Original Research Article

Food And Feeding Habits, Length-Length Relationship and Condition Factor of Fresh Water Fish *Mystus armatus*.

Abstract:

The present study describes the food and feeding habits, Length- length relationship and condition factor in Cat fish *Mystus armatus*. Food contains was measured by frequency of occurrence method. Length-length relation was measured by correlation regression equation method. The length indicates that relationship between length if highly correlated. R2 > 0.56: P<0.001. The values of condition factor varies from 0.70 to 0.88. The present study is useful to study conservation and sustainable fisheries management. In the present study it was concluded that Mystus armatus is carnivorous feeder, length length relationship is significant, condition of fish is in poor condition due to various conditions of water.

Key Words: *Mystus armatus*, length-length relationship, condition factor, gut content analysis

INTRODUCTION:

Mystus armatus is commonly called as katarna is one of common catfish founds in rivers and reservoirs of India, Bangladesh, Pakistan, Afghanistan and Nepal. In fisheries biological investigation of food of the fishes has been very important because it regulates or at least influence the occurrence, growth of fish. Feeding habits of fish help to know the inter specific relationship and productivity of the water

bodies. Nutrition and feeding influence the growth, reproduction and health of fish (Srivastva et.al.2014).

Food is most important energy source for the growth and survival of all animals. Proper knowledge of food and feeding habits of fish is an important prerequisite for increasing fish production (Mamum, *et.al.,*2004). Dasgupta (2000) reported that the diversity in feeding habits that the fishes exhibit is particularly the result of evolution leading to structural adaptation for getting food from the equally great diversity of situations that have evolved in the environment.

Food is the main source of energy and plays an important role in determining the population levels, rate of growth and condition of fishes. Food and feeding habits of fishes have a great significance in aquaculture practice which will utilize all the available potential food of water bodies without any competition with one another but will live in association with other fishes (Victor *et.al.,* 2014).

Jhingran (1983) stated that the natural food of fishes are classified under three group

1. Main food
2. Occasional food
3. Emergency food

The stimuli to food are of two types

1. Factor affecting the internal motivation or drive for feeding, including season, time of day, light intensity, time and nature of last feeding, temperature and any internal rhythm that may exist.
2. Food stimuli perceived by sense like smell taste, sight and the lateral line system that release and control the momentary feeding out.

A variety of morphological, physiological, behavioral and biochemical characteristics are used to identify and classify the fishes. In practices though, it is more common to use morphometric measurements (i.e. body length, body depth, head length, eye diameter, jaw length) and meristic (i.e. fin ray, scale, teeth, gill raker, and lateral line pore counts). These morphometric measurements are usually presented as a proportion of standard, fork and total length (Howe,2002). Morphometric measurements and statistical relationships of fishes are imperative for both fishery biology (Sparre *et al* 1989; Mustafa & Brooks 2008) and taxonomy studies (Tandon *et al* 1993; Simon *et al* 2010a). It is very important especially in comparative studies which little information seems to be available for fish species (Froese and Pauly, 2005, Khillare and Sonawane 2016).

The aim of present study was to determine length length relationship, food and feeding habits and condition factor of *Mystus armatus* in Aurangabad region.

MATERIAL AND METHODS:

Gut content analysis

Total 100 fishes (Sample) of different size and shape were collected for the study of food and feeding habits of fishes, samples were collected from Kaigaon Toka Aurangabad (M.S.) from sampling site during the period of January 2018 to December 2018. Specimens were properly cleaned and total length (measured form anterior tip of the longest jaw to the posterior part of the tail) and total weight of fish were recorded. Specimens were dissected and their stomach removed and the length stomach was recorded and preserved in 10% formalin for further analysis.

Analysis of food was done by frequency occurrence method followed by Dewen and Shah (1979). Frequency of occurrence (Fi)= ni/NT Where, ni= No. of samples containing type of prey (i) NT=Total no. of stomach with food in sample.

For length-length relationship:

Total length was measured from the anterior tip of the longest jaw to the most posterior part of the tail, standard length was measured from anterior tip of the upper jaw to the tip of hypural bone (urostyle), fork length was measured from the anterior tip of upper jaw to the median point of the caudal fin, head length was measured from anterior tip of upper jaw to posterior region of head, dorsal length was measured from upper anterior tip of upper jaw to the end of dorsal fin (Laevastu, 1965). The relationship between total length, standard length, fork length, head length and alimentary canal length were calculated by linear regression. (Hossain *et al*., 2006).

