IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

RELATIVE GUT LENGTH AND GASTRO-SOMATIC INDEX OF FOUR FRESH WATER FISHES FROM KAIGAON TOKA AURANGABAD (MH)

[1] KHADE RAVI, [1]KHILLARE CHHAYA*

Late Pushpadevi Patil Arts and Science College Risod, Dist. Washim

Abstract:

The Relative gut length (RGL) and Gastro-somatic index (Ga.SI) of fresh water fishes viz. *Mystus armatus, Cyprinus carpio, Hypothalamichthys molitrix, and Cirrihinius mrigala* collected from Pravaranagar, Kaigaon Toka Maharashtra for the period of 6 month. It was observed that the relation between the total length of body and length of the alimentary canal changes according to the feeding habits of fishes. The feeding habits in *Mystus armatus* shows that eury-omnivores feeding habits, it was also observed feeding habitat may differ in juvenile and adult according to RLG values. *Cirrhinius mrigala* shows complete herbivores as the length of the alimentary canal increases as total length of body. *Cyprinus carpio* shows great fluctuations in feeding and found to be detritivores and herbivores feeding habits while in *Hypophthalimichthys molitrix* shows carni-herbivores feeding habits, fish also have strong gill rakers which are used for filter feeding. Feeding intensity was also analyzed of these fishes which depicted inverse relation between feeding with breeding, availability of food, habitat.

Keywords:, Herbivores, Carnivores, feeding intensity, freshwater fishes, Kaigaon Toka

Introduction:

Growth, breeding and life history of animals including migration, (Bal and Rao, 1994). This also helps to know the predicted changes on ecosystems due to natural or anthropogenic interventions. Food and feeding affects the density, growth, reproduction and survival of a natural population in any aquatic ecosystem. Knowledge of food in an organism is generally very important for studies of its nutritional requirements, its interactions with other organisms and potential for culture. Feeding activity affects the growth and productivity of an aqua culturable species (Mahaseth, 2007).

Relative gut lengths of vertebrates have long been studied and compared within and among species (Al-Hussaini, 1949). The most common explanations for relatively longer guts in herbivores focus on the chemical defenses of plants (Hay and Fenical, 1988), the indigestibility of plant fiber (Karasov and Martinez del Rio, 2008), or the poor nutritional quality of plants as food. If plants are considered "low quality" foods, then increased relative gut length in herbivores could serve as an adaptation in several possible ways: to increase the amount that can be ingested, to increase the time that food remains in the gut for digestion and absorption, and/or to increase the amount of surface area available for absorption (Karasov and Diamond, 1988; Starck 2005).

Feeding is the dominant activity of the entire life cycle of fish (Royce,1972) and food is the main source of energy which plays an important role in determining the population levels, rate of growth and condition of fishes (Begum et al., 2008). The success of good scientific planning and management of fish species largely depends on the knowledge of their biological aspects, in which food and feeding habits include a valuable portion (Sarkar and Deepak, 2009). Study of food and feeding habits of fishes have manifold importance in fishery biology and in fisheries management programmes (Khan and Fatima, 1993; Sarkar and Deepak, 2009). In order to determine the feeding habits such as herbivorous, carnivorous, omnivorous, herbi-omnivorous or carni-omnivorous RGL is widely used (De &Datta, 1990: Silva et al., 1976; Koundal et.al., 2013). The gastro-somatic index (Ga.SI) was used to determine the feeding intensity of fish (Rawat & Nautiyal, 1995; Serajuddin &Mustafa, 1998). Thus present study aims to add the knowledge of feeding biology of economically important fish species like *Mystus armatus, Cirrihinius mrigala, Cyprinus carpio and Hypothalamichthys molitrix* that can be a useful indicator of modified environments.

2. Materials and Methods:

2.1 Study Area:

The research lasted for 12 month, where the fishes were collected. Kaygaon Toka sampling station is situated at 19°37′N 75°01′ E with an elevation of 462 m. This dam is located at the backwater area of Paithan dam near to small village Kayagaon in Gangapur taluka of Aurangabad (Maharashtra, India) based on river Godavari. At this station the Pravara tributary joins the main river, hence this point is recognized as Pravara Sangam. The topography of the sampling station is deep black clay soil, depth of water varies from 0.5- <10 m and width is in between 70-130 m. This location is dominated by many aquatic weeds and vegetation. During summer and winter seasons the water flow was reduced but during monsoon it was increased and sometimes fully flooded.

