishes showed that many of them strictly follow cue law while there are many in which the weights of fishes either tend to increase or decrease in proportion to the cube of length. Isometric growth pattern has been reported in *Catla catla* (Karthi and Rao, 1990; Ahmad Dar, *et al.*, 2012)

and *Schizopyge plagisotomus* (Bhagat and Sunder, 1983). The slope value of regression line less than '3' has been reported in *Tor tor* (Malhotra, 1982), *Labeo dero* (Malhotra and Chauhan, 1984), *Labeo dyocheilus* (Malhotra, 1985), and *Cyprinus carpio communis*

and *Ctenopharyngodon idella* (Dhanze and Dhanze, 1997) and *Rasbora daniconius* (Sunil, 2000). These reports in agreement with the present findings on the length-weight relationship in *S. esocinus*, in which significant departure of 'b' value from the isometric value of 3 was observed (Salam *et al.*, 2005). Length-weight relationships may present spatial and temporal variations due to water temperature, food availability and reproductive activities (Abdallah, 2002; Arslan *et al.*, 2004). The b value in the length-weight relationship of fish can be used as an indicator of food intake and growth pattern, and may differ according to such biotic and abiotic factors as water temperature, food availability and habitat type (Abdallah, 2002; Avsar, 1998). Consequently, during the winter, when biological resources were insufficient and certain abiotic factors like water temperature were inadequate, *Salmo trutta* living in the Kan Stream could not feed sufficiently and demonstrated a negative allometric growth. In contrast, environmental conditions did not change the normal isometric growth of this species during the rest of the year, and both females and males demonstrated the same growth type, Trout cannot take food at temperatures lower than 2°C or during reproductive season, Hence, these fish feed insufficiently and display low b values during cold seasons. However, adequate feeding and gonad development increases fish weight and b values (Arslan *et al.*, 2004). Smaller size of an individual present high growth rate and it was observed on the monthly variation in the regression coefficient, which was correlated to constant regression, which inversely related to condition factor, The negative growth pattern of the Yellow Catfish in Vembanad Lake was attributed to the poor environmental conditions prevalent in the lake ecosystem, especially the high level of pollution coupled with poor

availability of food items (Prasad *et al.*, 2012). As the variation in the regression constant corresponds to the condition factor, which, subjected to seasonal oscillations, its variation can interfere in the variation of the regression coefficient. Braga (1997) suggests that the regression coefficient was not a good support indicator for characterization of different populations, because it can vary seasonally in the same population (Ayoade and Ikulala, 2007). The condition factor was an index reflecting interactions between biotic and abiotic factors in the physiological condition of fishes. It showed that the population's welfare during the various stages of the life cycle (Ahmad Dar *et al.*, 2012). Ahmed Dar *et al.*, (2012) state that the condition factor did not merely reflect the feeding condition of the adult stage, but includes the state of gonadal development, based on the consumption of fat reserves during the spawning period. Similar results obtained by Ahmed *et al.*, (2011) for *M. furnieri*. For instance, the factor of condition (K) in fish reflects, through its variations, information on the physiological state of the fish in relation to its welfare. From a nutritional point of view, increase in K values indicated the accumulation of fat and sometimes gonadal development (Winfield *et al.*, 2011). From a reproductive point of view, the highest K values (0.38- *E. andersoni*, 0.09- *L. lentjan*, 0.15- *L. fulviflamma* and 0.14- *S. sutor*) reached in species if the fishes fully mature and having higher reproductive potentiality .

References

- Abdallah, M. ,(2002) Length-weight Relationship of Fishes Caught by Trawl off Alexandria, Egypt. Naga, The ICLARM Quarterly, 25(1), 1-2.
- Abowei, J.F.N.,(2009) The Abundance, Condition Factor and Length-weight Relationship of *Cynoglossus galensis* (Kaup, 1858) from Nkoro River Niger Delta, Nigeria Adv. J. Food Sci. Technol., 1(1),57-62.
- Ahmad Dar, S.; Najar, A. M. ;Balkhi, M. H.; Rather, M. A. and Sharma, R.,(2012) Length weight Relationship and Relative Condition Factor of *Schizopyge geosocinus* (Heckel, 1838) from Jhelum River, Kashmir, International Journal of Aquatic Science, 3(1),29-36.
- Anbalagan, T.; Vijayanand, P. and Veerappan, N.,(2009) Length weight Relationship and Condition Factor of Soldier Fish *Myripristis murdjan* from Cuddalore Coast, South East Coast of India, Current Research Journal of Biological Sciences, 1(1), 18-20.
- Anderson, O.R. and Neumann, R.M.,(1996) Length, Weight and Associated Structural Indices, p. 447-482 In: Fisheries Techniques ,Nielsen, L.A. and Johnson, D.L. (Eds). Bethesda, American Fisheries Society, 732p.
- Arslan, M.; Yıldırım, A. and Bekta, S., (2004) Length-Weight Relationship of Brown Trout, *Salmo trutta* L., In habiting Kan Stream, oruh Basin, North-Eastern Turkey, Turk. J. Fish. Aquat. Sci., 4, 45-48.
- Avsar, D., (1998) Stock Differentiation Study of the Sprat off the Southern Coast of the Black Sea, Fisheries Research 19, 363-378, Bass North of Cape Hatteras, North Carolina. Am. J. Fish. Manag., 11, 139-149.
- Ayoade, A. A. and Ikulala, A. O. O. ,(2007) Length weight Relationship, Condition Factor and Stomach Contents of *Hemichromis bimaculatus*, *Sarotherodon melanotheron* and *Chromidotilapia guentheri* (Perciformes: Cichlidae) in Eleiyele Lake, Southwestern Nigeria, Rev. Biol. Trop., 55 (3-4),969-977.
- Bhagat, M.J. and Sunder, S., (1983) A Preliminary Note on Length weight Relationship and Condition Factor of *Schizopyge plagiostomus* (Heckel) from Jammu Region, Journal of Inland Fisheries Society of India, 15, 73-74.
- Braga, F.M. DE S., (1997) Analise da Equaçãoomét Ricanarelacão Peso-Comprimento e o Fator de Condiçãoem Plagioscions Quamosissimus (Teleostei, Sciaenidae). Revista Brasileira de Biologia, Rio de Janeiro, 57 (3),417-425.
- Cherif, M.;Zarrad, R.;Gharbi, H.;Missaoui, H. and Jarboui, O. ,(2008) Length-weight Relationships for 11 Fish Species from the Gulf of Tunis (SW Mediterranean Sea, Tunisia), Pan-American Journal of Aquatic Sciences,3 (1), 1-5.
- Chu, Wu-S.;Hou, Yi-Y.;Ueng, Yih-T. and Wang, Jiang-P.,(2012) Length-weight Relationship of Large Scale mullet, *Liza macrolepis*(Smith, 1846), of the Southwestern Coast of Taiwan, African Journal of Biotechnology, 11(8), 1948-1952.
- Dhanze, R. and Dhanze, J.R.,(1997) Biology of Scale Carp and Grass Carp 1. Length-weight Relationship and Growth Performance Under the Agro Climatic Zone of Himachal Pradesh, Indian Journal of Fisheries, 44, 255- 263.
- İlhan D., Akalın S., Tosunoğlu Z. and zaydın O.,(2010) Growth Characteristics and Reproduction of Comber, *Serranus cabrilla* (Actinopterygii, Perciformes,

