



Length-weight Relationship and Condition Factor of Four Catfish Species (Actinopterygii: Siluriformes) from the Stanley Reservoir, Tamil Nadu, Southeast India

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ABSTRACT

Background: The length-weight relationship is estimated for four catfish species in order Siluriformes.

Methods: Fish samples were collected from the three sampling stations at Stanley Reservoir, Tamil Nadu, Southeast India, between December 2021 to November 2022. Fulton's condition factor (KF) (Fulton, 1904), calculated using the formula $K_F = (W/L^3) \times 100$ and Relative condition factor (KR) using the equation $KR = W/(a \times Lb^3)$ was employed to evaluate the health of the subjects and variations in form or condition with length respectively.

Result: The estimated b values range from 2.50 to 3.77. This study also provides the length-weight relationship for the newly described species, *Pangasius icaria*, which possesses delicacy in commercial markets. Both Fulton's condition factor (KF) and relative condition factor (KR) further highlight the health and ecological status of these species. These findings provide critical baseline data for the conservation and management of catfish species in this reservoir, highlighting the impact of anthropogenic pressures on their populations.

Key words: Catfishes, Condition factor, Length-weight relationships, *Pangasius icaria*, Siluriformes, Stanley reservoir.

INTRODUCTION

The length-weight relationship is a key metric that offers essential insights into the condition of fish stocks. Accurate data on body weight aids fisheries management and conservation efforts in regulating catches and estimating biomass (Rao *et al.*, 2024). Data on the length-weight relationship of fish species are crucial for biologists to assess fish stocks, manage populations effectively, make morphological comparisons across species and populations, evaluate life history patterns across regions and support species conservation efforts (Ozaydin *et al.*, 2007). The length-weight relationship (LWR) is a key tool for biologists to assess the well-being of fish populations as well as offers information regarding the growth rates of fish, estimation of biomass, genetic variations and condition factors (Froese, 2006; Jafari-Patcan *et al.*, 2018; Qadri *et al.*, 2017; Kop *et al.*, 2019; Eagder *et al.*, 2020; Phromthep *et al.*, 2024). The condition factor is a significant factor in determining the overall productivity and physiological condition of the fish population (Richter, 2007). It can be utilized for assessing the potential differences within the stocks (Froese, 2006).

The order Siluriformes includes freshwater catfishes and occurs all over the world (Malabarba *et al.*, 2020). Catfish species form one of the most diverse and species-rich groups in freshwater and marine environments, holding significant commercial value. Their name comes from the prominent tactile barbels (whiskers) near their mouths, resembling those of a cat (Muhammad *et al.*, 2016). Catfish have scaleless body, fleshy adipose fins without fin rays

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and sharp spines in their dorsal and pectoral fins, which serve as a defense mechanism (Wang *et al.*, 2016). They also exhibit various sizes, reflecting their adaptability and ecological versatility (Muhammad *et al.*, 2016).

Over the past decade, scientific interest in the length-weight relationship in fish has grown significantly (Froese

et al. 2011). Most research has focused on the length-weight relationships of common fish species from various aquatic habitats worldwide (Miranda et al. 2009). However, studies on the length-weight relationship of catfish species in Southern India's reservoirs have been limited (Gupta et al. 2011). In particular, length-weight relationships for fish species in Stanley Reservoir have not been previously documented. Therefore, this study aims to evaluate the length-weight relationships of four catfish species collected from the Stanley Reservoir of the Cauvery River in Southeast India.

MATERIALS AND METHODS

Samples were taken from sampling stations (S1) Masilapalayam (S2) Keeraikaranoor (S3) Kottaiyur (Fig 1) and transferred to laboratory facility at Erode Centre for Sustainable Aquaculture (ECeSA), TNJFU, Bhavanisagar. Fish samples were collected from the reservoir by using a coracle and gillnet with mesh sizes

ranging from 50-200 mm for catching fish of different sizes from December 2021 to November 2022. Fish samples were identified up to the species level, followed by standard fish identification books/manuals/literature (Talwar and Jhingran, 1991; Jayaram, 1999). The length and weight were measured from the freshly collected specimens. Total length (TL) was measured to the nearest millimeter (from the tip of the snout to the tip of the lower caudal lobe) and weight was measured by a digital top pan scale with an accuracy of 0.01 g. The weight was taken after wiping off the moisture from the fish body. The relationship between length and weight was determined according to a linear regression model using the formula:

$$TW = a TLb$$

Where,

W = Total body weight in grams.