2.2 Sampling:

A random collection of *Mystus. armatus, Cyprinus carpio, Hypothalamichthys molitrix, and Cirrhinus mrigala* was done by using diverse gears like hooks and lines, cast net (Local Name *fake jali)* , hand net and some local fishing gears such as Tuti, Dalgi (Box Trap) which is mostly used to collect small size fishes. The collected samples were subjected for detailed analysis after preserving them in 10 percent formalin.

2.3 Methodology:

The characterization of different sized fish as a carnivore, herbivore and omnivore was undertaken by using the Relative gut length (RGL) as a main morphological variable while feeding intensity was determined by Gastro-somatic index (Ga.SI). The RGL of the fish was determined by (Al-Hussani, 1949.

The variations in the feeding intensity of fishes were calculated by **(**Bhatnagar and Karamchandani, 1970). The morphometric measurements of the fish were recorded as per the criteria of the Jayaram (1981).

2.4 Analytical techniques:

The relationship between total length and gut length were represented by the least square equation Y = a + b X, where X = total length (TL) and Y= alimentary canal length (ACL). The grouping of the various sized fish was done on the basis of SL therefore it was used as X to analyze the regression line, by using five summary statistics , SDx, , SDy and *r* (i.e. the mean and standard deviation of *X*, the mean and standard deviation of *Y*, and the Pearson correlation between *X* and *Y*.). The slope 'b' and intercept 'a' were calculated as, a = - b. The test of significance for correlation 'r' was employed by using an equation where 'r' is correlation coefficient, 'R^2' is coefficient of determination and (n-2) is degree of freedom.

Results:

The relative gut length and gastro somatic index of four different fishes belonging in different size groups were calculated and plotted into different figures (1,2,3,4,5,6,7,8). The constant of regression 'a' and 'b', the Pearson correlation coefficient (r) and coefficient of determination (R^2) were also analyzed.

Table 1: Correlation between total length and alimentary canal length

Fish Species	n	a	b	r	R^2	t-test	p-Value	95% of CI
Mystus armatus	100	-0.46	1.05	0.94	0.89	3.903	0.0001	0.987-1.042
Cirrihinius. mrigala	100	12.4	0.03	0.79	0.84	3.872	2.674	3.553-5.629
Cyprinus Carpio	100	1.26	0.08	0.96	0.92	4.792	1.630	0.803-0.948
Hypothalamichthys Nobilis	100	4.86	0.19	0.93	0.86	1.497	0.137	2.736-2.828

Table 2. Range of RGL and Ga.SI of different fish

Fish	Range TL Min-Max (cm)	RGL	Ga.SI
Mystus armatus	11.2-34.9	0.91-1.27	2.03-4.26
Cirrihinius. mrigala	11.2-52.0	10.9-11.26	3.7-5.504
Cyprinus Carpio	14.2-29.8	10.8-13.5	2.526-3.21
Hypothalamichthys Nobilis	17.2-38.6	2.9-4.38	0.453-1.366