The condition factor

K was estimated from the relationship

K=100W/L3, Where W= weight of fish in grams, L= total length of fish in centimeters.

Results:

Gut Content analysis:

Gut content analysis of *Mystus armatus* shows mostly animal types of food consisting crustaceans, small fishes, mulluscs, aquatic insect, small size prawns, fish also feeds on plant material such as alage, aquatic plants, and mud particles but in very small quantity.

In the present study it was observed that percentage of frequency of occurrence of crustacean is highest 25% in the month of May 2018 and lowest in 12.5 in December 2018 (Table 1).

Percentage of frequency of fishes was highest 20.018 in June 2018 and lowest 13.329 in July 2018(Table 1)..

It was observed that frequency of occurrence of food for mullusc was highest 9.440 in November 2018, the mullusc were not found in the February 2018(Table 1).

The percentage of frequency of occurrence of food aquatic crustaceans was higher 15.517 in March 2018, lower 6.25 in August 2018(Table 1).

It was observed that percentage of frequency of occurrence of food Prawn was highest 14.296 in month April 2018, lowest in 9.440 in November 2018(Table 1).

Percentage of frequency of occurrence of food algae was highest 13.470 in February 2018, lowest 6.25 in April 2018(Table 1).

It was observed percentage of frequency of occurrence of food aquatic plant was highest 12.504 in July 2018 and lowest in 7.537 in November 2018 (Table 1).

The percentage of frequency of occurrence of mud particles was highest 9.847 in October 2018 and lowest in 1.285 in December 2018(Table 1).

Month/ Food		Jan 2018	Feb 2018	Mar 2018	Apr 2018	May 2018	June 2018	July 2018	Aug 2018	Sept. 2018	Oct 2018	Nov 2018	Dec 2018

Table1: Percentage of frequency of occurrence of food in *Mystus armatus*

Crustacean	ni	12	9	9	10	20	13	11	11	13	16	9	7
	NT	19	21	20	21	27	22	19	20	19	24	19	20
	Fi	0.631	0.428	0.45	0.476	0.740	0.590	0.578	0.55	0.684	0.666	0.473	0.35
	Fc%	18.461	17.313	15.517	17.874	**25**	18.570	19.639	17.187	18.323	22.538	16.977	**12.5**
Fishes	ni	13	9	11	8	14	14	10	12	14	12	10	9
	NT	19	21	20	21	27	22	19	20	19	24	19	20
	Fi	0.684	0.428	0.55	0.380	0.518	0.636	0.526	0.6	0.736	0.5	0.526	0.45
	Fc%	20.011	17.313	18.965	14.269	17.5	**20.018**	**13.329**	18.75	19.716	16.920	18.880	16.071
Mollusca	ni	6	0	4	2	3	4	6	4	2	3	5	4
	NT	19	0	20	21	27	22	19	20	19	24	19	20
	Fi	0.315	0	0.2	0.095	0.111	0.181	0.315	0.2	0.105	0.125	0.263	0.2
	Fc%	9.215	**0**	6.896	3.567	3.75	5.697	7.988	6.25	2.812	4.230	**9.440**	7.142
Aquatic insects	ni	9	6	9	7	9	9	6	10	11	10	8	8
	NT	19	21	20	21	27	22	19	20	19	20	19	20
	Fi	0.473	0.285	0.45	0.333	0.333	0.409	0.315	0.2	0.578	0.416	0.421	0.4
	Fc%	10.125	11.529	**15.517**	12.504	11.25	12.873	7.988	**6.25**	15.483	14.077	15.111	14.285
prawn	ni	8	7	7	8	9	8	7	9	7	9	5	6
	NT	19	21	20	21	27	22	19	20	19	24	19	20
	Fi	0.421	0.333	0.35	0.380	0.333	0.363	0.368	0.45	0.368	0.375	0.263	0.3
	Fc%	12.317	13.470	12.068	**14.269**	11.25	11.425	12.504	14.062	9.858	12.690	**9.440**	10.714
Algae	ni	7	7	5	5	6	8	5	5	8	7	6	7
	NT	19	21	20	21	27	22	19	20	19	24	19	20
	Fi	0.368	0.333	o.25	0.238	0.222	0.363	0.263	0.25	0.421	0.291	0.315	0.35
	Fc%	11.689	**13.470**	8.620	8.930	**7.5**	11.425	8.936	7.812	11.277	9.847	11.306	12.5
Aquatic Plant	ni	5	6	5	6	7	6	6	6	7	7	4	7
	NT	19	21	20	21	27	22	19	20	19	24	19	20
	Fi	0.263	0.285	o.25	0.285	0.259	0.272	0.315	0.3	0.368	0.291	0.210	0.35
	Fc%	7.694	**11.529**	8.620	10.702	8.75	12.494	12.504	9.375	9.858	9.847	**7.537**	12.5
mud particles	ni	5	8	8	10	12	8	5	7	9	7	6	8
	NT	19	21	20	21	27	22	19	20	19	24	19	20
	Fi	0.263	0.380	0.4	0.476	0.444	0.363	0.263	0.35	0.473	0.291	0.315	0.4
	Fc%	7.694	5.372	3.793	7.874	1.51	1.425	8.936	1.937	1.670	9.847	1.306	1.285