L = Total length of fish.

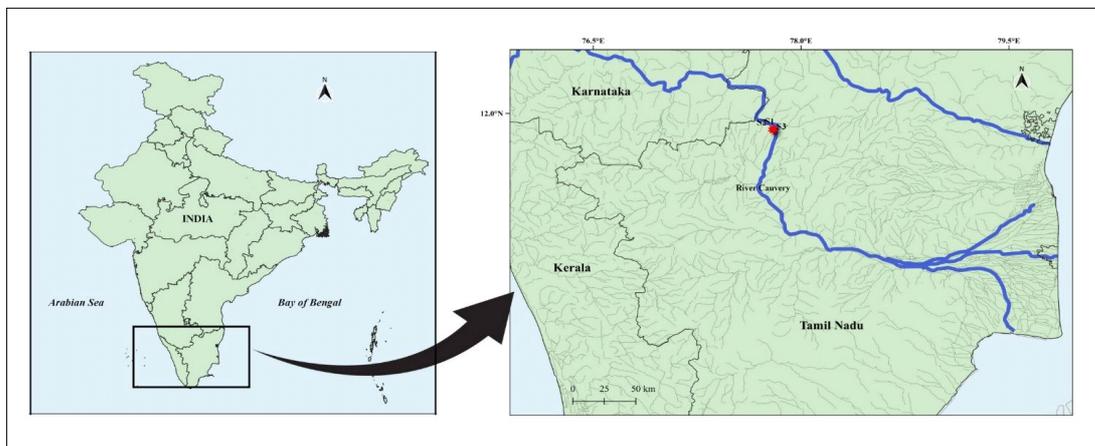


Fig 1: Map showing sampling stations sampling stations Masilapalayam(S1), Keeraikaranoor (S2), Kottaiyur (S3) at Stanley Reservoir along the River Cauvery.

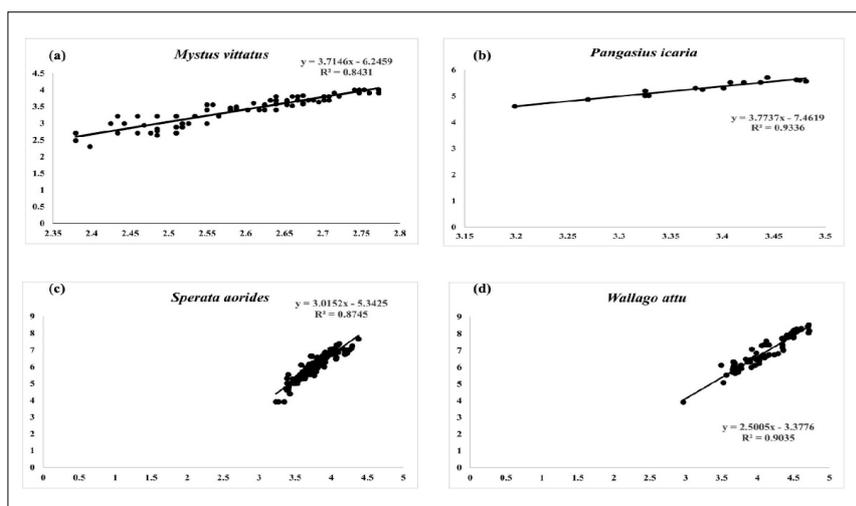


Fig 2: Length-weight relationship (a) *Mystus vittatus* (a = 0.0019, b = 3.71, r2 = 0.843, n = 83); (b) = *Pangasius icaria* (a = 0.0005, b = 3.77, r2 = 0.933, n = 16); (c) *Sperata aorides* (a = 0.0047, b = 3.01, r2 = 0.874, n = 284); (d) *Wallago attu* (a = 0.0341, b = 2.5, r2 = 0.903, n = 82) from the Stanley Reservoir, Tamil Nadu, Southeast India.

a = Intersection of regression curve or slope (coefficient related to body shape).

b = Growth coefficient.