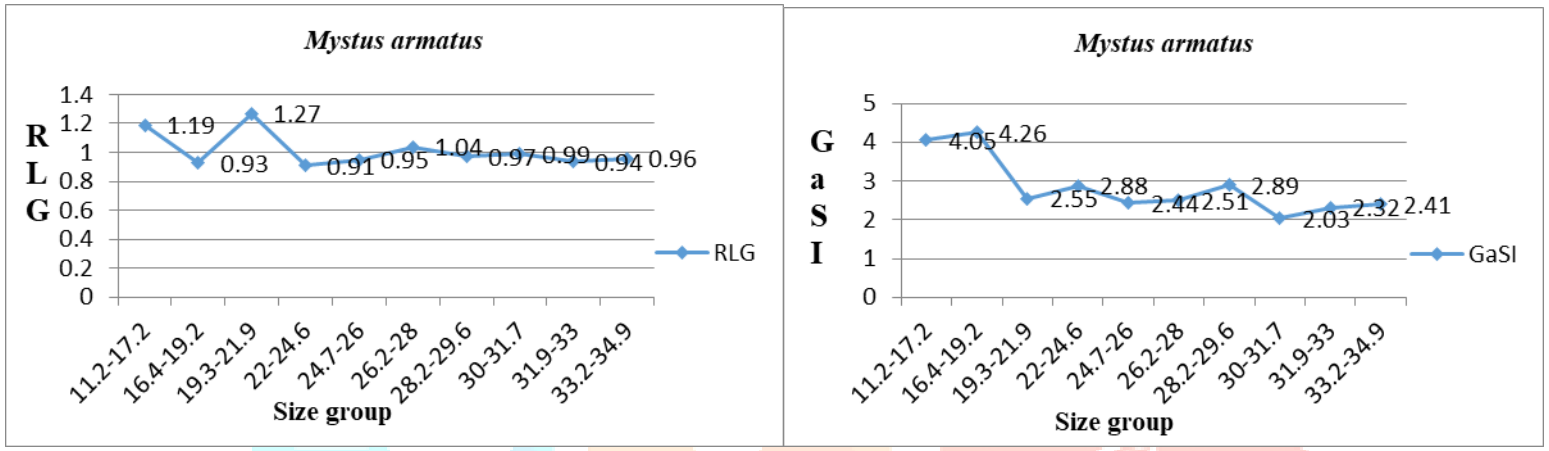


Figure 1 RGL and Ga.SI at different stages of M. armatus

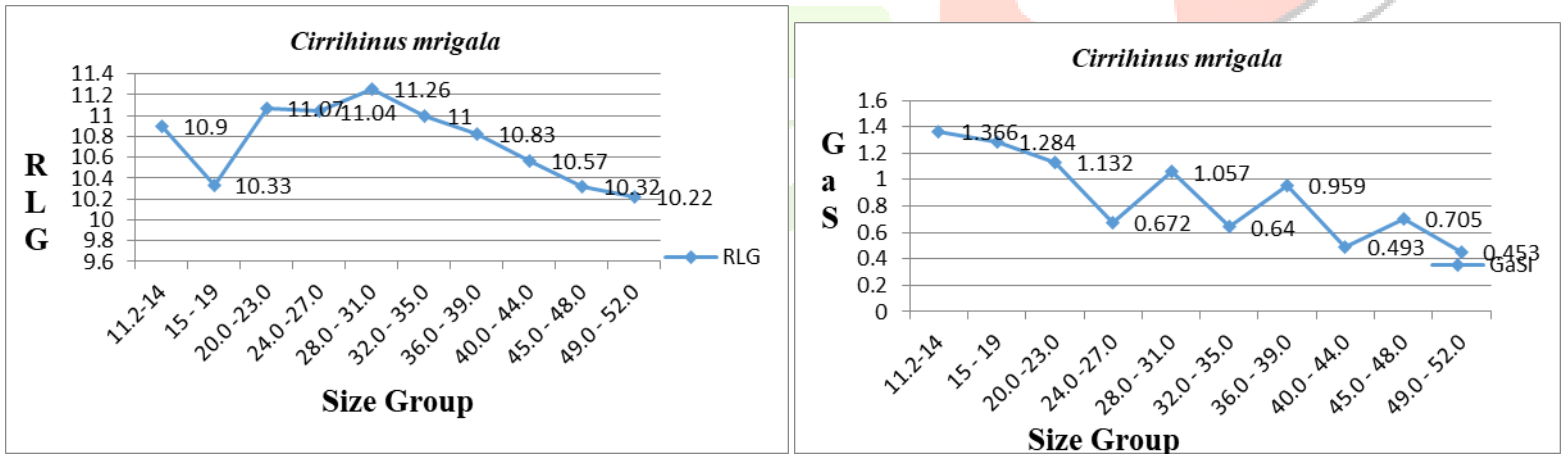