Where 'ni' No. of stomachs containing a type of food 'i'and NT= is No. of not empty stomachs examined ; Fi=ni/NT and Fc%= Fi/∑Fi×100

Length-length Relationship:

Table no. 2 shows conversion among length-length measurements i.e. relationship between total length (TL), Fork length (FL), standard length (SL), alimentary canal length and Head length of 100 fish specimens, along with the estimated parameters of the length- length relationship and coefficient determination (r2). Length-length (relationship between total length to standard length, standard length to fork length, fork length to total length, total length to head length, total length to alimentary canal length) relationship was highly significant. (p<0.01), with the most of the coefficient determination value being greater than 0.70

Table No. 2: Estimated Parameters in Length-length relationship

Fish name	Type of conversion	Slope (a)	Intercept (b)	r	R2	Regression equation Y=a+bX
Mystus armatus	TLV SL	0.925	1.23	1.14	1.29	TL=a+bSL
	FL V SL	0.062	1.12	0.97	0.94	FL=-a+bSL
	TL V FL	1.22	1.08	1.08	1.16	TL=a+bFL
	TL V HL	3.46	2.94	0.85	0.83	TL=a+bHL
	TL V ACL	-1.79	1.10	0.98	0.96	TL= a=bACL

a, intercept: b, slope:: r2 coefficient of determination: TL, total length, SL standard length, FL fork length, ACL alimentary canal length, HL head length

Fig 1: Shows Relationship between Total length and standard length *Mystus armatus*

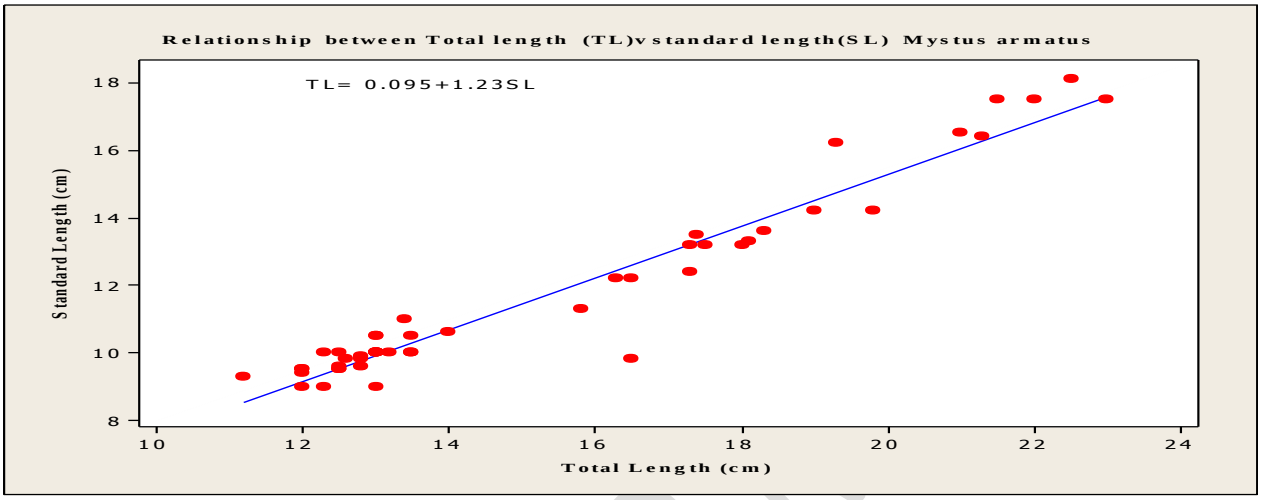


Fig 2: Shows Relationship between fork length and standard length in *Mystus armatus*