The b value denotes information on the type of fish growth of fish *i.e.*, isometric growth $b=3$ (no change in fish body shape as it grows), if the b value is less than 3 *i.e.*, $b<3$ shows negative allometric (as the fish grows body shape becomes more slender), if fish b value is greater than 3 *i.e.*, $b>3$ it shows positive allometric growth (as fish grows body shape becomes relatively stouter or deeper-bodied) (Bagenal and Tesch, 1978). The extreme outliers were found and removed before regression analysis (Froese, 2006). Also, the coefficient of determination (r^2) and 95% confidence limit of 'a' and 'b' were evaluated using linear regression. Fulton's condition factor (KF), calculated using the formula below was employed to evaluate the health of the subjects.

$$KF = (W/L^3) \times 100$$

The relative condition factor (KR) was determined using the equation below to account for variations in form or condition with length.

$$KR = \frac{W}{(a \times Lb^3)}$$

RESULTS AND DISCUSSION

A total of 465 specimens of Siluriformes catfish species belonging to four genera were involved in the present analysis. Descriptive statistics and the length-weight relationship of the species are presented in Fig 2 and Table 1. During this study period, the intercept value ranged from 0.0005 (*Pangasius icaria*) to 0.0341 (*Wallago attu*). The slope b value ranged from 2.5 (*W. attu*) to 3.77 (*P. icaria*).

The results of the b value for *P. icaria* was 3.77 which indicates positive allometric growth. It is a new catfish species, described from the river Cauvery (Ayyathurai *et al.*, 2022). The findings of the present study were concurrent with the earlier reports by Kumar *et al.* (2020) who also concluded the positive allometric growth for its congener *P. silasi*. The b value for *Mystus vittatus* was 3.71 which shows positive allometric growth in the present findings. Hossain *et al.* (2009) and Chetia and Chutia *et al.* (2020) also concluded positive allometric growth in *M. vittatus*. However, Hossain *et al.* (2006) and Victor *et al.* (2014) concluded negative allometric growth in the same species. The b value of *Sperata aoroides* (3.01) was close to the isometric growth. The b value for *W. attu* observed during the present study recorded was 2.5 which indicates negative allometric growth. Similarly, many researchers (Sani *et al.* 2010; Sarkar *et al.* 2011) also reported that the value of b was significantly $b<3.0$ in *W. attu*, which shows agreement with the present finding. However, Khan *et al.* (2011) stated the isometric growth in *W. attu*. In contrast, several researchers (Yousaf *et al.* 2009; Achakzai *et al.* 2013; Rufus *et al.* 2015) observed positive allometric growth ($b > 3$) in *W. attu* across different water bodies. Kumar *et al.* (2023)

Table 1: Descriptive statistics and length-weight relationship of four Siluriformes fishes collected in the Stanley Reservoir, Tamil Nadu, Southeast India from December 2021 to November 2022.

Siluriformes species	n	Total length (cm)		Total weight (g)		a	95% CL of a	b	95% CL of b	r ²	K _F	K _R
		Min	max	min	Max							
<i>Mystus vittatus</i> (Bloch, 1794)	83	10.8	16	10	55	0.0019	0.0007-0.0048	3.7146	3.3603-4.0688	0.843	0.81-1.54	0.71-1.44
<i>Pangasius icaria</i> (Ayyathurai <i>et al.</i> 2022)	16	24.5	32.5	100	300	0.0005	0.0001-0.0040	3.7737	3.1966-4.3508	0.933	0.68-0.98	1.04-1.38
<i>Sperata aoroides</i> (Jerdon, 1849)	284	25.3	79.7	50	2100	0.0047	0.0028-0.0079	3.0151	2.8813-3.1490	0.874	0.22-1.09	0.57-2.07
<i>Wallago attu</i> (Bloch and Schneider, 1801)	82	19.4	112.6	50	5000	0.0341	0.0160-0.0724	2.5005	2.3187-2.6823	0.903	0.23-1.25	0.58-2.11

Abbreviations: a, intercept; b, slope; CL, confidence limits; max, maximum; min, minimum; n, number of individuals; r², coefficient of determination, K_F, Fulton's condition factor; K_R, relative condition factor.

concluded that *W. attu* showed negative allometric growth in Ganga, Yamuna and Yamuna whereas positive allometric growth in Hoogly and Pampa rivers. There are several reasons which were been suggested to influence the *b* value such as sex, age, season, feeding behaviour, variation in the number of specimens examined, anthropogenic activities, ontogenic changes, variation in the length of the specimen caught and gonad weight variation during different stages of sexual maturity (Moutopoulos *et al.* 2002; Peck *et al.* 2005, Winfield *et al.*, 2012). The lower r^2 value was observed in *M. vittatus* (0.843) and *S. aorooides* (0.874) may be due to the overrepresentation of same size range groups in the specimens examined (Gupta *et al.*, 2011).