Figure 2 RGL and Ga.SI at different stages of C. mrigala

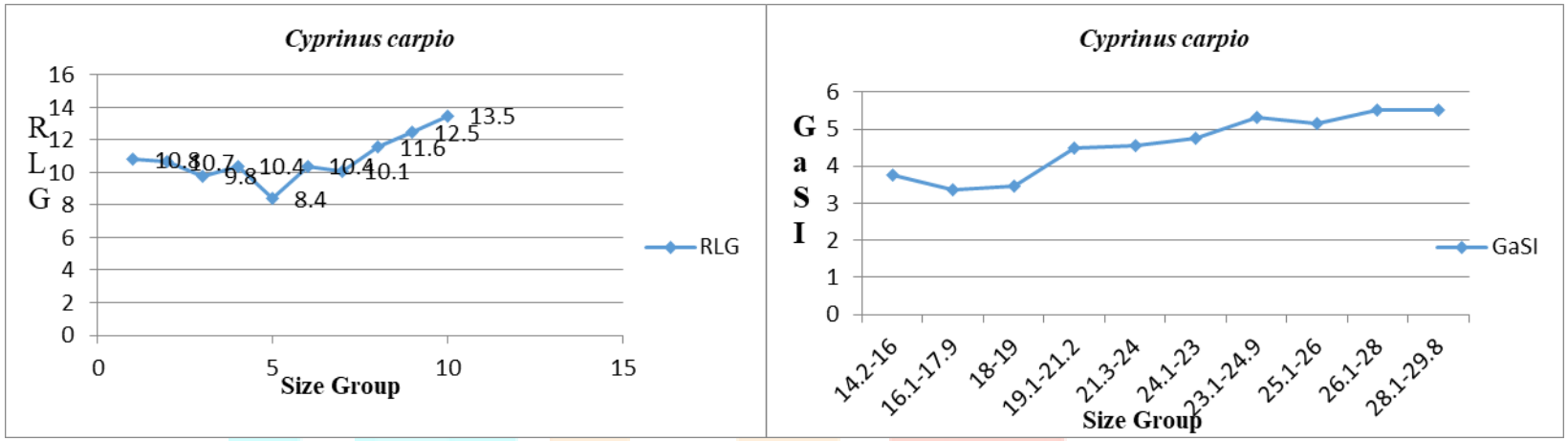
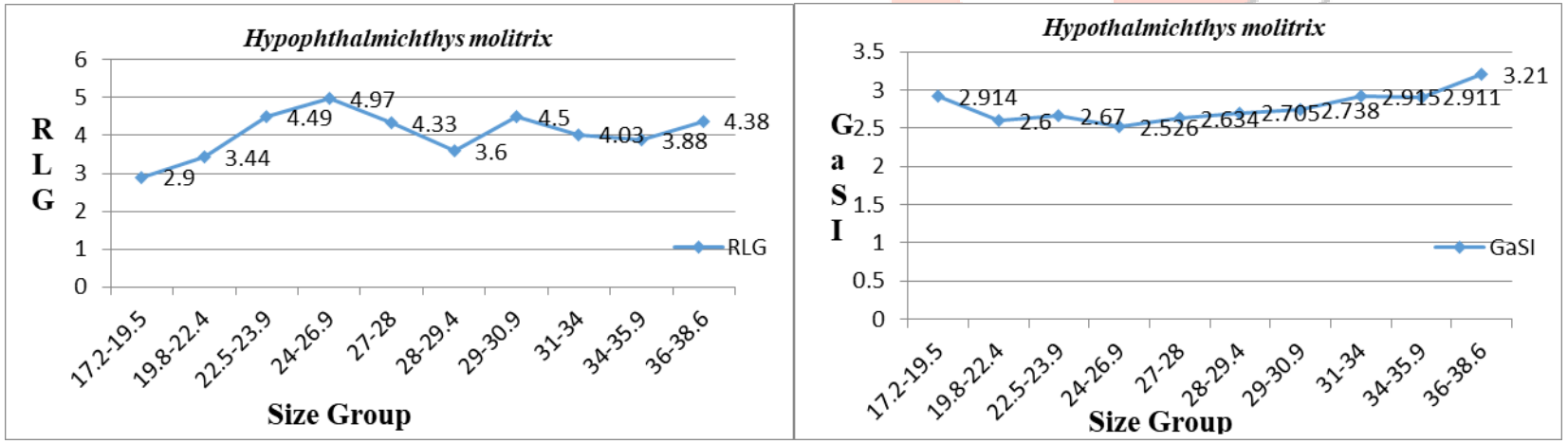