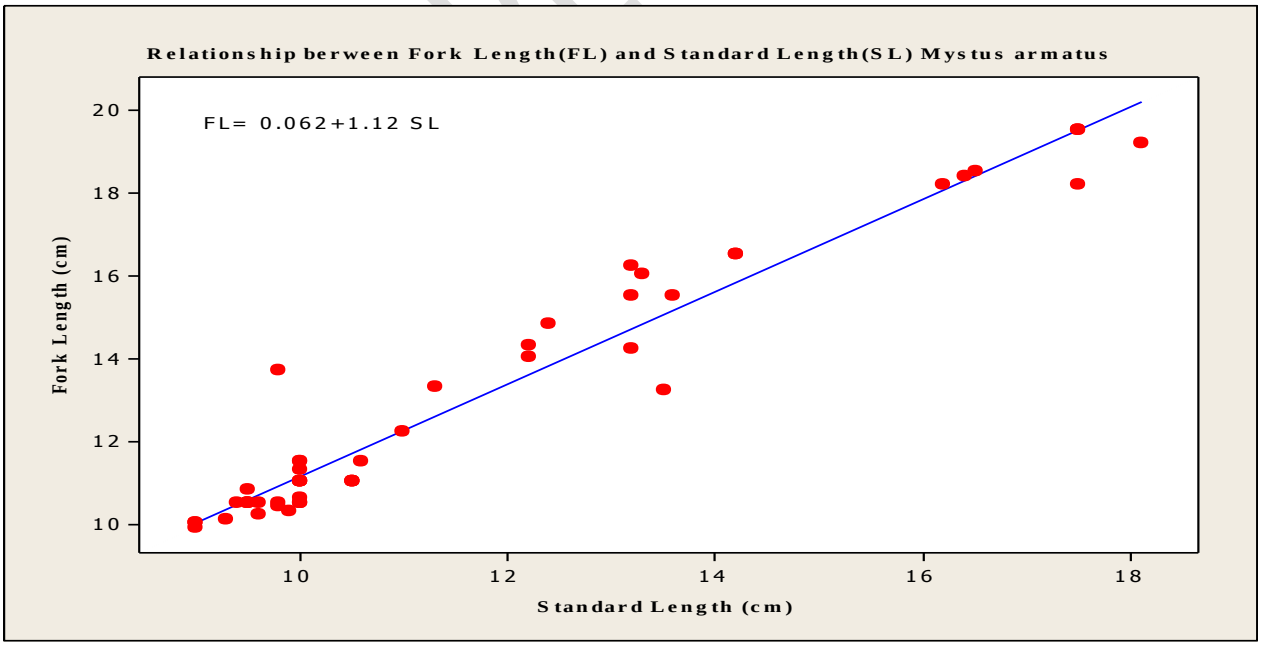


Fig 3: Shows relationship between fork length and total length in *Mystus armatus*