- Serranidae), in the Aegean Sea. Acta Ichthyol. Piscat.40 (1),55–60
- Issac-Nahum, V.J. and A.E.A. DE M. Vazzoler,(1983) Biologia Reprodutiva de Micropogonias Furnieri (desmarest, 1823) (*Teleostei, Sciaenidae*). 1. Fator de Condiçãocomoindicador do Período de Desova. Boletim do InstitutoOceanografico, São Paulo, 32 (1),63-69.
- Kartha, K.N and Rao, K.S.,(1990) Length-weight and Length-maximum Girth Relationship of *Catla catla*(Ham.) in Commercial Landings of Gandhi Sagar Reservoir, Fishery Technology. 27,155-156.
- Le Cren E.D. ,(1951), The Length-weight Relationship and Seasonal Cycle in Gonadal Weight and Condition of Perch (*Percafluviatilis*), Journal of Animal Ecology, 20, 201- 219.
- Maci, S. ; Longoa, E. and Basseta, A. ,(2009) Length-weight Relationships for 24 Selected Fish Species from a non-tidal Lagoon of the Southern Adriatic Sea (Italy), TWB, Transit. Waters Bull., 3 (3), 1-9.
- Malhotra, S. K and Chauhan, R. S. ,(1984) Bionomics of Hill- Stream Cyprinids IV. Length-weight relationship of *Labeo dero* (Ham.) from India, Proceeding of Indian Academy of Science, 93,411-417.
- Mbaru, E. K.; Kimani, E.N.;Otwoma, L .M.; A. Kimeli and Mkare, T. K. ,(2011) Abundance, Length-weight Relationship and Condition Factor in Selected Reef Fishes of the Kenyan Marine Artisanal Fishery, Advance Journal of Food Science and Technology 3(1),1-8.
- Pauly, D. ,(1993) Fish byte Section. Editorial.Naga, ICLARMQuart., 16-26
- Prasad, G. A. ; Ali, M. ; Harikrishnan and Raghavan R.,(2012) Population Dynamics of An Andemic and Threatened Yellow Catfish *Horabagrus brachysoma* (Günther) from Periyar River, Southern Western Ghats, India, Journal of Threatened Taxa, 4(2),2333–2342.
- Rajput, V.,(2011) The length- weight Relationship, Condition Factor and Impact of Florida Concentration in *Tor Tor* (Mahasheer) of Lake Bhimtal, India, Ribarstvo, 69(2), 63-69.
- Ricker, W. E.,(1973) Linear Regressions in Fishery Research, Journal of the Fisheries Research Board of Canada,30, 409-434.
- Salam, A.; Naeem, M. and Shehnaz, K.,(2005) Length-Weight and Condition Factor Relationship of A Fresh Water Wild *Puntiuschola* from Islamabad, Pakistan, Pakistan J. Biol. Sci., 8(8), 1112-1114.
- Sandon, H. ,(1950) Sudan Notes and Rec, 25,61.
- Schneider, J. C.; Laarman, P. W. and Gowing,H. , (2000) Length-weight Relationships, Manual of Fisheries Survey Methods II, Chapter 17,1-18.
- Sunil, M.S. ,(2000) Length- weight Relationship in *Rasboradanicnius* (Ham.) from Achenkoli River, Pathanamthitta. Kerala, India, Indian Journal of Fisheries, 47, 271-274.
- Zakaria, Z. M.; Jalal, K. C. A. and Ambak, M. A.,(2000) Length-weight Relationship and Relative Condition Factor of Sebarau, *Hampalamacrolepidota* (Van Hasselt) in Kenyir, Malaysia. Pakistan, J. Biol. Sci., 3(5), 721-724.