Figure 3: RGL and Ga.SI at different stages of C. carpio



The correlation coefficient 'r' between total length and alimentary canal length 0.94 and coefficient of determination 0.89 was found to be significant at 0.5 % level in *Mystus armatus* group. The regression equation TL= -0.46+1.05ACL which opined that a unit increment in the size of TL increased gut length by 1.05 cm (Table 1). A gradual increase in RGL was observed from 16.4 to 19.2 size groups of fishes which further decreases. The highest peak (1.27) was observed in the size ranging 19.3-21.3 cm size of group while lowest (0.91) in the size ranging 22-22.6 in total length (Fig 1). The overall values of RGL range between 0.91-1.27 (Table 2). Through variations of RGL was less among the size group of (11.2-28cm), yet acute fall was observed in the largest size fish. The higher value of RGL in smaller fish indicated Herbi-Omnivorous feeding habits. Thus in the present investigation it was observed that growth in *Mystus armatus* inferred, changed in dietary habitat from smaller to large in size. The results in the present investigation are similar to earlier reports. (Chaturvedi and Sexsena, 2013) that the fish is Eury-onmivorus which feeds a wide range in Phytoplankton (52.48%) and Zooplankton (42.52%). (Jesu et al., 2004) reported feeding habits in *Mystus mentanus* with omnivore feeding habits. (Dasgupta, 2004) reported, gut length increases due to more intake of vegetative matter and decreases with the increase in animal matter. The feeding intensity is indicated by Ga.SI values revealed decreasing trend with increased size of *Mystus armatus*. The GaSI values ranged from 2.03-4.05. The higher 4.05 was observed in 16.4-19.2 TL group and after that value decreases. The smaller size fish exhibited more voracious nature as compared larger. The probable reason for the highest GaSI value in small fish is that to take more food for growth and maturity and hence feeding intensity is higher.

The value of 'r' 0.79 found significant correlation at 0.5% level between total length and alimentary canal length in *Cirrihinius mrigala*. Overall regression equation is TL=12.4+0.03ACL, indicating that total length leads to an increase in gut length by 0.03cm. The peak of RGL (11.26) was observed in the 28-31 cm total length group and after that decreasing trend was observed (Fig 3). RGL values ranged from 10.9-31 cm in the group of *Cirrihinius mrigala*. The higher values of RGL inferred that herbivores' feeding habits. Though variations among the values was less, a decreasing trend was observed after the fish attained the size of 36 cm. The gut length of fish can decrease due to gonad development, as during maturity most of the body cavity is covered by gonads. (Kpundal , 2013) studied relative gut length and food and feeding habits of some dominant fishes and observed that the relative length of gut (RLG) of *Cirrhinus mrigala* was 10. 21 to 18.52, similarly (Nath and Moitra, 2014) found the relative gut length of *Cirrhinus mrigala* as 10. (Alikunhi and Rao, 1951) observed the ratio of 1:11 in *Cirrhinus mrigala* and also reported that the fish purely feeds on vegetable matter. The GaSI values found an increasing trend. The highest peak value was observed 4.49 in 19.9-21.2 cm range size total length. The highest value (5.504) was observed in range size of 28-31cm total length, lowest (3.38) in range size of 16.1-17.9 cm range size. The data obtained from analyzing RGL and GaSI indicated that, length of fish will decreases but intake of food is increases according to its sexual cycle The regression equation was transformed as TL=1.26+0.08ACL in *Cyprinus carpio* which indicates that total length leads to alimentary canal length by 0.08cm. The correlation coefficient 'r' is 0.96 was found to be significant to 0.5%level. The

value of RGL ranges from 8.4 to 13.5. The peak was observed in a size range of 22.1-23 cm, after that the value of RGL increases as the length of fish increases indicating the herbivores' feeding habits in fish. The highest (13.5) was observed in size group 28.1-29.8 and lowest (8.4) observed in 21-24cm length group. The values of RGL shows omnivores' feeding habits but mainly consists of detritus food items as the fish resides in the benthic region. Mangi and Memon reported the omnivore's feeding habit of *Cyprinus carpio.* The value of GaSI changes as the length of the fish. The values range from 0.45-1.36. Feeding intake capacity was majorly high in smaller sizes of fish and fell down as the increases in length. (Bhat et .al, 2012) reported similar results that minimum GaSI was recorded from belonging to the highest length group, and the smallest length group recorded maximum value. (Naik et al. 2015) reported that the fish attains larger size feeding rate would be relatively low. Most of the time the fish are observed with an empty stomach. (Sahoo et.al., 2011) reported that the seasonal fluctuations of the feeding intensity and dietary composition of fishes are influenced not only by maturation of gonads but also non-availability of food in the habitat.