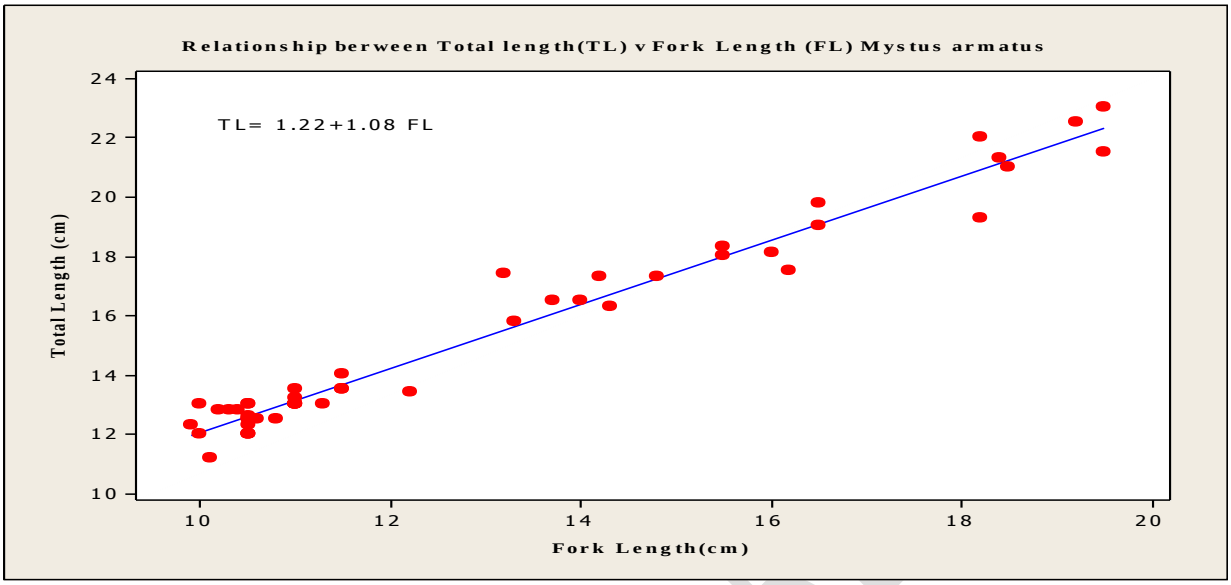


Fig: 4 Shows relationship between Total length and Head length in *Mystus armatus*

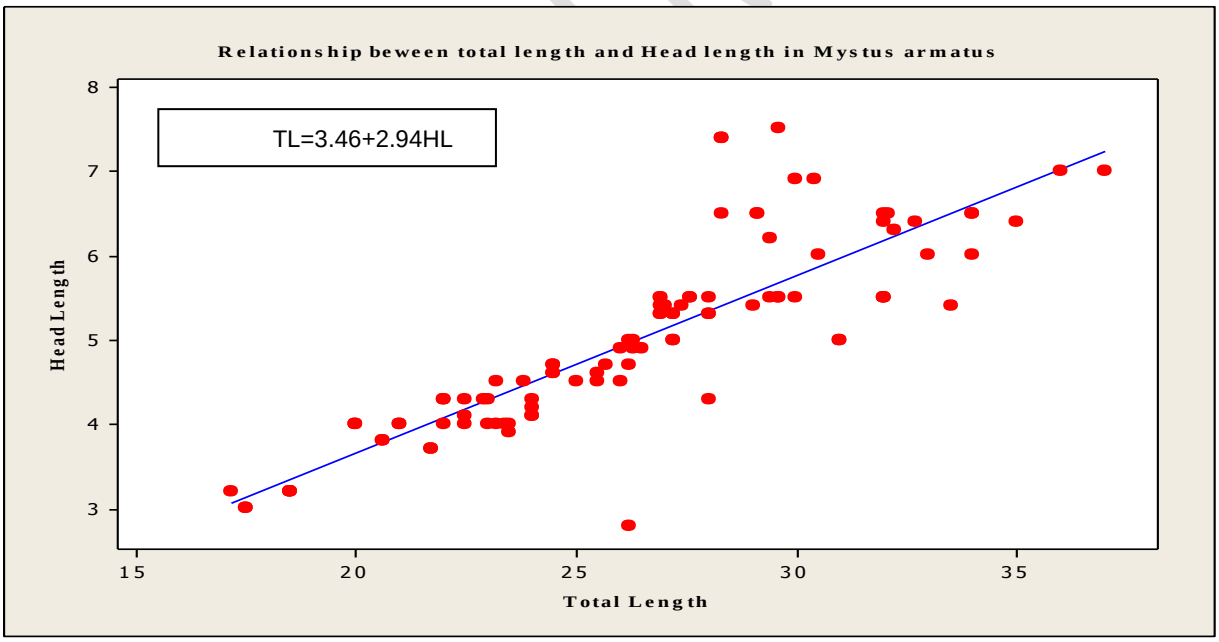
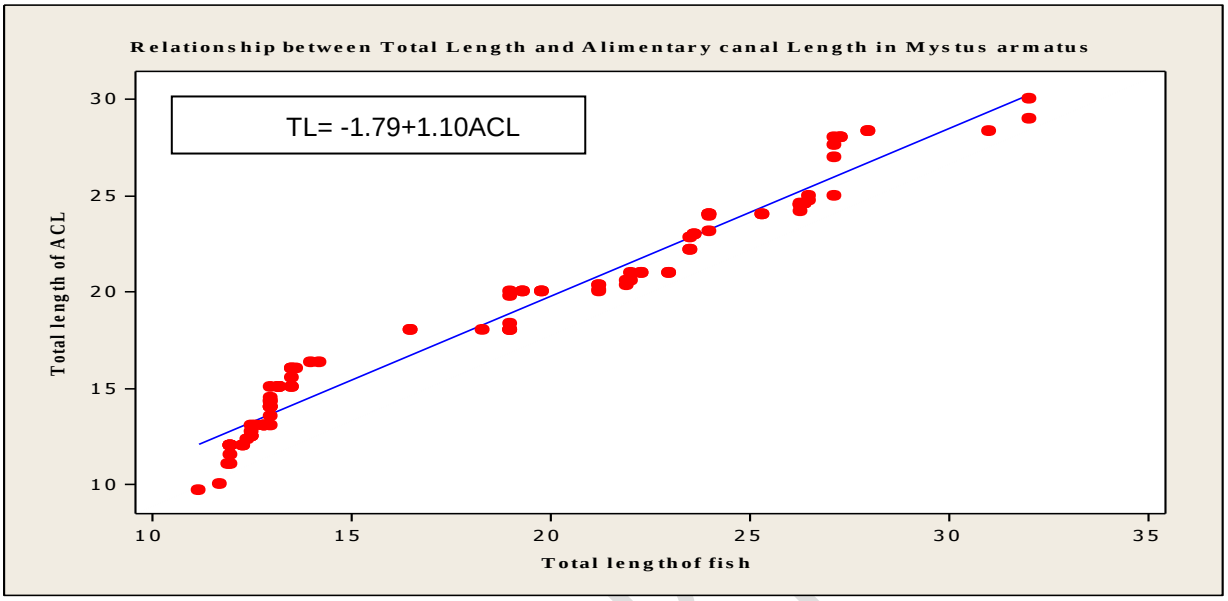