Condition factor (K) is the parameter which indicates fish health (Bagenal and Tesch, 1978) and is strongly influenced by both the biotic and abiotic environmental variables such as feeding habits, feeding intensity, age, growth rate and the reproductive cycle (Le Cren, 1951). The values for KR and KF ranged from *S. aorooides* (0.57) to *W. attu* (2.11) and *S. aorooides* (0.22) to *M. vittatus* (1.54) respectively. Clark (1928) identified a link between the condition factor (KF) and the parameters of the length-weight relationship (LWR), illustrating that if the *b* value approximates 3, KF can be directly compared. KR, on the other hand, measures an individual's deviation from the average weight for a given length within the sample (Le-Cren, 1951). KF indicates the influence of biotic and abiotic factors on fish physiology (Çiçek *et al.* 2022) and assesses the health of the aquatic ecosystems they inhabit (Anene, 2005). Hence, the present analysis of KF indicates positive health and favourable environmental condition for all catfishes.

CONCLUSION

This pioneering study will offer essential baseline information for effectively conserving and managing catfish species in their natural habitats, such as the Stanley Reservoir. This reservoir is already experiencing significant anthropogenic pressures, leading to the rapid decline of endangered species like *Hemibagrus punctatus* (and commercially valuable catfish species like *P. icaria* in the reservoir and the River Cauvery. This present study provides length-weight information of catfishes around the Stanley Reservoir alone, which can be useful in future research with several other biological and environmental parameters and extensive sampling along the entire river will provide suitable exploitation and conservation management of fishery resources along the Stanley Reservoir.

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Disclaimers

The views and conclusions expressed in this article are solely those of the authors and do not necessarily represent the views of their affiliated institutions. The authors are responsible for the accuracy and completeness of the information provided, but do not accept any liability for any direct or indirect losses resulting from the use of this content.

Informed consent

All animal procedures for experiments were approved by the Committee of Experimental Animal care and handling techniques were approved by the University of Animal Care Committee.

Conflict of interest

All authors declares no conflict of interest. No funding or sponsorship influenced the design of the study, data collection, analysis, decision to publish, or preparation of the manuscript.

REFERENCES

- Achakzai, W.M., Baloch, W.A., Saddozai, S. and Memon, N. (2013). Length weight relationships (LWR s) of Wallago attu (Bloch and Schneider) from Manchar Lake Jamshoro, Sindh, Pakistan. *Journal of Applied Ichthyology*. 29(5): 1172-1172.
- Anene, A. (2005). Condition factor of four Cichlid species of a man-made lake in Imo State, Southeastern Nigeria. *Turkish Journal of Fisheries and Aquatic Sciences*. 5(1): 43-47.
- Ayyathurai, K.P., Kodeeswaran, P., Mohindra, V., Singh, R.K., Ravi, C., Kumar, R., Valaparambil, B., Thangappan, A.K.T., Jena, J. and Lal, K.K. (2022). Description of a new *Pangasius* (Valenciennes, 1840) species, from the Cauvery River extends distribution range of the genus up to South Western Ghats in peninsular India. *PeerJ*. 10: 14258-14258.
- Bagenal, T.B. and Tesch, F.W. (1978). Age and Growth. In *Methods for Assessment of Fish Production in Freshwaters* (ed. Bagenal, T), Blackwell Scientific Publications, Oxford, UK. pp. 101-136.
- Chetia, C. and Chutia, P. (2020). Length-weight relationship, condition factor and gonadosomatic index of *Mystus vittatus* (bloch, 1794). *BIOINFOLET-A Quarterly Journal of Life Sciences*. 17(4a): 612-614.
- Çiçek, E., Seçer, B., Eagderi, S. and Sungur, S. (2022). Length-weight relations and condition factors of 34 *Oxynoemacheilus* species (Actinopterygii: Cypriniformes: Nemacheilidae) from Turkish inland waters. *Acta Ichthyologica et Piscatoria*. 52(1): 29-34.
- Clark, F.N. 1928. The weight-length relationship of the California sardine (*Sardina caerulea*) at 281 San Pedro. Division of Fish and Game. *Fish Bulletin* No. 12: 59.
- Eagderi, S., Mouludi-Saleh, A. and Cicek, E. (2020). Length-weight relationship of ten species of Leuciscinae sub-family (Cyprinidae) from Iranian inland waters. *International Aquatic Research*. 12(2): 133-136. [https://doi.org/10.22034/IAR\(20\).2020.1891648.1004](https://doi.org/10.22034/IAR(20).2020.1891648.1004).
- Froese, R. (2006). Cube law, condition factor and weight-length relationships: History, meta analysis and recommendations. *Journal of applied ichthyology*. 22(4): 241-253.