In the group of *Hypophthalmichthys molitrix*, the correlation 'r' 0.93 (Table 1) between total length and alimentary canal length was found to be highly significant at % level. The regression equation found in TL=4.86+0.19ACL indicates that total length leads to increased gut length by 0.19 cm. The peak of RGL was observed in the 24-26.9 cm size range group and found in increasing trend as the length of fish increased. The values range from 2.9 to 4.79 (Fig 4) depicted carni- herbivores feeding type. Same result reported by (Spaho et.al., 2013) silver carp in the stage from larvae to fingerlings is distinguished for having two feeding régimes. The larvae are carnivorous since they feed on zooplankton, while fingerlings have tendency to feed on algae and as result their feeding habits régimes phytophagous. The feeding was increasing as the length of the fish increased. Similar reports were mention by (Cremer and Smitherman , 1980) reported collection of food particles by the *Hypophthamichthys molitrix* is largely dependent on the food availability in the environment i.e. when the most of the food items are small, they can collect food particles even smaller than the distance between gill rakers. When most of the food items are large, they collect mainly those food particles larger than the distance between the gill rakers. There are fluctuations observed. The values of GaSI ranged from 2.6-3.21 (Table 2). The highest peak (3.21) was observed in 36-38.6 size groups while lowest (2.6) was observed 19.8 - 22.4.

Conclusion:

In the present study it was concluded that Relative length gut in fishes changes according to their food, maturity and size. It also depends on the availability of food in the water body. The feeding intake also changes according to size and maturity in above fishes. The food engulfed by fish is also dependent on gill rakers size. This work may help in culture fish as we know the feeding intake capacity of fishes and what amount of food should be provided.

Acknowledge:

Author is highly thankful to the Head of Department, Department of Zoology, Dr. Babasaheb Ambedkar Marathwada University Aurangabad (Mh) for providing facilities to carry out the research. We are also very much thankful to local fishermen for helping to catch fishes.

Reference:

Al-Hussaini, A.H. (1949). On the functional morphology of the alimentary tract of some fish in relation to differences in their feeding habits; anatomy and histology. Quaternary Journal Microscopial science. 90 part2.

Alikunhi, K.H., Rao, S.N. (1951). Notes on the early development, growth and maturity of *Cirrhinus reba* (Hamilton). Journal of the Zoological Society of India, 3:85-89.

Bal, D.V. & Rao, K.V. (1993). Marine fisheries. Tata McGraw-Hill Publishing Company, New Delhi,

Begum, M., Alam, M.J., Islam, M.A. and Pal, H.K. (2008). On the food and feeding habit of an estuarine catfish (*Mystus gulio* Hamilton) in the south west coast of Bangladesh., Rajshahi University. Journal of zoology. 27:91-94.

Bhat, F. A., Yousuf, A. R. and Parveen, M. (2012). Biology of *Cyprinus carpio communis* from Dal Lake, Kashmir with Reference to Food and Feeding Habits, Length-Weight Relationship, and Fecundity., Nature Environment and Pollution Technology, An International Quarterly Scientific Journal, (11):79-87.

Bhatnagar, G.K. and Karamchandani, S.J. (1970). Food and feeding habits of *Labeo fimbriatus* (Bloch) in river Narbada near Hoshangabad (M.P.). Journal of the Inland Fisheries Society India 2: 30-50.

Chaturvedi, J., and Saksena, D.N. (2013): Diet composition, feeding intensity, gastro somatic index and hepatosomatic index of a catfish, *Mystus cavasius* from Chambal river (near Rajghat) Morena, Madhya Pradesh. International Journal of Recent Scientific Research, 4:1350-1356.

Cremer, M.C. and Smitherman, R.O. (1980). Food habits and growth of silver carp and bighead carp in cages and ponds., Journal of aquaculture, 20:57-64.

Dasgupta, M. (2004): Relative length of the gut of some fresh water fishes of West Bengal in relation to food and feeding habits., Indian journal of fisheries, 51:381-384.