Fig 5: Shows relationship between Total length and Total length of ACL in *Mystus armatus*



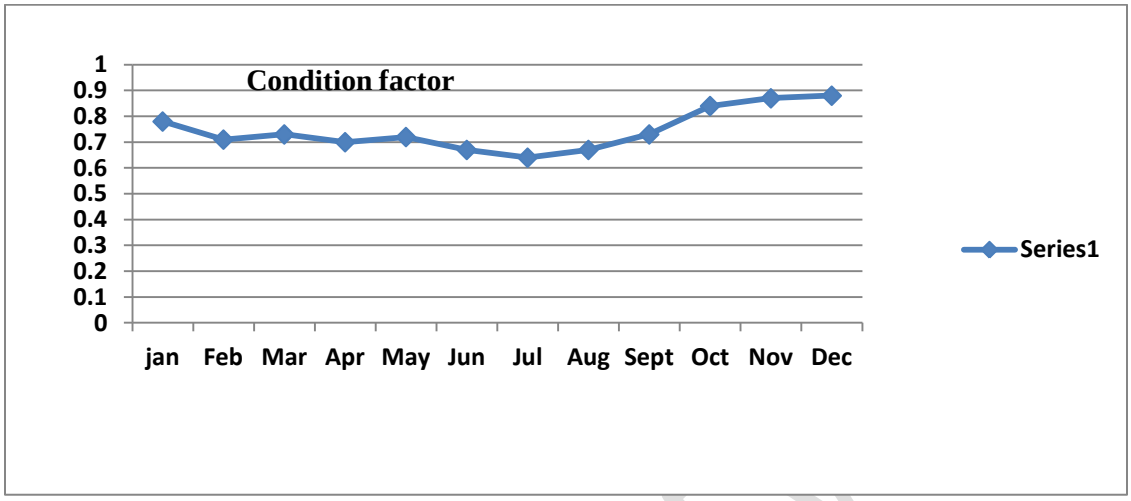
CONDITION FACTOR:

Table number 3 shows the monthly condition factor *Mystus armatus* , from January 2018 to December 2018. It was observed the condition factor was highest 0.88 in month of December and lower in 0.64 in month of july2018.

Table 3: Monthly data for condition Factor

Month	Condition factor
Jan	0.78
Feb	0.71
Mar	0.73
Apr	0.7
May	0.72
Jun	0.67
Jul	0.64
Aug	0.67
Sept	0.73
Oct	0.84
Nov	0.87
Dec	0.88

Fig 6: Shows monthly variation in condition factor in *Mystus armatus*



Discussion:

The food analysis of *Mystus armatus* revealed that it consisted of crustaceans, fishes, molluscs, aquatic insect, prawns, algae, and aquatic plants and mud particles. In *Mystus cavacius* higher percentage of food consist of fishes, crustacean, aquatic insect, prawn and lower percentage in molluscs, algae, aquatic plants, sand and mud particles thus *Mystus armatuss* shows carnivorous type of feeding habitat.