- Fulton, T.W. (1904). The rate of growth of fishes. Twenty-second Annual Report, Part III, Fisheries Board of Scotland, Edinburgh, 1904.
- Gupta, B.K., Sarkar, U.K., Bhardwaj, S.K. and Pal, A. (2011). Condition factor, length-weight and length-length relationships of an endangered fish *Ompok pabda* (Hamilton 1822) (Siluriformes: Siluridae) from the River Gomti, a tributary of the River Ganga, India. *Journal of Applied Ichthyology*. 27(3): 962-964.
- Hossain, M.Y., Ahmed, Z.F., Leunda, P.M., Jasmine, S., Oscoz, J., Miranda, R. and Ohtomi, J. (2006). Condition, length-weight and length-length relationships of the Asian striped catfish *Mystus vittatus* (Bloch, 1794) (Siluriformes: Bagridae) in the Mathabhanga River, southwestern Bangladesh. *Journal of Applied Ichthyology*. 22(4): 304-307.
- Hossain, M.Y., Rahman, M.M. and Mollah, M.F.A. (2009). Threatened fishes of the world: *Pangasius pangasius* Hamilton-Buchanan, 1822 (Pangasiidae). *Environmental Biology of Fishes*. 84: 315-316.
- Jafari-Patcan, A., Eagderi, S. and Mouludi-Saleh, A. (2018). Length-weight relationship for four fish species from the Oman Sea, Iran. *International Journal of Aquatic Biology*. 6(5): 294-295. <https://doi.org/10.22034/ijab.v6i5.562>.
- Jayaram, K.C. (1999). *The Freshwater Fishes of the Indian Region*. Narendra Publishing House. Delhi, India.
- Khan, S., Khan, M.A., Miyan, K. and Mubark, M. (2011). Length weight relationships for nine freshwater teleosts collected from River Ganga, India. *International Journal of Zoological Research*. 7(6): 401-405.
- Kop, A., Korkut, A.Y. and Gurkan, S. (2019). Length-weight relationship and condition factor as an indicator of growth and feeding intensity of Sea bream (*Sparus aurata* L., 1758) given feed with different protein contents. *Indian Journal of Animal Research*. 53(4): 510-514. doi: 10.18805/ijar.B-998.
- Kumar, G., Kashyap, A. and Serajuddin, M. (2023). Length-weight relationships and condition factor of Asian sheat catfish, *Wallago attu* (Bloch and Schneider, 1801) inhabiting different rivers of India. *Journal of Fisheries*. 11(1): 111203-111203.
- Kumar, T.A., Kumar, S. and Lal, K.K. (2020). Length-weight relationship of a newly described catfish *Pangasius silasi* Dwivedi *et al.*, 2017 from Nagarjuna Sagar Dam, Telengana, India. *Journal of Fisheries*. 67(2): 130-133.
- Le-Cren, E.D. (1951). The length-weight relationship and seasonal cycle in gonadal weight and condition in the perch, *Perca fluviatilis*. *Journal of Animal Ecology*. 20: 201-219.
- Malabarba, L.R. and Malabarba, L.R. (2020). Phylogeny and classification of neotropical fish. *biology and physiology of freshwater neotropical fish*. Bernardo Baldisserotto Elisabeth Criscuolo Urbinati J.E.P. Cyrino Academic Press. 1-19. doi <https://doi.org/10.1016/C2017-0-03766-7>.
- Miranda, R., Galicia, D., Monks, S. and Pulido-Flores, G. (2009). Weight-length relationships of some native freshwater fishes of Hidalgo state, Mexico. *Journal of Applied Ichthyology*. 25(5): 620-621.
- Moutopoulos, D.K. and Stergiou, K.I. (2002). Length-weight and length-length relationships of fish species from the Aegean Sea (Greece). *Journal of Applied Ichthyology*. 18(3): 200-203.
- Muhammad, H., Iqbal, Z. and Akhlaq, T. (2016). Length-weight, length-length relationships and condition factor of fishes of family cyprinidae from the Indus River, Pakistan. *Punjab University Journal of Zoology*. 31(2): 143-147.
- Özaydin, O., Uçkun, D., Akalin, S., Leblebici, S. and Tosunoğlu, Z. (2007). Length-weight relationships of fishes captured from Izmir Bay, Central Aegean Sea. *Journal of Applied Ichthyology*. 23(6): 695-696.
- Peck, M.A., Clemmesen, C. and Herrmann, J.P. (2005). Ontogenic changes in the allometric scaling of the mass and length relationship in *Sprattus sprattus*. *Journal of Fish Biology*. 66(3): 882-887.
- Phromthep, A., Prisingkorn, W. and Wongmaneeprateep, S. Kumla S., Doolgindachbaporn S. (2024). Length-weight relationship and study using RAPD technique to determine the genetic variation of yellow catfish (*Mystus nemurus*, Valenciennes 1840) in Nong Han lake, Sakon Nakhon Province, Thailand. *Agricultural Science Digest*. 1-7. doi: 10.18805/ag.DF-674.
- Qadri, S., Shah, T.H., Balkhi, M.H., Bhat, B.A., Bhat, F.A., Najjar, A.M., Asmi, O.A., Farooq, I. and Alia, S., (2017). Morphometrics and length-weight relationship of *Schizothorax curvifrons* heckel 1838 in River Jhelum, Kashmir, India. *Indian Journal of Animal Research*. 51(3): 453-458. doi: 10.18805/ijar.v0i0f.3787.
- Rao, N.V., Jawahar, P., Jayakumar, N., Sujathkumar, N.V., Rani, V., Rathod, R. *et al.* and Kalavathi, N.R. (2024). Length-weight relationship and condition factor of siluriformes fish species, endangered *Eutropiichthys vacha*, hamilton (1922) and endemic deccan catfish rita kuturnee (Sykes, 1839) of godavari river Andhra Pradesh, South India. *Indian Journal of Animal Research*. 58(2): 336-341. doi: 10.18805/IJAR.B-5222.
- Richter, T.J. (2007). Development and evaluation of standard weight equations for bridgelip suckers and largescale suckers. *North American Journal of Fisheries Management*. 27(3): 936-939.
- Rufus, T., Eldho, P.S., Anvar Ali, N.D. and Raghavan, R. (2015). Length-weight relationship and condition factor of a large predatory catfish, *Wallago attu* (Schneider, 1801) from the rivers of central Kerala, India. *Journal of Aquatic Biology and Fisheries*. 3(1):105-110.
- Sani, R., Gupta, B.K., Sarkar, U.K., Pandey, A., Dubey, V.K. and Lakra, W.S. (2010). Length-weight relationships of 14 Indian freshwater fish species from the Betwa (Yamuna River tributary) and Gomti (Ganga River tributary) rivers. *Journal of Applied Ichthyology*. 26(3): 456-459.
- Sarkar, U.K., Khan, G.E., Dabas, A., Pathak, A.K., Mir, J.I., Rebello, S.C. and Singh, S.P. (2013). Length weight relationship and condition factor of selected freshwater fish species found in River Ganga, Gomti and Rapti, India. *Journal of environmental biology*. 34(5): 951-956.