De, D.K. and Datta, N.C. 1990. Studies on certain aspects of the morpho-histology of Indian shad hilsa, *Tenualosa ilisha* (Hamilton) in relation to food and feeding habits. Indian Journal of Fisheries.; 37:189-198.

De, Silva S.S., Kortmulde,r K., Wijeyaratne, M.J. (1976). A comparative study of the food and feeding habits of *Puntius bimaculatus* and *P. titteya* (Pisces, Cyprinidae). Netherlands Journal of Zoology. 27:253-263.

Fatima, M. and Khan, A.A. (1993). Cyclic changes in the gonads of (Ham) from river Yamuna India. Journal of Asian fish Science. 48: 23-29.

Hay, M.E. and Fenical, W. F (1988). Large mobile versus small sedentary herbivores and their resistance to seaweed chemical defenses. Oecologia 75:246–252.

Jayaram, K. C. (1981). The freshwater fishes of India, Pakistan, Bangladesh, Burma, Sri Lanka: a handbook. (Calcutta): Zoological Survey of India, 475.

Jesu, A., Haniffa, M.A., Seetharaman S. and Singh S.P. (2004): Food an feeding habits of an endemic catfish *Mystus monatanus* (Jerdon) in river Tambarapani. Indian journal of fisheries, 51:107-109.

Karasov, W.H. and Diamond, J.M. (1988). Interplay between physiology and ecology in digestion. Journal of Bioscience, 38: 602-611.

Karasov, W.H. and Martinez, C. Del Rio (2008). Physiological Ecology: How Animals Process Energy, Nutrients, and Toxins. Illustrated edition.

Koundal, S., Dhanze, R., Koundal A. and Sharma I. (2013). Relative gut length and gastro-somatic index of six hill stream fishes, Himachal Pradesh, India. Journal of Environment and Biosciences. 27:11-18.

Kpundal, S., Dhanze, R., Kounda, A. and Sharma, I. (2013). Relative gut length and gastro-somatic index of six hill stream fishes from Himachal Pradesh, India. Journal of environmental biological science. 27:11-18.

Mahaseth, V.K. (2007). Limnological study of river Mahakali with special reference to Tor species. PhD. Thesis, submitted to department of Zool. Th. DSB Campus, Kumaun University.

Marsida, B. (Libohova), Arben, B. Spaho, V. (2013). Assessment of natural feeding in larvae, free living fry and fingerlings of sliver carp (*Hypopthalmichthys molitrix* valenc. In Cuvier and Valenc., 1844) and grass carp (*Ctenopharyangodon idella (*valenc. In Cuvier and Valenc., 1844). Albanirnal of journal of agriculture sciences 12:149-157.

Naik G, Rashid M., Balkhi M.H. and Bhat F.A., (2015). Food and Feeding Habits of *Cyprinus carpio Var. communis:* A Reason that Decline Schizothoracine Fish Production from Dal Lake of Kashmir Valley., Fisheries and Aquatic Journal, 6:1-5.

Nath S., Moitra S.K. and Das S.M. (2014). Comparative anatomy of alimentary canal of common fresh water fishes and their food and feeding habits., Narendra publishing house, New Delhi

Rawat V.S., Nautiyal P. (1995). Natural History of a Hill stream cyprinid *Barilius bendelisis*: Food and feeding habits in relation to growth rate. Indian Journal of Fisheries. 27:6-13.

Royce W.F. (1972) . Introduction to the fishery science. Academic press, Inc., New York, 351pp.

Sahoo D., Panda S. and Guru B.C. (2011). Studies on reproductive biology and ecology of blue swimming crab *Portunus pelagicus* from Chilika Lagoon, Orissa, India. Journal of marine biology. 91: 257-264.

Sarkar U.K. and Deepak P.K. (2009). The diet of clown knife fish *Chitala chitala* (Hamilton- Buchanan) an endangered notopterid from different wild population. Egyptian journal of ichthyology. 1: 11-20.

Serajuddin M. S. (1998). Feeding specialization in adult spiny eel *Mastacembelus armatus*. Asian Fisheries Science. 7:63-65.

Starck J.M. (2005). Structural flexibility of the digestive system of tetrapods – patterns and processes at the cellular level. In 'Physiological and Ecological Adaptations to Feeding in Vertebrates'. (Eds J. M. Starck and T. Wang.) Science Publishers: Enfield, NH, 175-200, 2005.