No fish is either genuinely carnivorous or herbivorous but, taking into consideration the maximum percentage of the of food items, they are broadly divided into the into three groups; herbivorous, carnivorous and omnivorous (Nath *et.al*., 2014).

Similar results were reported by Nath *et.al.,*(2014) with 11.4% of dietary was formed by plant food while 82.5 % was formed by animal food on an average for the year. On the basis of this they conclude that *Mystus cavacius* is carnivorous feeder. Chaturvedi and Saksena (2013) have reported the fish as eury-omnivorous fish as it feeds on a wide range of diet including phytoplankton and (57.48%) and zooplankton (42.52). However even on the basis of biomass of food items accounted in the gut of this fish *Mystus cavacius* during their

study they have reported that inclination of *Mystus cavacius* is towards carnivorous feeding habits.

Md. Reaz Chaklader *et.al.* (2014) studies on feeding habits *Mystus vittatius* (Bloch,1794) shows that the food of *Mystus vittatius* consists of fish, mollusca, crustacean, copepods, diatoms, green algae, worms, insects, plant material, thus it indicated that the fish a carnivorous feeder having majority of food which consists of animal.

Barnham and Baxter (1998) proposed that if the K value is 1.00, the condition of the fish is poor, long and thin. A 1.20 value of K indicates that the fish is of moderate condition and acceptable to many anglers. A good and well-proportioned fish would have a K value that is approximately 1.40. Based on this criterion the sampled fish is in very poor condition and required good care to be taken.

According to Gupta et al. (2011) the difference in condition factor could be due to the availability of food organisms at a particular time as well as the difference of gonad development. The condition factor of fishes has been reported to be influenced by a number of factors such as the onset of maturity (Hoda, 1987), Spawning (De-Silva and Silva, 1979; Al-Dham and Wahab, 1991), sex and maturity (Gowda *et al.,* 1987; Doddamani and Shanbouge 2001) and Pollution (Bakhoum, 1999 and Devi *et al.,* 2008, Khillare and Sonawane, 2016). The present study could not explain what it the factor for poor condition for the sampled fish.

The regression equation of LLRs are established for Mystus armatus to assess the symmetrical growth in relation to body length i.e. relationships with TL among SL, HL, FL, ACL. It was observed that the equations are highly significant with all ‘r’ values being > 0.785. The values of the equations clearly revealed that the lengths of the body parts are proportional to the total length which agreed with Tandon et al (1993). The interrelationships among aforementioned length parameters were also found highly significant ($p < 0.01$) with all ‘r’ values being > 0.711 from the multiple correlation analysis. The findings of the LLR analysis of this present work are similar to the findings of Hossain et al (2009a) for A. mola, P. ticto and G. giuris at Rajshahi district, Bangladesh.

CONCLUSION:

From the above study it was concluded that the gut content in Mystus armatus consist of animal as well plant type of food but majority of food contents animal, it was concluded that the *Mystus armatus* is carnivorous feeder. Length length relation in this fish is highly correlated, all relationship such TL with SL, TL with FL, TL with HL, TL with ACL. All related parameters such correlation coefficient r=0.5, coefficient of determination R2= 0.5, with the values of P< 0.01. on the values of condition factor it was concluded that the condition of sampled fish is poor due to various reason such as condition of water, wheather it is polluted or not, maturation of gonads, availability of food, space of living etc. and it is recommended that it is very important that ecology of river Godavari from kaigaon toka region has to be studied.

REFERENCES:

A. Mamun, K.M.A. Tareq and M.A. Azadi. Food and feeding habits of *Amblypharyngodon mola* (Hamilton) from Kaptai reservoir, Bangladesh. Pakistan journal of biological sciences, 2004:(7)4:584-588.

Al-Daham NK, Wahab NK. Age, growth and reproduction of the greenback mullet, *Liza subviridis* (Valenciennes), in an estuary in Southern Iraq. J. Fish Biol. 1991; 38:81-88

Chaklader, Md. R, Nahar, A., Siddik, B. and Sharker, R. Feeding habits and diet composition of Asian catfish *Mystus vittatus* (Bloch, 1974) in shallow water of an impacted coastal habitat., *World journal of fish and marine sciences; 2014; 6(6),551-556*.