- Talwar, P.K. and Jhingran, A.G. (1991). Inland fishes of India and adjacent countries. Oxford-IBH Publishing Co. Pvt. Ltd., New Delhi, India.
- Victor, R.M., Sivakumar, R. and Mathialagan, R. (2014). Food and feeding habit and length-weight relationship of the Asian striped catfish *Mystus vittatus* (Bloch, 1794) (Siluriformes: Bagridae) in the Vadavar River, Lower Anicut, Tamil Nadu. Indian Journal of Science. 8(20): 55-64.
- Wang, J., Lu, B., Zan, R., Chai, J., Ma, W., Jin, W., Duan, R., Luo, J., Murphy, R.W., Xiao, H. and Chen, Z. (2016). Phylogenetic relationships of five asian schilbid genera including clupisoma (Siluriformes: Schilbeidae). PLoS ONE. 11(1).
- Winfield, I.J., Adams, C.E., Armstrong, J.D., Gardiner, R., Kirika, A., Montgomery, J., Spears, B.M., Stewart, D.C., Thorpe, J.E. and Wilson, W. (2012). Changes in the fish community of Loch Leven: Untangling anthropogenic pressures. Hydrobiologica. 68: 73-84.
- Yousaf, M., Salam, A. and Naeem, M. (2009). Length-weight relationships of Wallago attu and Sperata sarwari from the Indus River, southern Punjab, Pakistan. Journal of Applied Ichthyology. 25(5): 614-615.