Charles Barnham & Alan Baxter Condition Factor, K, for Salmonid Fish. State of Victoria, Department of Primary Industries . (1998): 1-4

Chaturvedi J, Saksena,D.N. Diet composition, feeding intensity, gastrosomatic index and hepatosomatic index of a catfish, *Mystus cavasius* from Chambal river (near Rajghat) Morena, Madhya Pradesh. *International Journal of Recent Scientific Research, 2013; 4(9);1350-1356.*

De. Silva SS, Silva EIL. Biology of young grey mullet, *Mugil cephalus* (L.). Populations of a coastal lagoon in Sri lanka, J Fish Biol. 1979; 15:9-20.

Dewan, S. and S. N. Saha, Food and feeding habits of Tilapia nilotica (L.) (Perciformes: Cichlidae), II Diet and seasonal patterns of Feeding. Bangladesh J. Zool; 1979,7(2): 75 – 80.

Doddamani MTJR, Shanbhogue SL. Length-weight relationship and condition factor of *Stolephorus bataviensis* from Mangalore area. Indian J Fish. 2001; 48(3):329-332.

Gowda G, Shanbougu SL, Udupa KS. Length-weight relationship and relative condition of Grey mullet, *Valamugil sehci* (Forskal), from Manglore waters. Indian J. Fish. 1987; 34(4):340-342.

Gupta BK, Sarkar UK, Bharadwaj SK, Pal A. Condition factor, length-weight and length-length relationship of an endangered fish Ompokpabda (Hamilton 1822) (Siluriformes: Siluridae) from the river Gomti, a tributary of the river Ganga, India. Journal of applied Ichthyology; 2011; 27:962-964.

Hossain M. Y., Ahmed Z. F., Leunda P. M., Jasmine S., Oscoz J., Miranda R., Ohtomi J., 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; 2006; 22:304–307.

J.C. Howe. Standard length: not quite so standard. Fisheries Research: 2002: 56: 1-7.

K.D. Simon, A.G. Mazlan, Samat, A., Zaidi, C.C., Aziz, A.. Size, growth and age of two congeneric archer fishes (Toxotes jaculatrix Pallas, 1767 and Toxotes chatareus Hamilton, 1822) inhabiting Malaysian coastal waters. Sains Malaysiana. 2010: 39(5):697–704.

K.K. Tandon, Johal, M.S. and Bala, S. Morphometry of Cirrhinus reba (Hamilton) from Kanjli wetland, Punjab, India. Res. Bull. Punjab Univ. Sci: 1993.43(1-4):73-78.

Khillare C.A. & Sonawane S.R.. Morphometric measurement, food and feeding habits and condition factor of fresh water fish *Hypophthalamichthys nobilis. International journal of fisheries and aquatic science: 2016; 4(5); 347-353*

M. Dasgupta. Adaptation of the alimentary tract to feeding habits in four species of fish of the genus *Channa*., Indian journal of fisheries, 2000: 47(3), 265-269.

Mustafa M. G., Brooks A. C. Status of fisheries resource and management approach in the open Beels of Bangladesh: a comparative case study. Asian Fisheries Science: 2008 : 21:189–203.

P. Sparre, E. Ursin and Venema, S.C. Introduction to tropical fish stock assessment. Part 1. Manual. FAO Fisheries Technical Paper No. 306, 1989.Rome, 429 pp.

R.M. Victor, R. Sivakumar, and R. Mathialagan . Food and feeding habit and length-weight relationship of Asian striped catfish, *Mystus vittatus* (Bloch, 1794) (Siluriformes- Bagridae) in the Vadavan river, lower Anicut, Tamil-Nadu., Indian journal of science:2014:8(20):55-64.

S.R. Nath, T. Beraki, Awet Abraha, K. Abraham and Yonas Berhane. Gut content analysis of Indian mackerel *(Rastrelliger kanagurta)., Journal of aquaculture and marine biology; 2015; 3(1), ,1-5.*

Sharad C. Srivastava, Pankaj Verma, Kailash C. Yadav and Madhu Tripathi. Feeding ecology of carp fishes and cat fishes captured from Gomati River stretch at Lucknow, Uttar Prades, India. International Journal of fauna and biological studies:2014:1(5):65-68.

V. G. Jhingran. Fish and Fisheries of India (Revised and enlarged 2nd ed). *Hindustan Publishing Corporation (India) Delhi. 645pp.*